



EX15

User Guide

Firmware version 21.2

Revision history—90002344

Revision	Date	Description
D	April 2020	Added support for the 1003-CM CORE modem. Note The 1003-CM CORE modem currently has limited availability.

Revision	Date	Description
E	June 2020	Release of Digi EX15 firmware version 20.5: ■ Support for LDAP user authentication. ■ Preconfigured Wi-Fi SSID and password enabled by default (available for the Wi-Fi enabled EX15W model only). • The default SSID for the access point is: Digi-EX15W-serial_number • Default password is the unique password as found on the device's label. You will need to change the SSID and password before any configuration changes can be saved. ■ Wi-Fi client isolation options. ■ Firmware installation from the Digi firmware server. ■ Enhanced Digi Remote Manager support: • Support for remote proxy server for Digi Remote Manager. • Watchdog support for connection to Digi Remote Manager. • Locally authenticate CLI option added to Digi Remote Manager configuration to control whether a user is required to provide device-level authentication when accessing the console of the device through Digi Remote Manager. • Added a randomized two minute delay window for uploading health metrics to the Digi Remote Manager to avoid situations where multiple devices are uploading metrics at the same time. ■ Enhanced Python support: • Support for the Python serial module to allow programmatic access to serial ports. • Support for the Python HID module to allow programmatic access to a USB Human Interface Device (HID) from within a Python script. ■ Application mode for serial ports to allow for Python programmatic control.

Revision	Date	Description
F	September 2020	Release of Digi EX15 firmware version 20.8: ■ Support for NEMO/DMNR virtual private networks. ■ Support for serial Modbus Gateway. ■ Support for Ethernet network bonding. ■ Support for VRRP+, an extension to the VRRP standard that uses network probing to monitor connections through VRRP-enabled devices. ■ Cloud service enhancements: • Reduced data usage for reporting health metrics to Digi Remote Manager. - Added Monitoring > Device Health > Only report changed values to Digi Remote Manager option to control sending metrics to Digi Remote Manager on the basis of whether the values have changed since they were last reported. • Added Monitoring > Device Health > Data point tuning configuration options to fine tune what datapoints are uploaded as health metrics to Digi Remote Manager. • Added the ability to select Digi aView as the cloud service. ■ Added the ability to duplicate firmware to copy the active firmware to the secondary firmware partition. ■ Moved the update firmware CLI command to system firmware update. ■ Added new Authoritative option under TACACS+, RADIUS, and LDAP user authentication methods to prevent falling back to additional authentication methods. ■ Cisco Umbrella content filtering. ■ Wi-Fi enhancements: • Added new options under Network > Wi-Fi to control Tx Power of the Wi-Fi module. • Added support for multiple RADIUS servers for WPA2 Enterprise. ■ Added options under System > Log > Server list to allow users to specify the TCP/UDP protocol and port of the remote syslog server. ■ Serial port enhancements: • Added configuration option under Serial > TCP connection to specify encrypted connection types. • Added configuration option under Serial >

Revision	Date	Description
		TCP/Telnet/SSH connections to enable/disable TCP keep-alive messages and nodelay. ■ Enhanced SMS support: • Added System > Scheduled tasks > Allow scheduled scripts parameter to allow custom python scripts to handle sending/receiving SMS messages • Added the digidevice.sms python module for sending/receiving SMS messages in a custom python script. ■ MQTT client support via Paho Python module. ■ Added a random unprivileged port for performing ntp time syncs if standard port 123 fails. ■ Scripting enhancements: • Added a Status > Scripts page in the web UI and show scripts command to the Admin CLI to view custom scripts and applications configured in the device, along with their status. Added the system scripts stop command to the Admin CLI to stop a custom script or application.

Revision	Date	Description
G	December 2020	Release of Digi EX15 firmware version 20.11: ■ Modem firmware update commands added to the Admin CLI. ■ Network bridging enhanced to use the MAC address of the first active device listed in Network > Bridges > Bridge name > Devices as the MAC address for the bridged interface. ■ IPsec enhancements: • Support for full IPsec IPv6 tunnels: IPv6-over-IPv4, or IPv4-over-IPv6 tunnels. • IPsec tunnels are now treated like network interfaces, which allows tunnels to be selected for routing and routing priority and access control lists. • IPsec tunnels now wait for Surelink tests, if configured, to pass prior to initiating outbound tunnels. ■ Modbus gateway enhancements: • Status > Modbus gateway page in the Web UI displays information about modbus clients and servers connected to the gateway. • show modbus command displays information about the the Modbus gateway service. ■ Serial port enhancements: • Serial port logging options added for starting, stopping, and viewing serial port activity. • Option added to the System > Serial configuration page to copy serial port settings. ■ Policy-based routing enhancements: • Added a DSCP option to match the routing rule by the type of DSCP field in the packet. • Added a Defaultroute option for matching policy-based routes to the device's active default route. ■ Python pip support for installing external modules and libraries. ■ Service > Location added to enable location services. Requires either GPS from the cellular modem, or an external GNSS module connected via serial to the device. ■ Link speed and duplex options added to Ethernet port configuration. ■ ssh and telnet commands added to Admin CLI.

Revision	Date	Description
		■ Services > Ping responder allows you to control the interfaces and firewall zones on which the DAL device will respond to ICMP requests. ■ Enhanced policy-based routing: • Added a DSCP option to match the routing rule by the type of DSCP field in the packet. • Added a Defaultroute option for matching policy-based routes to the device's active default route. ■ Added a link to User Guide under the User menu in the Web UI.

Revision	Date	Description
H	March 2021	Release of Digi EX15 firmware version 21.2: ■ Location services added, including: • The ability to define a static latitude and longitude as a location for the device. • GNSS support through the cellular modem (requires the CM07 CORE modem). • Reporting location information as health metrics to Digi Remote Manager. • Geo-fencing: Allow you to define one or more circular or polygonal geo-fence areas and then perform a set of actions when the device enters or leaves that area. • Python support for location information through the digidevice.location python module. ■ Cellular modem carrier scanning and locking: • New <code>modem scan</code> CLI command for listing available carriers for the current modem and SIM. • Manual carrier selection option to allow you to lock the SIM to a specific carrier. ■ Enhanced serial support: • Certificate management control for TCP and autoconnect serial port setups. • Autoconnect. ■ Enhanced Wi-Fi support: • Support 5GHz DFS Wi-Fi channels in client mode. Only available for devices with 5GHz Wi-Fi radio support. • Added 5GHz frequencies to the list of channels that can be scanned for client-mode Wi-Fi background scanning. ■ Local REST API for automated configuration of the device. ■ Support for remote CLI commands through Digi Remote Manager. ■ Support for automatically checking for device and modem firmware updates.

Trademarks and copyright

Digi, Digi International, and the Digi logo are trademarks or registered trademarks in the United States and other countries worldwide. All other trademarks mentioned in this document are the property of their respective owners.

© 2021 Digi International Inc. All rights reserved.

Disclaimers

Information in this document is subject to change without notice and does not represent a commitment on the part of Digi International. Digi provides this document “as is,” without warranty of any kind, expressed or implied, including, but not limited to, the implied warranties of fitness or merchantability for a particular purpose. Digi may make improvements and/or changes in this manual or in the product(s) and/or the program(s) described in this manual at any time.

Warranty

To view product warranty information, go to the following website:

www.digi.com/howtobuy/terms

Customer support

Gather support information: Before contacting Digi technical support for help, gather the following information:

- ✓ Product name and model
- ✓ Product serial number (s)
- ✓ Firmware version
- ✓ Operating system/browser (if applicable)
- ✓ Logs (from time of reported issue)
- ✓ Trace (if possible)
- ✓ Description of issue
- ✓ Steps to reproduce

Contact Digi technical support: Digi offers multiple technical support plans and service packages. Contact us at +1 952.912.3444 or visit us at www.digi.com/support.

Feedback

To provide feedback on this document, email your comments to

techcomm@digi.com

Include the document title and part number (Digi EX15 User Guide, 90002344 H) in the subject line of your email.

Contents

Revision history—90002344	2

What's new in Digi EX15 version 21.2

Digi EX15 Quick start

Quick start using the Digi Remote Manager mobile app	20
Step 1: What's in the box	21
Step 2: Connect	23
Step 3: Power up	24
Step 4: Configure	24

Digi EX15 hardware reference

Hardware features	26
Device status LEDs	27
Signal quality indicators	28
Signal quality bars explained	28
LTE status indicators	29
Serial port pinout and use	30

Hardware setup

Site survey	32
Site survey troubleshooting	32
Physical installation	33
Connecting to the site network with local power	33
Connecting to the site network with remote power	33
Remote power troubleshooting	33
Install SIM cards in the Plug-in LTE modem	34
Tips for improving cellular signal strength	35
Connect data cables	35
Mount the EX15 device	35
Network integration	36
Enable router mode	36

Configuration and management

Review EX15 default settings	40

Local WebUI	40
Digi Remote Manager	40
Default interface configuration	40
Change the default password for the admin user	42
Reset default SSID and pre-shared key for the preconfigured Wi-Fi access point	43
Enable router mode	45
Configuration methods	47
Using Digi Remote Manager	48
Access Digi Remote Manager	48
Configure the device to use aView for central management	48
Using the web interface	52
Log out of the web interface	54
Using the command line	55
Access the command line interface	55
Log in to the command line interface	55
Exit the command line interface	56

Interfaces

Wide Area Networks (WANs)	58
Wide Area Networks (WANs) and Wireless Wide Area Networks (WWANs)	60
Configure WAN/WWAN priority and default route metrics	60
WAN/WWAN failover	63
Configure SureLink active recovery to detect WAN/WWAN failures	64
Configure the device to reboot when a failure is detected	71
Disable SureLink	78
Example: Use a ping test for WAN failover from Ethernet to cellular	82
Using Ethernet devices in a WAN	85
Using cellular modems in a Wireless WAN (WWAN)	85
Configure a Wide Area Network (WAN)	108
Configure a Wireless Wide Area Network (WWAN)	115
Show WAN and WWAN status and statistics	124
Delete a WAN or WWAN	127
Local Area Networks (LANs)	129
About Local Area Networks (LANs)	130
Configure a LAN	130
Example: Configure two LANs	136
Show LAN status and statistics	146
Delete a LAN	147
DHCP servers	149
Create a Virtual LAN (VLAN) route	165
Bridging	168
Edit the preconfigured LAN bridge	169
Configure a bridge	172

Serial port

Configure the serial port	176
Show serial status and statistics	187
Log serial port messages	188

Wi-Fi

Wi-Fi configuration	190
Default access point SSID and password	190
Default Wi-Fi configuration	190
Use the default Wi-Fi access point	191
Create a LAN interface for the access point	192
Configure the existing LAN interface to include the access point	194
Configure the Wi-Fi radio's channel	196
Configure the Wi-Fi radio to support DFS channels in client mode	198
Required configuration items	198
Configure the Wi-Fi radio's band and protocol	199
Configure the Wi-Fi radio's transmit power	201
Configure a Wi-Fi access point with no security	203
Configure a Wi-Fi access point with personal security	208
Configure a Wi-Fi access point with enterprise security	213
Isolate Wi-Fi clients	221
Isolate clients connected to the same access point	221
Isolate clients connected to different access points	222
Configure a Wi-Fi client and add client networks	228
Show Wi-Fi access point status and statistics	234
Show Wi-Fi client status and statistics	236

Routing

IP routing	239
Configure a static route	240
Delete a static route	243
Policy-based routing	245
Configure a routing policy	245
Example: Dual WAN policy-based routing	254
Example: Route traffic to a specific WAN interface based on the client MAC address	257
Routing services	262
Configure routing services	263
Show the routing table	266
Dynamic DNS	267
Configure dynamic DNS	267
Virtual Router Redundancy Protocol (VRRP)	273
VRRP+	273
Configure VRRP	274
Configure VRRP+	277
Example: VRRP/VRRP+ configuration	285
Configure device one (master device)	286
Configure device two (backup device)	290
Show VRRP status and statistics	296

Virtual Private Networks (VPN)

IPsec	300
IPsec data protection	300
IPsec modes	300
Internet Key Exchange (IKE) settings	300
Authentication	301
Configure an IPsec tunnel	301

Configure IPsec failover	323
Configure SureLink active recovery for IPsec	326
Show IPsec status and statistics	333
Debug an IPsec configuration	333
OpenVPN	336
Configure an OpenVPN server	337
Configure an OpenVPN Authentication Group and User	346
Configure an OpenVPN client by using an .ovpn file	350
Configure an OpenVPN client without using an .ovpn file	353
Configure SureLink active recovery for OpenVPN	357
Show OpenVPN server status and statistics	364
Show OpenVPN client status and statistics	365
Generic Routing Encapsulation (GRE)	367
Configuring a GRE tunnel	367
Show GRE tunnels	372
Example: GRE tunnel over an IPsec tunnel	373
NEMO	388
Configure a NEMO tunnel	389
Show NEMO status	395

Services

Allow remote access for web administration and SSH	398
Configure the web administration service	402
Configure SSH access	411
Use SSH with key authentication	417
Generating SSH key pairs	417
Configure telnet access	420
Configure DNS	425
Simple Network Management Protocol (SNMP)	431
SNMP Security	431
Configure Simple Network Management Protocol (SNMP)	431
Download MIBs	435
Location information	437
Configure the location service	438
Enable or disable modem GNSS support	440
Configure the device to use a user-defined static location	442
Configure the device to accept location messages from external sources	444
Forward location information to a remote host	448
Configure geofencing	454
Show location information	466
Modbus gateway	467
Configure the Modbus gateway	468
Show Modbus gateway status and statistics	481
System time	484
Configure the system time	484
Network Time Protocol	487
Configure the device as an NTP server	487
Configure a multicast route	493
Ethernet network bonding	496
Enable service discovery (mDNS)	498
Use the iPerf service	502
Example performance test using iPerf3	506
Configure the ping responder service	506
Example performance test using iPerf3	510

Applications

Configure applications to run automatically	512
Task one: Upload the application	512
Task two: Configure the application to run automatically	514
Run a Python application at the shell prompt	518
Start an interactive Python session	520
Digidevice module	522
Use digidevice.cli to execute CLI commands	523
Use digidevice.datapoint to upload custom datapoints to Digi Remote Manager	524
Use digidevice.config for device configuration	526
Use Python to respond to Digi Remote Manager SCI requests	529
Use digidevice runtime to access the runtime database	537
Use Python to upload the device name to Digi Remote Manager	539
Use Python to access the device location data	541
Use Python to send and receive SMS messages	545
Use Python to access serial ports	548
Use the Paho MQTT python library	549
Use the local REST API to configure the EX15 device	552
Use the GET method to return device configuration information	552
Use the POST method to modify device configuration parameters and add items to a list array	554
Use the DELETE method to remove items from a list array	555
Stop a script that is currently running	556
Show script information	556

User authentication

EX15 user authentication	559
User authentication methods	559
Add a new authentication method	561
Delete an authentication method	563
Rearrange the position of authentication methods	565
Authentication groups	567
Change the access rights for a predefined group	568
Add an authentication group	570
Delete an authentication group	574
Local users	577
Change a local user's password	578
Configure a local user	580
Delete a local user	587
Terminal Access Controller Access-Control System Plus (TACACS+)	590
TACACS+ user configuration	591
TACACS+ server failover and fallback to local authentication	592
Configure your EX15 device to use a TACACS+ server	592
Remote Authentication Dial-In User Service (RADIUS)	596
RADIUS user configuration	597
RADIUS server failover and fallback to local configuration	597
Configure your EX15 device to use a RADIUS server	598
LDAP	601
LDAP user configuration	603
LDAP server failover and fallback to local configuration	604
Configure your EX15 device to use an LDAP server	604
Disable shell access	609

Set the idle timeout for EX15 users	611
Example user configuration	613
Example 1: Administrator user with local authentication	613
Example 2: RADIUS, TACACS+, and local authentication for one user	615

Firewall

Firewall configuration	623
Create a custom firewall zone	623
Configure the firewall zone for a network interface	625
Delete a custom firewall zone	627
Port forwarding rules	628
Configure port forwarding	628
Delete a port forwarding rule	633
Packet filtering	636
Configure packet filtering	636
Enable or disable a packet filtering rule	640
Delete a packet filtering rule	642
Configure custom firewall rules	644
Configure captive portals	646
Delete captive portals	650
Configure Quality of Service options	651

System administration

Review device status	664
Configure system information	665
Update system firmware	667
Manage firmware updates using Digi Remote Manager	667
Certificate management for firmware images	668
Downgrading	668
Dual boot behavior	670
Update cellular module firmware	671
Update modem firmware over the air (OTA)	672
Update modem firmware by using a local firmware file	674
Reboot your EX15 device	675
Reboot your device immediately	676
Schedule reboots of your device	676
Erase device configuration and reset to factory defaults	678
Configure the EX15 device to use custom factory default settings	683
Configuration files	685
Save configuration changes	685
Save configuration to a file	686
Restore the device configuration	687
Schedule system maintenance tasks	690
Disable device encryption	697
Re-enable cryptography after it has been disabled.	698
Configure the speed of your Ethernet ports	700

Monitoring

intelliFlow	704
Enable intelliFlow	704

Use intelliFlow to display average CPU and RAM usage	707
Use intelliFlow to display top data usage information	708
Use intelliFlow to display data usage by host over time	710
Configure NetFlow Probe	711

Central management

Digi Remote Manager support	717
Configure Digi Remote Manager	717
Collect device health data and set the sample interval	723
Log into Digi Remote Manager	727
Use Digi Remote Manager to view and manage your device	728
Add a device to Digi Remote Manager	729
View Digi Remote Manager connection status	729
Use the Digi Remote Manager mobile app	730
Configure multiple devices using profiles	731
Learn more	731

File system

The EX15 local file system	733
Display directory contents	733
Create a directory	734
Display file contents	735
Copy a file or directory	735
Move or rename a file or directory	736
Delete a file or directory	737
Upload and download files	738
Upload and download files by using the WebUI	738
Upload and download files by using the Secure Copy command	739
Upload and download files using SFTP	740

Diagnostics

Generate a support report	743
View system and event logs	744
View System Logs	744
View Event Logs	746
Configure syslog servers	748
Configure options for the event and system logs	750
Analyze network traffic	755
Configure packet capture for the network analyzer	756
Example filters for capturing data traffic	760
Capture packets from the command line	761
Stop capturing packets	762
Show captured traffic data	763
Save captured data traffic to a file	764
Download captured data to your PC	765
Clear captured data	766
Use the ping command to troubleshoot network connections	768
Ping to check internet connection	768
Stop ping commands	768
Use the traceroute command to diagnose IP routing problems	768

Regulatory guide

End user license agreement

Command line interface

Access the command line interface	772
Log in to the command line interface	772
Exit the command line interface	773
Execute a command from the web interface	773
Display help for commands and parameters	774
The help command	774
The question mark (?) command	774
Display help for individual commands	775
Use the Tab key or the space bar to display abbreviated help	776
Auto-complete commands and parameters	776
Available commands	777
Use the scp command	778
Display status and statistics using the show command	779
show config	779
show system	780
show network	780
Device configuration using the command line interface	780
Execute configuration commands at the root Admin CLI prompt	781
Display help for the config command from the root Admin CLI prompt	781
Configuration mode	783
Enable configuration mode	783
Enter configuration commands in configuration mode	783
Save changes and exit configuration mode	783
Exit configuration mode without saving changes	784
Configuration actions	784
Display command line help in configuration mode	785
Move within the configuration schema	787
Manage elements in lists	788
The revert command	790
Enter strings in configuration commands	792
Example: Create a new user by using the command line	792
Command line reference	795
analyzer	796
cp	797
help	798
ls	799
mkdir	800
modem	801
modem puk status [imei STRING] [name STRING]	806
modem scan [imeiSTRING] [nameSTRING]	807
more	809
mv	810
ping	811
reboot	813
rm	814
scp	815
show	816

ssh	824
system	826
traceroute	830

Antenna notes and solutions

Antenna terminology	833
Physical specifications	833
Antennas tested by Digi	833
Extra-small IoT paddle antennas	834
Large external MIMO antenna (outdoor rated)	834
Flat MIMO antenna #1	835
Flat MIMO antenna #2	835
Paddle extender	836

What's new in Digi EX15 version 21.2

Release of Digi EX15 firmware version 21.2:

- Location services added, including:
 - The ability to define a static latitude and longitude as a location for the device.
 - GNSS support through the cellular modem (requires the CM07 CORE modem).
 - Reporting location information as health metrics to Digi Remote Manager.
 - Geo-fencing: Allow you to define one or more circular or polygonal geo-fence areas and then perform a set of actions when the device enters or leaves that area.
 - Python support for location information through the digidevice.location python module.
- Cellular modem carrier scanning and locking:
 - New `modem scan` CLI command for listing available carriers for the current modem and SIM.
 - Manual carrier selection option to allow you to lock the SIM to a specific carrier.
- Enhanced serial support:
 - Certificate management control for TCP and autoconnect serial port setups.
 - Autoconnect.
- Enhanced Wi-Fi support:
 - Support 5GHz DFS Wi-Fi channels in client mode. Only available for devices with 5GHz Wi-Fi radio support.
 - Added 5GHz frequencies to the list of channels that can be scanned for client-mode Wi-Fi background scanning.
- Local REST API for automated configuration of the device.
- Support for remote CLI commands through Digi Remote Manager.
- Support for automatically checking for device and modem firmware updates.

Digi EX15 Quick start

Note Devices manufactured with firmware version 20.2.x or greater are configured by default to use the Digi Remote Manager for cloud-based central device management. For information about configuring the device to use aView for central management instead, see [Configure the device to use aView for central management](#).

Quick start using the Digi Remote Manager mobile app

After connecting your hardware and powering up, you can use the Digi Remote Manager mobile app to quickly install your EX15 into your Digi Remote Manager account.

Here's how:

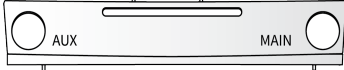
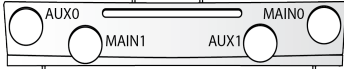
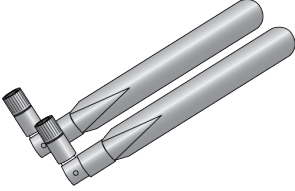
If you already have a Digi Remote Manager account:

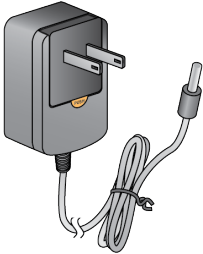
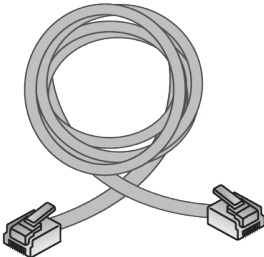
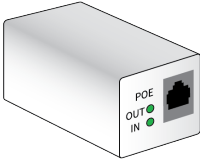
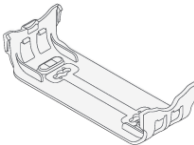
1. Download the **Digi Remote Manager** mobile app from the [App Store](#) (iPhone) or [Google Play](#) (Android).
2. Click **Log in or Sign Up** and log in to your account.
3. From the menu, select **Install a device with a QR or bar code** and scan the installation QR code on the label.
4. Follow the prompts to complete your EX15 registration.

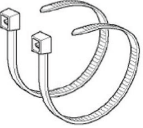
If you need to sign up for a Digi Remote Manager account:

1. Click [here](#) to create a new account. You'll receive an email with login instructions.
2. On your smartphone or tablet, download the **Digi Remote Manager** mobile app from the [App Store](#) (iPhone) or [Google Play](#) (Android).
3. Open the **Digi Remote Manager** mobile app, click **Log in** and log into your new account.
4. From the menu, select **Install a device with a QR or bar code** and scan the installation QR code on the label.
5. Follow the prompts to complete your EX15 registration.

Step 1: What's in the box

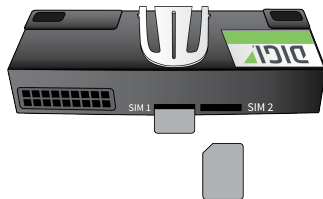
Item	Description
	EX15 unit
1002-CM CORE modem:  1003-CM CORE modem: 	Digi 1002-CM or 1003-CM CORE modem Note The 1003-CM CORE modem currently has limited availability.
	CM unit anchor screws ■ 1 Phillips head ■ 1 hex head
1002-CM CORE modem cover plate:  1003-CM CORE modem cover plate: 	CORE modem cover plate
	Cellular antennas (2)

Item	Description
	Power supply
	Temporary battery pack
	Ethernet cables: ■ 1 x 18 inch ■ 1 x 156 inch
	Passive power-over-Ethernet injector
	Mounting bracket
	Ceiling rail clips, narrow (2)
	Ceiling rail clips, wide (2)

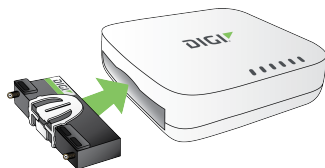
Item	Description
	Screws (2)
	Drywall anchors (2)
	Zipties (2)

Step 2: Connect

1. Insert your activated SIMs provided by your cellular carrier into the Digi 1002-CM or 1003-CM CORE modem.



2. Insert the CORE modem into the EX15 by aligning the white clip. Press the modem in and then push the white clip in until it locks firmly in place.

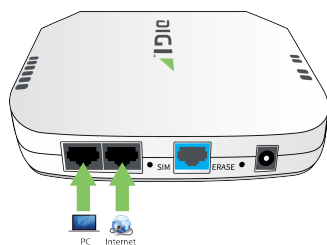


3. Secure the CORE modem with one of the CM unit anchor screws.
4. Cover the installed CORE modem with the cover plate. The cover plate will snap into place. Image shows the 1002-CM CORE modem.



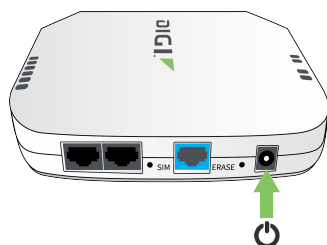
5. Attach antenna(s).

6. If you intend to configure Ethernet WAN access at this time, use an Ethernet cable to connect the EX15's **2/WAN** port to a hub with access to the Internet.
7. Use an Ethernet cable to connect the EX15 **1/PoE** port to your PC.



Step 3: Power up

- a. Connect DC power.



- b. Verify that the signal strength indicator on the front of the EX15 shows 2 or more bars, and that the LTE LED on the front of the EX15 shows either green or blue (solid or flashing) for proper operation.

Step 4: Configure

This section describes how to configure the device by using the local Web UI. You can also use Digi Remote Manager to configure the device, including using a Digi RM device configuration to automatically update the device. See the [Digi Remote Manager User Guide](#).

- a. On the PC connected to the EX15, open a browser and go to **http://192.168.210.1**.
- b. Log into the EX15:

User name: Use the default user name: **admin**.

Password: Use the unique password printed on the bottom label of the device (or the printed label included in the package).

Note If your device was manufactured prior to the release of firmware version 19.11.x, the default user name may be **root**.

When you first log into the WebUI or the command line, you must change the password for the **admin** user. See [Change the default password for the admin user](#) for instructions.

Additionally, for Wi-Fi enabled models, when you first log into the WebUI or the command line, you will be required to change the SSID and pre-shared key (password) for the preconfigured Wi-Fi access point. See [Reset default SSID and pre-shared key for the preconfigured Wi-Fi access point](#) for instructions.

Devices that connect to Digi aView for cloud management may have a different password for the default user, based on the aView configuration profile used by the device. Devices with firmware prior to release 20.2.x are configured to connect to aView by default.

To connect to the local Web UI in this case, you must either know the password from the aView configuration profile, or you must disconnect from aView and reset the device to factory defaults.

To disconnect from aView and reset the device:

- a. Remove any SIM and WAN connections to prevent the device from connecting to aView after resetting to factory defaults.
 - b. Follow the instructions at [Erase device configuration and reset to factory defaults](#) to reset the device to factory defaults.
 - c. Log into the local Web UI by using the default username and password.
 - d. Prior to inserting a SIM or connecting to a WAN connection, disable central management or configure the device to connect to Digi Remote Manager, as described in [Configure Digi Remote Manager](#).
-

Ethernet port default configuration

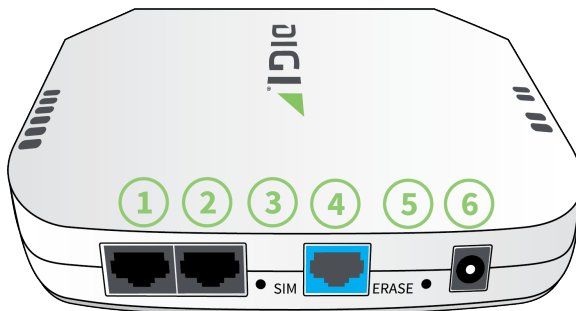
- Port 1 is configured as a LAN port and will issue a single passthrough IP Address using DHCP based on the IP received from the cellular connection.

Note By default, the EX15 device is in cellular passthrough mode. This prevents clients that attach to the device's LAN port from using the device's WAN internet connection. See [Enable router mode](#) for instructions regarding how to configure the EX15 device to provide internet connectivity to more than one connected device at a time.

- Port 2 is configured as a WAN port and will accept an IP Address from an existing local network router.

Digi EX15 hardware reference

Hardware features



1. **LAN/PoE** Port

2. **WAN** Port

3. **SIM** Button

The **SIM** button is used to manually toggle between the two SIM slots included in the CM module.

4. **SERIAL** Port

5. **ERASE** Button

The **ERASE** button is used to perform a device reset, and it has three modes:

- a. **Configuration reset:** Pressing the **ERASE** button one time will reset the device configurations to the factory default. It will not remove any automatically generated certificates and keys.
- b. **Full device reset:** After the device reboots from the first button press, press the **ERASE** button again before the device is connected to the internet to also remove generated certificates/keys.
- c. **Firmware reversion:** Press and hold the **ERASE** button and then power on the device to boot to the version of firmware that was used prior to the current version.

6. Power Socket



- 7. LTE connection indicator
- 8. LTE signal quality



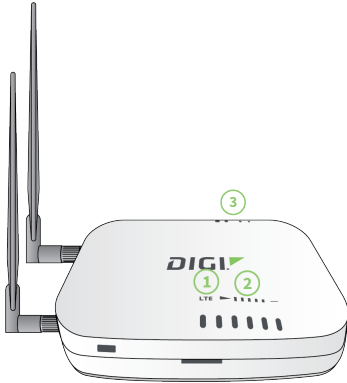
- 9. LAN/WAN indicator
- 10. SIM 1/2 indicator

For a detailed list of EX15 hardware specifications, see [Digi EX15 specifications](#).

Device status LEDs

Once power has been established, your device will initialize and attempt to connect to the network. Device initialization may take 30-60 seconds. By default your EX15 will attempt to use DHCP to establish an Internet connection either through its cellular modem or the ethernet port .

- 1. Cellular connectivity status is indicated by the color-coded LTE light.
- 2. Indicator lights on the Wireless Strength Indicator show you the cellular network signal strength.
- 3. Ethernet connections are confirmed via the light corresponding to the EX15 port number.



Signal quality indicators

Signal bars	Weighted dBm	Signal strength %	Quality
	-113 to -99	0% to 23%	Bad
	-98 to -87	24% to 42%	Marginal
	-86 to -76	43% to 61%	OK
	-75 to -64	62% to 80%	Good
	-63 to -51	81% to 100%	Excellent

The weighted dBm measurements are negative numbers, meaning the smaller negative values denote a larger number. For example, a -85 is a better signal than -90.

Note See [Signal quality bars explained](#) for more information regarding how signal strength is calculated and subsequently displayed via the LED indicators.

Signal quality bars explained

The signal status bars for the Digi EX15 measure more than simply signal strength. The value reported by the 4G LTE signal bars is calculated using an algorithm that takes into consideration the Reference Signals Received Power (RSRP), the Signal-to-noise ratio (SNR), and the Received Signal Strength Indication (RSSI) to provide an accurate indicator of the quality of the signal that the device is receiving.

For 3G networks (including HSPA+) and 2G networks, the signal strength bars are determined by the RSSI value.

4G LTE algorithms

For 4G LTE, the EX15 device determines the RSRP, SNR, and RSSI values separately and uses the following algorithms to display the signal quality:

```

RSRP > -85, rsrp_bars=5
-95 < RSRP <= -85, rsrp_bars=4
-105 < RSRP <= -95, rsrp_bars=3
-115 < RSRP <= -105, rsrp_bars=2
-199 < RSRP <= -115, if we're connected to the cellular network, rsrp_bars=1,
if not rsrp_bars=0

```

If RSRP <= -199, the device uses the RSSI as the value with the same algorithm:

```

SNR >= 13, snr_bars=5
4.5 <= SNR < 13, snr_bars=4
1 <= SNR < 4, snr_bars=3
-3 < SNR < 1, snr_bars=2
-99 < SNR <= -3, if we're connected to the cellular network, snr_bars=1, if not
snr_bars=0

```

Once the **snr_bars** and **rsrp_bars** values are determined, the device uses the lesser of the two as the reported signal a bars.

3G algorithm

For 3G, the EX15 determines RSSI signal strength:

```

RSSI > -80, bars=5
-90 < RSSI <= -80, bars=4
-100 < RSSI <= -90, bars=3
-106 < RSSI <= -100, bars=2
RSSI <= -106, if we're connected to the cellular network, bars=1, if not bars=0

```

bars is then reported as the signal strength bars.

2G algorithm

For 2G, the EX15 determines RSSI signal strength:

```

RSSI > -80, bars=5
-89 < RSSI <= -80, bars=4
-98 < RSSI <= -89, bars=3
-104 < RSSI <= -98, bars=2
RSSI <= -104, if we're connected to the cellular network, bars=1, if not bars=0

```

bars is then reported as the signal strength bars.

LTE status indicators

The LTE LED provides the following network status information:

	Solid yellow (or orange) Initializing or starting up.		Solid green Connected to 2G or 3G and also has a device linked to its 1/PoE port.
	Flashing yellow (or orange) In the process of connecting to the cellular network and to a device on its 1/PoE port.		Flashing blue Connected to 4G LTE and in the process of connecting to a device on its 1/PoE port.

	Flashing white 1/PoE port connection established and in the process of connecting to the cellular network.		Solid blue Connected to the 4G LTE and also has a 1/PoE connection.
	Flashing green Connected to 2G or 3G and is in the process of connecting to any device on its 1/PoE port, or nothing is connected to the port.		Alternating Red/yellow (or orange) Upgrading firmware.  WARNING! DO NOT POWER OFF DURING FIRMWARE UPGRADE.

Serial port pinout and use

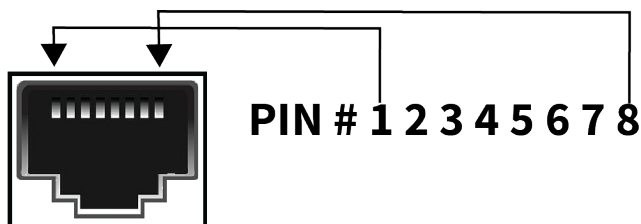
The RS232 standard requires support for baud rates up to 9600 baud on shielded multicore cable up to 50 feet (15 meters) long. For the EX15, the use of standard CAT 5 cables enables serial communication at all baud rates up to 50 feet. CAT5 unshielded twisted pair cable lengths much longer than 50 feet have been verified at 9600 baud but are non-standard and are not guaranteed.

The EX15 RS232 serial port is DTE and has the following pin configuration:

Pin 1	RTS	Request to send	Output from EX15
Pin 2	DCD	Data carrier detect	Input to EX15
Pin 3	RXD	Receive data	Input to EX15
Pin 4/5	—	Ground	Signal ground
Pin 6	TXD	Transmit data	Output from EX15
Pin 7	DTR	Data terminal ready	Output from EX15
Pin 8	CTS	Clear to send	Input to EX15

Note Ring indicate (RI) and data set ready (DSR) are not implemented.

The serial port uses a female RJ45 jack to enable connection using UTP Ethernet cabling.



Hardware setup

This chapter contains the following topics:

Site survey	32
Physical installation	33
Install SIM cards in the Plug-in LTE modem	34
Connect data cables	35
Mount the EX15 device	35
Network integration	36
Enable router mode	36

Site survey

A cellular site survey is not necessary if your anticipated installation location is known to have strong cellular signal strength. If you are unsure of available cellular signal strength or are choosing between several installation locations, follow the below instructions to perform a site survey to determine your best possible installation location. After the optimal location has been determined, set up the EX15 with either the power supply unit or the PoE injector cable.

1. During a site survey it is useful to use the included battery pack instead of the power supply unit to power the EX15. The battery pack will power your device for approximately two hours while you perform your site survey. The battery pack is not rechargeable and should be properly disposed of after use.
2. Move the EX15 to different locations within your site to determine the best compromise between signal strength and installation constraints. Since cellular signal strength may fluctuate, it is important to wait at each location for 1 minute while observing the signal strength indicator on the front of the device. Minimum cellular signal strength for proper operation is 2 bars.
3. After the optimal location has been determined, remove the battery pack and connect either the main power supply unit or PoE injector cable (see [Physical installation](#)).

Note After the optimal location has been determined, set up the EX15 with either the power supply unit or the PoE injector cable.

Site survey troubleshooting

If you are unable to verify a location with a strong cellular signal:

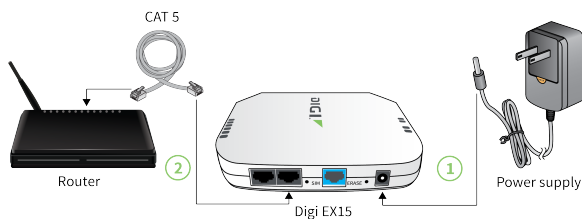
- Verify your SIM has been activated with your cellular operator.
- If you do not get a cellular signal when the EX15 is located indoors, then take the device outdoors to verify that your cellular network operator has coverage in your location.
- If the outdoor cellular signal strength is less than 2 bars, it may be necessary to connect using a different cellular network operator. This requires an activated SIM from the alternate cellular network operator.
- Try the device/antennas in different orientations and away from other nearby electronic equipment at each test location.

Note LTE requires the use of both antennas, and the antennas will usually give better performance when vertical.

- Refer to [Device status LEDs](#) to use the EX15 indicator lights to aid in diagnosis.

Physical installation

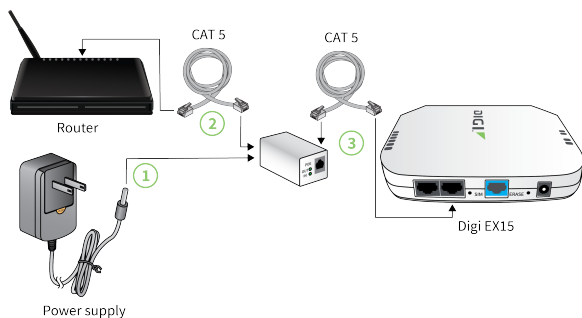
Connecting to the site network with local power



1. Plug the power supply unit into an AC power outlet
2. Connect the PSU to the EX15.

Connecting to the site network with remote power

If your device needs to be positioned some distance from either the nearest AC power outlet or site network equipment, using the included passive Power-over-Ethernet (PoE) injector will simplify the installation cabling and allow for improved cellular signal strength. The POE injector cable allows the DC power and Ethernet connection to be run to the EX15 via the Ethernet connection only.



1. Plug the power supply unit into an AC power outlet and connect to the PoE injector.
2. Connect the male RJ45 connector plug of the POE injector cable to the site network equipment/router.
3. Connect a standard Ethernet cable from the RJ45 socket/jack on the POE injector cable, (marked **DC OUT**), to the LAN/PoE Ethernet port of the EX15.

Remote power troubleshooting

The LED marked **IN** will illuminate when the PoE injector is receiving power from the PSU. The LED marked **OUT** lights up green when an Ethernet connection is recognized by the EX15.

If the **IN** LED is not illuminated check the following:

- Ensure that the PSU is plugged into an AC power outlet and is receiving power.
- Ensure that the PSU power plug is correctly connected to the POE injector cable power input socket.

If the **OUT** LED is not illuminated after connecting to the EX15, verify the integrity of the Ethernet cable.

Note The PoE injector must be connected to LAN port 1 on the EX15 for the device to properly receive power.

Install SIM cards in the Plug-in LTE modem

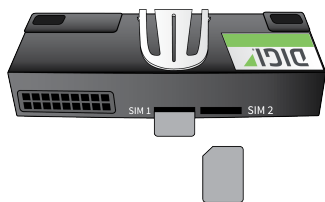
There is a label on the bottom of the CORE modem that indicates the plug-in modem IMEI number. The modem is referred to as 1002-CM or 1003-CM.

Note The 1003-CM CORE modem currently has limited availability.

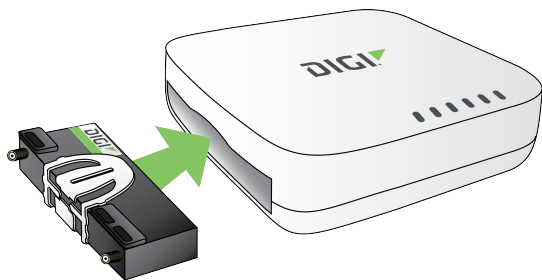
To install SIM cards:

1. Identify the SIM 1 and SIM 2 slots on the 1002-CM or 1003-CM. If using only one SIM card, insert it into SIM 1. A second SIM may be inserted into slot SIM 2 for an alternate wireless carrier.
2. Insert the SIM cards into the 1002-CM or 1003-CM.

Note If the EX15 device is used in an environment with high vibration levels, SIM card contact fretting may cause unexpected SIM card failures. To protect the SIM cards, Digi strongly recommends that you apply a thin layer of dielectric grease to the SIM contacts prior to installing the SIM cards.



3. With the antennas SMA connectors pointing outward, slide the Digi 1002-CM or 1003-CM CORE modem into the EX15 device. A clicking sound will indicate it is properly inserted. Image shows the 1002-CM CORE modem.



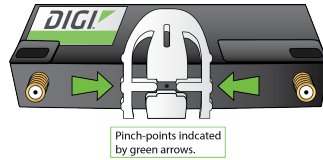
4. Secure the 1002-CM or 1003-CM CORE modem with an anchor screw.
5. Slide the white plastic plate over the antenna connectors to cover the plug-in modem as shown; it will clip into place. Image shows the 1002-CM CORE modem.



6. Affix the cellular antennas to the two connectors protruding from the device.

To remove the CORE modem:

1. Remove the anchor screw.
2. Pinch the two vertical sides of the white clip.



3. Slide the CORE modem out of the EX15 device.

Tips for improving cellular signal strength

If the signal strength LEDs or the signal quality for your device indicate **Poor** or **No service**, try the following things to improve signal strength:

- Move the device to another location.
- Try connecting a different set of antennas, if available.
- Purchase a Digi Antenna Extender Kit: [Antenna Extender Kit, 1m](#).

Connect data cables

The EX15 provides two types of data ports:

- **Ethernet** (RJ-45): Use a Cat 5e or Cat 6 Ethernet cable.
- **Serial** (RJ-45): Use a serial cable with an RJ45 connector to connect to the EX15 device.

Mount the EX15 device

The EX15 device comes with three mounting options:

- Ceiling mounting clips. Ceiling mounting clips come in narrow and wide sizes, to match the size of your suspended ceiling rails.
- Screws and drywall anchors.
- Zip ties.

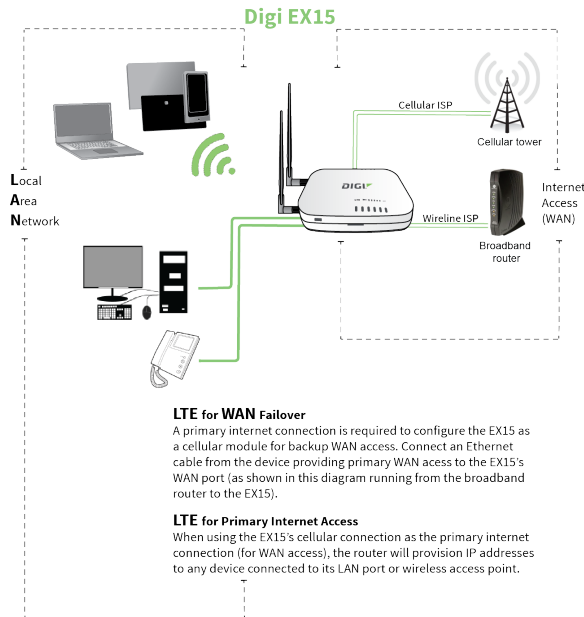
To mount the device:

1. Attach the mounting bracket to a surface using either the ceiling mounting clips, the screws and drywall anchors, or the zip ties.

If using the ceiling mounting clips, affix the appropriate clips to the mounting bracket by inserting the cross-tee end of the clip into the mounting holes on the bracket and twisting the clip until it locks into place.

2. Attach the EX15 device to the mounting bracket by aligning the tabs on bracket with the tab slots on the device.

Network integration



Note The EX15W is WiFi-enabled. The EX15 does not offer WiFi capabilities.

A second internet connection must be available for cellular failover.

When integrating a second Internet connection for cellular failover, connect the alternative ISP to the WAN port. This interface is configured for WAN access by default though ports can be reconfigured as necessary.

Enable router mode

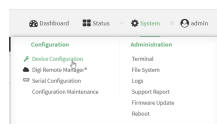
By default, the EX15 device is configured to operate in passthrough mode, which means that the device passes the IP address assigned to it via DHCP on its WAN interface, to a client connected to its LAN interface. See [Review EX15 default settings](#) for more information about the device's default settings.

Alternatively, the device can be configured to operate in router mode, where the LAN interface has a DHCP server that can provide IP addresses to multiple connected clients.

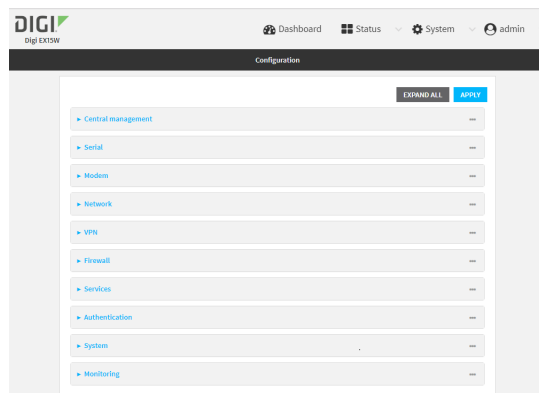
To configure the EX15 device to operate in router mode:

WebUI

1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.



3. Click **Network > Interfaces > LAN**.
4. For **Interface type**, select **Ethernet**.
5. (Optional) Set the IP address for the LAN. By default, the IP address is **192.168.2.1/24**.
 - a. Click to expand **IPv4**.
 - b. For **Address**, type the IP address you wish to assign to the device for its LAN DHCP network (that is, the gateway IP for the DHCP network).
6. Click **Apply** to save the configuration and apply the change.



Command line

1. Log into the EX15 command line as a user with full Admin access rights.
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the command line, type **config** to enter configuration mode:

```
> config
(config)>
```

3. Set the interface type to Ethernet:

```
(config)> network interface lan type ethernet
(config)>
```

4. (Optional) Set the IP address and netmask:

```
(config)> network interface lan ipv4 address ipv4_address/netmask
(config)>
```

5. Save the configuration and apply the change:

```
(config)> save
Configuration saved.
>
```

6. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

Configuration and management

This chapter contains the following topics:

Review EX15 default settings	40
Change the default password for the admin user	42
Reset default SSID and pre-shared key for the preconfigured Wi-Fi access point	43
Enable router mode	45
Configuration methods	47
Using Digi Remote Manager	48
Access Digi Remote Manager	48
Configure the device to use aView for central management	48
Using the web interface	52
Using the command line	55
Access the command line interface	55
Log in to the command line interface	55
Exit the command line interface	56

Review EX15 default settings

Note Devices manufactured with firmware version 20.2.x or greater are configured by default to use the Digi Remote Manager for cloud-based central device management. For information about configuring the device to use aView for central management instead, see [Configure the device to use aView for central management](#).

You can review the default settings for your EX15 device by using the local WebUI or Digi Remote Manager:

Local WebUI

1. Log into the EX15 WebUI as a user with Admin access. See [Using the web interface](#) for details.
2. On the menu, click **System > Device Configuration**.

Digi Remote Manager

1. If you have not already done so, connect to your Digi Remote Manager account.
2. Click **Device Management** to display a list of your devices.
3. Locate and select your device as described in [Use Digi Remote Manager to view and manage your device](#).
4. Click **Configure**.

The following tables list important factory default settings for the EX15.

Default interface configuration

Interface type	Preconfigured interfaces	Devices	Default configuration
Wide Area Network (WAN)	■ WAN	■ Ethernet: 2/WAN	■ Firewall zone: External ■ WAN priority: Metric=1 ■ IP Address: DHCP client ■ Digi SureLink™ enabled for IPv4
Wireless Wide Area Network (WWAN)	■ Modem	■ Modem	■ Firewall zone: External ■ WAN priority: Metric=3 ■ SIM failover after 5 attempts ■ SureLink enabled for IPv4

Interface type	Preconfigured interfaces	Devices	Default configuration
Local Area Network (LAN)	■ LAN	■ Ethernet: 1/PoE	■ Passthrough mode ■ Firewall zone: Internal ■ LAN priority: Metric=5 ■ Surelink disabled
	■ Loopback	■ Ethernet: Loopback	■ Firewall zone: Loopback ■ IP address: 127.0.0.1/8
	■ Default IP	■ Bridge: LAN	■ Firewall zone: Setup ■ IP address 192.168.210.1/24
	■ Default Link-local IP	■ Bridge: LAN	■ Firewall zone: Setup ■ IP address 169.254.100.100/16
Wi-Fi (available with EX15W models only)	■ Wi-Fi access point: Digi AP	■ Wi-Fi radio	■ Enabled Note While the access point is enabled by default, see Use the default Wi-Fi access point for procedures required to use the access point. ■ SSID: Digi-EX15W-<i>serial_number</i> ■ Encryption: WAP2 Personal (PSK) ■ Pre-shared key: The unique password printed on the bottom label of the device.
Bridges (Wi-Fi model only)	■ Bridge: LAN	■ Ethernet: 2/WAN ■ Wi-Fi access point: Digi AP	■ Disabled

Change the default password for the admin user

The unique, factory-assigned password for the default **admin** user account is printed on the bottom label of the device and on the loose label included in the package. When you first log into the WebUI or the command line, you will be required to change the password for the **admin** user prior to being able to save any configuration changes.

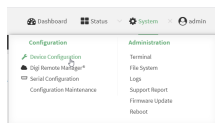
If you erase the device configuration or reset the device to factory defaults, the password for the **admin** user will revert to the original, factory-assigned default password.

Note If your device was manufactured prior to the release of firmware version 19.11.x, the default user name may be **root**.

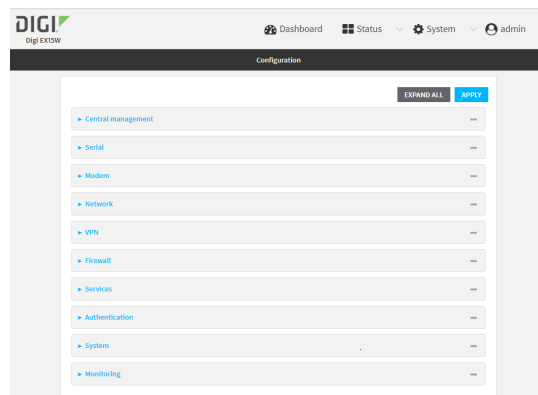
Additionally, for Wi-Fi enabled models, when you first log into the WebUI or the command line, you will be required the change the SSID and pre-shared key (password) for the preconfigured Wi-Fi access point. See [Reset default SSID and pre-shared key for the preconfigured Wi-Fi access point](#) for instructions.

WebUI

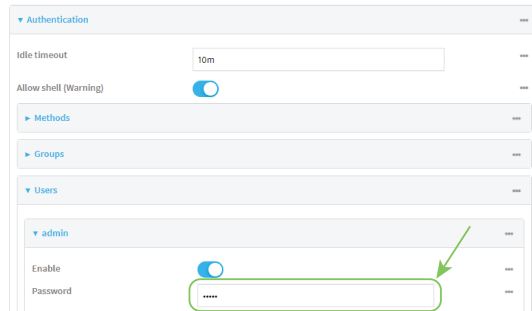
1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.



3. Click **Authentication > Users > admin**.
4. Enter a new password for the admin user. The password must be at least ten characters long and must contain at least one uppercase letter, one lowercase letter, one number, and one special character.



5. Click **Apply** to save the configuration and apply the change.



Command line

1. Log into the EX15 command line as a user with full Admin access rights.
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the command line, type **config** to enter configuration mode:

```
> config
(config)>
```

3. Set a new password for the admin user. The password must be at least ten characters long and must contain at least one uppercase letter, one lowercase letter, one number, and one special character.

```
(config)> auth user admin password new-password
(config)>
```

4. Save the configuration and apply the change:

```
(config)> save
Configuration saved.
>
```

5. Type **exit** to exit the Admin CLI.
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

Reset default SSID and pre-shared key for the preconfigured Wi-Fi access point

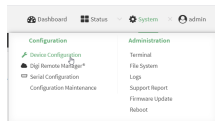
For the Wi-Fi enabled EX15W device, by default, the SSID and pre-shared key for the preconfigured Wi-Fi access point are:

- Enabled
- SSID: Digi-EX15W-serial_number
- Encryption: WAP2 Personal (PSK)
- Pre-shared key: The unique password printed on the bottom label of the device.

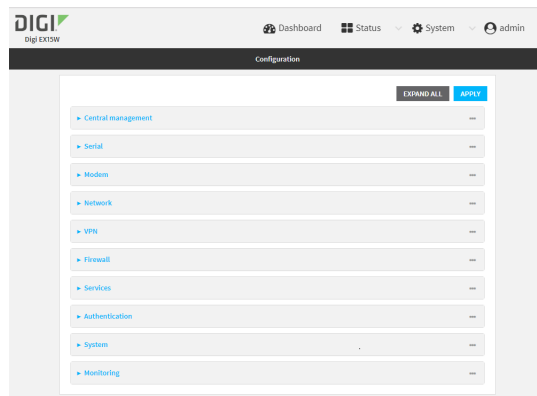
When you first log into the WebUI or the command line, or after erasing the configuration, you will be required to change the SSID and pre-shared key for the preconfigured Wi-Fi access point.

≡ WebUI

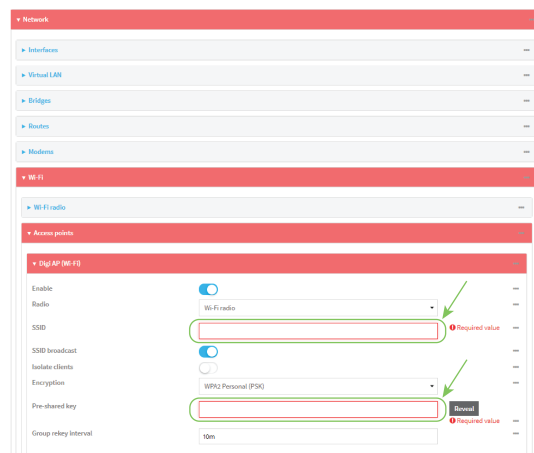
1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.



3. Click **Network > Wi-Fi > Digi AP**.



4. Enter a new **SSID** and **Pre-shared key**.
5. Click **Apply** to save the configuration and apply the change.



Command line

1. Log into the EX15 command line as a user with full Admin access rights.
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the command line, type **config** to enter configuration mode:

```
> config
(config)>
```

3. Set a new SSID for the **digi_ap** access point:

```
(config)> network wifi ap digi_ap ssid new_ssid
(config)>
```

4. Set a new pre-shared key:

```
(config)> network wifi ap digi_ap encryption key_psk2 new_key
(config)>
```

5. Save the configuration and apply the change:

```
(config)> save
Configuration saved.
>
```

6. Type **exit** to exit the Admin CLI.
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

Enable router mode

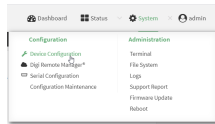
By default, the EX15 device is configured to operate in passthrough mode, which means that the device passes the IP address assigned to it via DHCP on its WAN interface, to a client connected to its LAN interface. See [Review EX15 default settings](#) for more information about the device's default settings.

Alternatively, the device can be configured to operate in router mode, where the LAN interface has a DHCP server that can provide IP addresses to multiple connected clients.

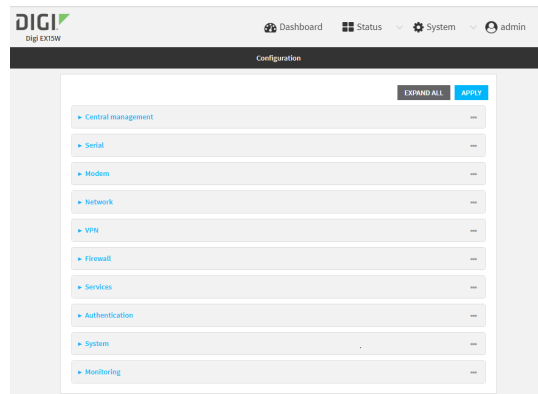
To configure the EX15 device to operate in router mode:

WebUI

1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.



3. Click **Network > Interfaces > LAN**.
4. For **Interface type**, select **Ethernet**.
5. (Optional) Set the IP address for the LAN. By default, the IP address is **192.168.2.1/24**.
 - a. Click to expand **IPv4**.
 - b. For **Address**, type the IP address you wish to assign to the device for its LAN DHCP network (that is, the gateway IP for the DHCP network).
6. Click **Apply** to save the configuration and apply the change.



Command line

1. Log into the EX15 command line as a user with full Admin access rights.
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the command line, type **config** to enter configuration mode:

```
> config
(config)>
```

3. Set the interface type to Ethernet:

```
(config)> network interface lan type ethernet
(config)>
```

4. (Optional) Set the IP address and netmask:

```
(config)> network interface lan ipv4 address ipv4_address/netmask
(config)>
```

5. Save the configuration and apply the change:

```
(config)> save
Configuration saved.
>
```

6. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

Configuration methods

There are two primary methods for configuring your EX15 device:

- Web interface.

The web interface can be accessed in two ways:

- Central management using the Digi Remote Manager, a cloud-based device management and data enablement platform that allows you to connect any device to any application, anywhere. With the Remote Manager, you can configure your EX15 device and use the configuration as a basis for a profile which can be applied to other similar devices. See [Using Digi Remote Manager](#) for more information about using the Remote Manager to manage and configure your EX15 device.
- The local web interface. See [Using the web interface](#) for more information about using the local web interface to manage and configure your EX15 device.

Web-based instructions in this guide are applicable to both the Remote Manager and the local web interface.

- Command line.

A robust command line allows you to perform all configuration and management tasks from within a command shell. Both the Remote Manager and the local web interface also have the option to open a terminal emulator for executing commands on your EX15 device. See [Using the command line](#) for more information about using the command line to manage and configure your EX15 device.

In this guide, task topics show how to perform tasks:

WebUI

Shows how to perform a task by using the local web interface.

Command line

Shows how to perform a task by using the command line interface.

Using Digi Remote Manager

Note Devices manufactured with firmware version 20.2.x or greater are configured by default to use the Digi Remote Manager for cloud-based central device management. For information about configuring the device to use aView for central management instead, see [Configure the device to use aView for central management](#).

By default, your EX15 device is configured to use Digi Remote Manager as its central management server. No configuration changes are required to begin using the Remote Manager.

For information about configuring central management for your EX15 device, see [Central management](#).

Access Digi Remote Manager

To access Digi Remote Manager:

1. If you have not already done so, go to <https://myaccount.digi.com/> to sign up for a Digi Remote Manager account.
Check your email for Digi Remote Manager login instructions.
2. Go to remotemanager.digi.com.
1. Enter your username and password.
The Digi Remote Manager Dashboard appears.

Configure the device to use aView for central management

EX15 devices manufactured with firmware version 20.2.x or greater are configured by default to use Digi Remote Manager for cloud-based central device management. Use this procedure to configure the device to connect to the aView central management tool instead.

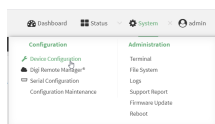
Note EX15 devices upgraded from a firmware version prior to 20.2.x to firmware version 20.2.x or greater will retain their central management configuration. Therefore, if the device was previously configured to use aView for central management, it will continue to use aView after upgrading to 20.2.x or greater.

However, if you erase the configuration of a device that was upgraded from a firmware version prior to 20.2.x, it will default to using Digi Remote Manager for cloud-based central device management.

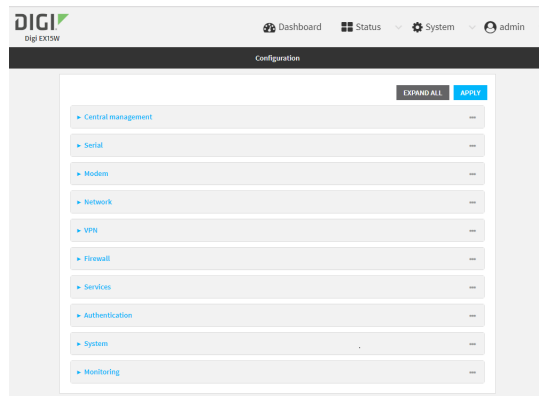
To configure the EX15 device to use aView rather than Digi Remote Manager for central management:

WebUI

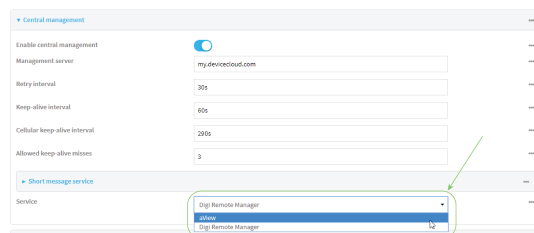
1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



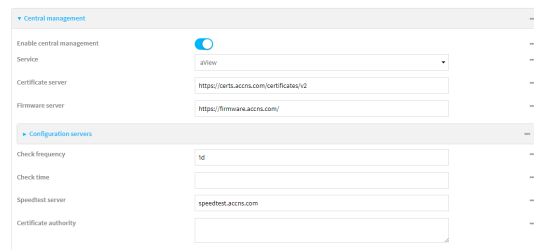
The **Configuration** window is displayed.



3. Click **Central Management**.
4. Click **Enable central management**, if it central management is not already enabled.
5. For **Service**, select **aView**.

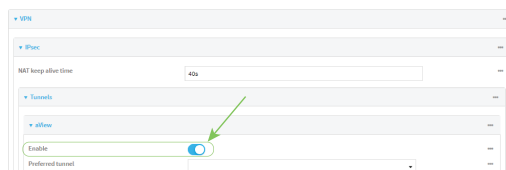


The Central management pane refreshes with the default aView configuration.



Review the default configuration. Generally, the default configuration should not be changed.

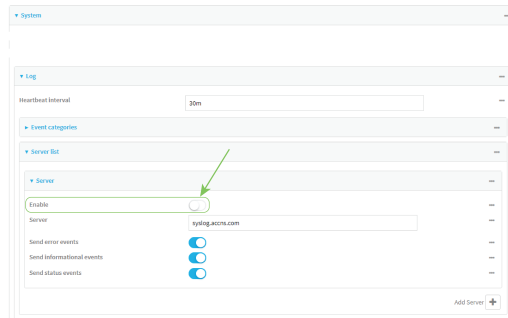
6. Enable the aView IPsec tunnel.
 - a. Click **VPN > IPsec > Tunnels > aView**.
 - b. Click **Enable**.



7. Enable the syslog server.

If the syslog server is not enabled and set to `syslog.accns.com`, the device will be able to connect to aView and receive configuration updates, but unless the aView configuration updates set the syslog server, the device will not be able to send any metrics or logs to aView.

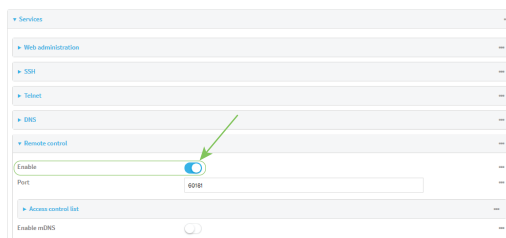
- a. Click **System** > **Log** > **Server list** > **Server**.
- b. Click **Enable**.



- c. Verify that **Server** is set to `syslog.accns.com`.
 - d. (Optional) Select the event types to be sent to aView.
8. (Optional) Enable **Remote control**.

Remote control allows remote commands to be sent from aView to the EX15 device. It is optional, but is required if you want to send remote commands from aView.

- a. Click **Services** > **Remote control**.
- b. Click **Enable**.



9. Click **Apply** to save the configuration and apply the change.



Command line

- Log into the EX15 command line as a user with full Admin access rights.
Depending on your device configuration, you may be presented with an **Access selection menu**. Type `admin` to access the Admin CLI.
- At the command line, type `config` to enter configuration mode:

```
> config
(config)>
```

3. Enable central management:

```
(config)> cloud enable true
(config)>
```

4. Set aView as the central management tool:

```
(config)> cloud service aview
(config)>
```

5. View the default aView configuration:

```
(config)> show cloud
aview
  certificate_url https://certs.accns.com/certificates/v2
  check_freq 1d
  no check_time
  config_url
    0 https://configuration.accns.com/
    1 https://arml.att.com/
    2 https://av-wob.gcsc.att.com/
  firmware_url https://firmware.accns.com/
  speedtest_server speedtest.accns.com
no ca
enable false
service aview
(config)>
```

Generally, the default configuration should not be changed.

6. Enable the aView IPsec tunnel.

```
(config)> vpn ipsec tunnel aview enable true
(config)>
```

7. Enable the syslog server.

If the syslog server is not enabled and set to syslog.accns.com, the device will be able to connect to aView and receive configuration updates, but unless the aView configuration updates set the syslog server, the device will not be able to send any metrics or logs to aView.

a. Enable the server:

```
(config)> system log remote 0 enable true
(config)>
```

b. Verify that the remote log server is set to syslog.accns.com:

```
(config)> show system log remote 0 server
syslog.accns.com
(config)>
```

c. (Optional) Select the event types to be sent to aView.

There are three event types that can be used configured for the remote syslog server:

- Informational
- Status
- Error

By default, all three event types are enabled. To disable:

- i. Disable informational messages from being sent to aView:

```
(config)> system log remote 0 info false
(config)>
```

- ii. Disable status messages from being sent to aView:

```
(config)> system log remote 0 status false
(config)>
```

- iii. Disable error messages from being sent to aView:

```
(config)> system log remote 0 error false
(config)>
```

8. (Optional) Enable remote control.

Remote control allows remote commands to be sent from aView to the EX15 device. It is optional, but is required if you want to send remote commands from aView.

```
(config)> service remote_control enable true
(config)>
```

9. Save the configuration and apply the change:

```
(config)> save
Configuration saved.
>
```

10. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

After configuring the device to use aView for its central management tool, consult with the [Digi aView User Guide](#) for additional information.

Using the web interface

To connect to the EX15 local WebUI:

1. Use an Ethernet cable to connect the EX15's **1/PoE** port to a laptop or PC.
2. Open a browser and go to **192.168.210.1**.
3. Log into the device using a configured user name and password.

The default user name is **admin** and the default password is the unique password printed on the label packaged with your device.

Note If your device was manufactured prior to firmware version 19.11.x, the default user for logging into the device may be **root**, rather than **admin**.

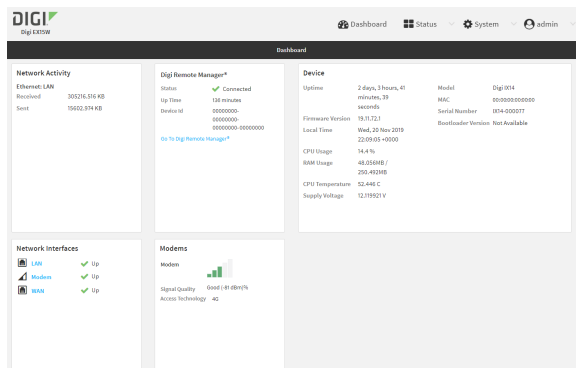
- The default user is **root**:
 - If the device is at a firmware level 19.8.x or older.
 - If the device has been upgraded from 19.8.x or older to 19.11.x or newer.
- The default user is **admin**:
 - If the device is at 19.11.x or newer when manufactured.
 - If the device has been upgraded from 19.8.x or older to 19.11.x or newer and has been factory reset after the upgrade.
- Devices that connect to Digi aView for cloud management may have a different password for the default user, based on the aView configuration profile used by the device. Devices with firmware prior to release 20.2.x are configured to connect to aView by default.

To connect to the local Web UI in this case, you must either know the password from the aView configuration profile, or you must disconnect from aView and reset the device to factory defaults.

To disconnect from aView and reset the device:

- a. Remove any SIM and WAN connections to prevent the device from connecting to aView after resetting to factory defaults.
- b. Follow the instructions at [Erase device configuration and reset to factory defaults](#) to reset the device to factory defaults.
- c. Log into the local Web UI by using the default username and password.
- d. Prior to inserting a SIM or connecting to a WAN connection, disable central management or configure the device to connect to Digi Remote Manager, as described in [Configure Digi Remote Manager](#).

After logging in, the local web admin dashboard is displayed.

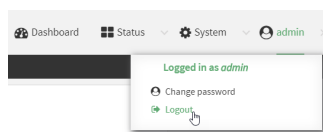


The dashboard shows the current state of the device.

Dashboard area	Description
Network activity	Summarizes network statistics: the total number of bytes sent and received over all configured bridges and Ethernet devices.
Digi Remote Manager	Displays the device connection status for Digi Remote Manager, the amount of time the connection has been up, and the Digi Remote Manager device ID. See Using Digi Remote Manager .
Device	Displays the EX15 device's status, statistics, and identifying information.
Network Interfaces	Displays the status of the network interfaces configured on the device.
Modems	Provides information about the signal strength and technology of the cellular modem (s).

Log out of the web interface

- On the main menu, click your user name. Click **Log out**.



Using the command line

The Digi EX15 device provides a command-line interface that you can use to configure the device, display status and statistics, update firmware, and manage device files.

See [Command line interface](#) for detailed instructions on using the command line interface and see [Command line reference](#) for information on available commands.

Access the command line interface

You can access the EX15 command line interface using an SSH connection, a telnet connection, or a serial connection. You can use an open-source terminal software, such as PuTTY or TeraTerm, to access the device through one of these mechanisms.

You can also access the command line interface in the WebUI by using the **Terminal**, or the Digi Remote Manager by using the **Console**.

To access the command line, your device must be configured to allow access, and you must log in as a user who has been configured for the appropriate access. For further information about configuring access to these services, see:

- WebUI: [Configure the web administration service](#)
- SSH: [Configure SSH access](#)
- Telnet: [Configure telnet access](#)

Log in to the command line interface

Command line

1. Connect to the EX15 device by using a serial connection, SSH or telnet, or the **Terminal** in the WebUI or the **Console** in the Digi Remote Manager. See [Access the command line interface](#) for more information.
 - For serial connections, the default configuration is:
 - **115200** baud rate
 - **8** data bits
 - **no** parity
 - **1** stop bit
 - **no** flow control
 - For SSH and telnet connections, the default IP address of the device is **192.168.210.1** on the .
2. At the login prompt, enter the username and password of a user with Admin access:

```
login: admin
Password: *****
```

The default username is **admin**. The default unique password for your device is printed on the device label.

3. Depending on the device configuration, you may be presented with another menu, for example:

Access selection menu:

a: Admin CLI
s: Shell
q: Quit

Select access or quit [admin] :

Type **a** or **admin** to access the EX15 command line.

You will now be connected to the Admin CLI:

Connecting now, 'exit' to disconnect from Admin CLI ...

>

See [Command line interface](#) for detailed instructions on using the command line interface.

Exit the command line interface

Command line

1. At the command prompt, type **exit**.

> exit

2. Depending on the device configuration, you may be presented with another menu, for example:

Access selection menu:

a: Admin CLI
s: Shell
q: Quit

Select access or quit [admin] :

Type **q** or **quit** to exit.

Interfaces

EX15 devices have several physical communications interfaces. These interfaces can be bridged in a Local Area Network (LAN) or assigned to a Wide Area Network (WAN).
This chapter contains the following topics:

Wide Area Networks (WANs)	58
Local Area Networks (LANs)	129
Bridging	168

Wide Area Networks (WANs)

The EX15 device is preconfigured with one Wide Area Network (WAN), named **WAN**, and one Wireless Wide Area Network (WWAN), named **Modem**.

Interface type	Preconfigured interfaces	Devices	Default configuration
Wide Area Network (WAN)	■ WAN	■ Ethernet: 2/WAN	■ Firewall zone: External ■ WAN priority: Metric=1 ■ IP Address: DHCP client ■ Digi SureLink™ enabled for IPv4
Wireless Wide Area Network (WWAN)	■ Modem	■ Modem	■ Firewall zone: External ■ WAN priority: Metric=3 ■ SIM failover after 5 attempts ■ SureLink enabled for IPv4

Interface type	Preconfigured interfaces	Devices	Default configuration
Wide Area Network (WAN)	■ WAN	■ Ethernet: 2/WAN	■ Firewall zone: External ■ WAN priority: Metric=1 ■ IP Address: DHCP client ■ Digi SureLink™ enabled for IPv4

Interface type	Preconfigured interfaces	Devices	Default configuration
Wireless Wide Area Network (WWAN)	■ Modem	■ Modem	■ Firewall zone: External ■ WAN priority: Metric=3 ■ SIM failover after 5 attempts ■ SureLink enabled for IPv4

You can modify configuration settings for the existing WAN and WWANs, and you can create new WANs and WWANs.

This section contains the following topics:

Wide Area Networks (WANs) and Wireless Wide Area Networks (WWANs)	60
Configure WAN/WWAN priority and default route metrics	60
WAN/WWAN failover	63
Configure SureLink active recovery to detect WAN/WWAN failures	64
Configure the device to reboot when a failure is detected	71
Disable SureLink	78
Example: Use a ping test for WAN failover from Ethernet to cellular	82
Using Ethernet devices in a WAN	85
Using cellular modems in a Wireless WAN (WWAN)	85
Configure a Wide Area Network (WAN)	108
Configure a Wireless Wide Area Network (WWAN)	115
Show WAN and WWAN status and statistics	124
Delete a WAN or WWAN	127

Wide Area Networks (WANs) and Wireless Wide Area Networks (WWANs)

A Wide Area Network (WAN) provides connectivity to the internet or a remote network. A WAN configuration consists of the following:

- A physical device, such as an Ethernet device or a cellular modem.
- Several networking parameters for the WAN, such as firewall configuration and IPv4 and IPv6 support.
- Several parameters controlling failover.

Configure WAN/WWAN priority and default route metrics

The EX15 device is preconfigured with one Wide Area Network (WAN), named **WAN**, and one Wireless Wide Area Network (WWAN), named **Modem**. You can also create additional WANs and WWANs.

When a WAN is initialized, the EX15 device automatically adds a default IP route for the WAN. The priority of the WAN is based on the metric of the default route, as configured in the WAN's IPv4 and IPv6 metric settings.

Assigning priority to WANs

By default, the EX15 device's WAN (**WAN**) is configured with the lowest metric (**1**), and is therefore the highest priority WAN. By default, the Wireless WAN (**Modem**) is configured with a metric of **3**, which means it has a lower priority than **WAN**. You can assign priority to WANs based on the behavior you want to implement for primary and backup WAN interfaces. For example, if you want a cellular connection to be your primary WAN, with an Ethernet interface as backup, configure the metric of the WWAN to be lower than the metric of the WAN.

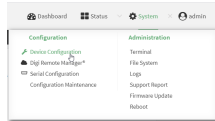
Example: Configure cellular connection as the primary WAN, and the Ethernet connection as backup

Required configuration items

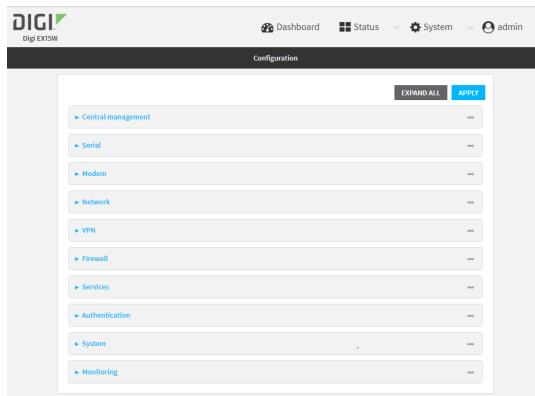
- Configured WAN and WWAN interfaces. This example uses the preconfigured **WAN** and **Modem** interfaces.
- The metric for each WAN.

WebUI

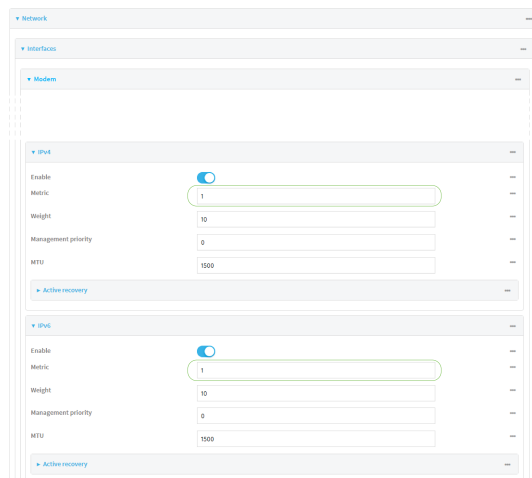
1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.



3. Set the metrics for **Modem**:
 - a. Click **Network > Interfaces > Modem > IPv4**.
 - b. For **Metric**, type **1**.
 - c. Click **IPv6**.
 - d. For **Metric**, type **1**.



4. Set the metrics for **WAN**:
 - a. Click **Network > Interfaces > WAN > IPv4**.
 - b. For **Metric**, type **2**.

- c. Click **IPv6**.
- d. For **Metric**, type **2**.

5. Click **Apply** to save the configuration and apply the change.

The EX15 device is now configured to use the cellular modem WWAN, **Modem**, as its highest priority WAN, and its Ethernet WAN, **WAN**, as its secondary WAN.

Command line

1. Log into the EX15 command line as a user with full Admin access rights.
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the command line, type **config** to enter configuration mode:

```
> config
(config)>
```

3. Set the metrics for **Modem**:
 - a. Set the IPv4 metric for **Modem** to **1**. For example:

```
(config)> network interface modem ipv4 metric 1
(config)>
```

- b. Set the IPv6 metric for **Modem** to **1**:

```
(config)> network interface modem ipv6 metric 1
(config)>
```

4. Set the metrics for **WAN**:
 - a. Set the IPv4 metric for **WAN** to 2:

```
(config)> network interface wan ipv4 metric 2
(config)>
```

- b. Set the IPv6 metric for **WAN** to 1:

```
(config)> network interface wan ipv6 metric 2
(config)>
```

5. Save the configuration and apply the change:

```
(config)> save
Configuration saved.
>
```

6. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

The EX15 device is now configured to use the cellular modem WWAN, **Modem**, as its highest priority WAN, and its Ethernet WAN, **WAN**, as its secondary WAN.

WAN/WWAN failover

If a connection to a WAN interface is lost for any reason, the EX15 device will immediately fail over to the next WAN or WWAN interface, based on WAN priority. See [Configure WAN/WWAN priority and default route metrics](#) for more information about WAN priority.

Active vs. passive failure detection

There are two ways to detect WAN or WWAN failure: active detection and passive detection.

- Active detection uses Digi SureLink™ technology to send probe tests to a target host or to test the status of the interface. The WAN/WWAN is considered to be down if there are no responses for a configured amount of time. See [Configure SureLink active recovery to detect WAN/WWAN failures](#) for more information about active failure detection.
- Passive detection involves detecting the WAN going down by monitoring its link status by some means other than active detection. For example, if an Ethernet cable is disconnected or the state of a cellular interface changes from **on** to **off**, the WAN is down.

Default Digi SureLink configuration

Beginning with firmware version 20.2.x, Surelink is enabled by default for IPv4 on all WAN and WWAN interfaces, and is configured to perform two tests on these interfaces:

- Interface connectivity.
- DNS query to the DNS servers for interface's the network connection.
DNS servers are typically received as part of the interface's DHCP client connection, although you can manually configure the DNS servers that will be used by SureLink.

Note If your device is operating on a private APN or on wired network with firewall restrictions, ensure that the DNS servers on your private network allow DNS lookups for my.devicecloud.com; otherwise, the SureLink DNS query test will fail and the EX15 device will determine that the interface is down.

By default, these tests will be performed every 15 minutes, with a response timeout of 15 seconds. If the tests fail three consecutive times, the device will reset the network interface to attempt to recover the connection.

Configure SureLink active recovery to detect WAN/WWAN failures

Problems can occur beyond the immediate WAN/WWAN connection that prevent some IP traffic from reaching its destination. Normally this kind of problem does not cause the EX15 device to detect that the WAN has failed, because the connection continues to work while the core problem exists somewhere else in the network.

Using Digi SureLink, you can configure the EX15 device to regularly probe connections through the WAN to determine if the WAN has failed.

Required configuration items

- Enable SureLink.

SureLink can be enabled for both IPv4 and IPv6 configurations. By default, SureLink is enabled for IPv4 for the preconfigured WAN (**WAN**) and WWAN (**Modem**). It is disabled for IPv6.

When SureLink is configured for Wireless WANs, SureLink tests are only run if the cellular modem is connected and has an IP address. Use the **SIM failover** options to configure the EX15 device to automatically recover the modem in the event that it cannot obtain an IP address. See [Configure a Wireless Wide Area Network \(WWAN\)](#) for details about **SIM failover**.

- The type of probe test to be performed, either:
 - Ping: Requires the hostname or IP address of the host to be pinged.
 - DNS query: You can perform a DNS query to a named DNS server, or to the DNS servers configured for the WAN.
 - HTTP or HTTPS test: Requires the URL of the host to be tested.
 - Interface status: Determines if the interface has an IP address assigned to it, that the physical link is up, and that a route is present to send traffic out of the network interface.

The preconfigured WAN is configured by default to use SureLink to both test the interface status and perform a test DNS query.

Additional configuration items

- The behavior of the EX15 device upon test failure:
 - The default behavior, which is to fail over to the next priority WAN/WWAN.
 - Restart the WAN interface.
 - Reboot the device.
- The interval between connectivity tests.
- The number of probe attempts before the WAN is considered to have failed.
- The amount of time that the device should wait for a response to a probe attempt before considering it to have failed.

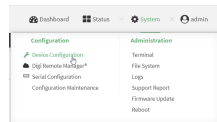
- If the type of probe test is:
 - Ping: Configure the number of bytes in the ping packet.
 - Interface status: Configure the amount of time that the interface is down before it is considered to have failed, and the amount of time it takes to make an initial connection before it is considered down.
- Additional test targets.
- If more than one test target is configured, determine whether the interface should fail over based on the failure of one of the test targets, or all of the test targets.

To configure the EX15 device to regularly probe connections through the WAN:

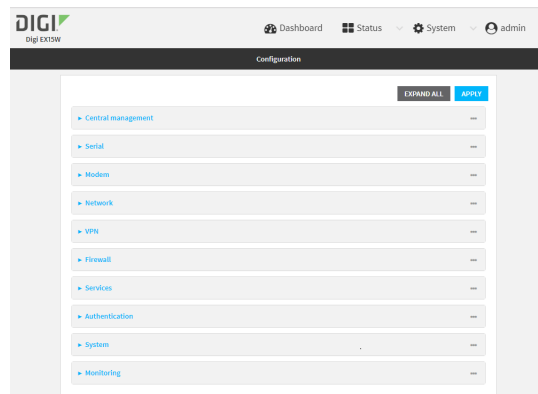
WebUI

SureLink can be configured for both IPv4 and IPv6.

1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.



3. Click **Network > Interfaces**.
4. Create a new WAN or WWAN or select an existing one:
 - To create a new WAN or WWAN, see [Configure a Wide Area Network \(WAN\)](#) or [Configure a Wireless Wide Area Network \(WWAN\)](#).
 - To edit an existing WAN or WWAN, click to expand the appropriate WAN or WWAN.

5. After creating or selecting the WAN or WWAN, click **IPv4** (or **IPv6**) > **SureLink**.

6. **Enable** SureLink.

SureLink can be enabled for both IPv4 and IPv6 configurations. By default, SureLink is enabled for IPv4 for the preconfigured WAN (**WAN**) and WWAN (**Modem**). It is disabled for IPv6.

When SureLink is configured for Wireless WANs, SureLink tests are only run if the cellular modem is connected and has an IP address. Use the **SIM failover** options to configure the EX15 device to automatically recover the modem in the event that it cannot obtain an IP address. See [Configure a Wireless Wide Area Network \(WWAN\)](#) for details about **SIM failover**.

7. Click to expand **Test targets**.
8. For **Add Test Target**, click **+**.

9. Select the **Test type**:

- **Ping test:** Tests connectivity by sending an ICMP echo request to the hostname or IP address specified in **Ping host**. You can also optionally change the number of bytes in the **Ping payload size**.
- **DNS test:** Tests connectivity by sending a DNS query to the specified **DNS server**.
- **HTTP test:** Tests connectivity by sending an HTTP or HTTPS GET request to the URL specified in **Web servers**. The URL should take the format of **http[s]://hostname/[path]**.
- **Test DNS servers configured for this interface:** Tests connectivity by sending a DNS query to the DNS servers configured for this interface.
- **Test the interface status:** The interface is considered to be down based on:
 - **Down time:** The amount of time that the interface can be down before this test is considered to have failed.
 Allowed values are any number of weeks, days, hours, minutes, or seconds, and take the format **number{w|d|h|m|s}**.
 For example, to set **Down time** to ten minutes, enter **10m** or **600s**.
 The default is 60 seconds.
 - **Initial connection time:** The amount of time to wait for an initial connection to the interface before this test is considered to have failed.
 Allowed values are any number of weeks, days, hours, minutes, or seconds, and take the format **number{w|d|h|m|s}**.
 For example, to set **Initial connection time** to ten minutes, enter **10m** or **600s**.
 The default is 60 seconds.

10. Optional active recovery configuration parameters:
 - a. For **Restart interface**, enable to configure the device to restart the interface when its connection is considered to have failed. This is useful for interfaces that may regain connectivity after restarting, such as a cellular modem.
 - b. For **Reboot device**, enable to instruct the device to reboot when the WAN connection is considered to have failed.

Note If both the **Restart interface** and **Reboot device** parameters are enabled, the **Reboot device** parameter takes precedence.

 - c. Change the **Interval** between connectivity tests.
 Allowed values are any number of weeks, days, hours, minutes, or seconds, and take the format **number{w|d|h|m|s}**.
 For example, to set **Interval** to ten minutes, enter **10m** or **600s**.
 The default is 15 minutes.
 - d. If more than one test target is configured, for **Success condition**, determine whether the interface should fail over based on the failure of one of the test targets, or all of the test targets.
 - e. For **Attempts**, type the number of probe attempts before the WAN is considered to have failed.
 - f. For **Response timeout**, type the amount of time that the device should wait for a response to a probe attempt before considering it to have failed.
 Allowed values are any number of weeks, days, hours, minutes, or seconds, and take the format **number{w|d|h|m|s}**.
 For example, to set **Response timeout** to ten minutes, enter **10m** or **600s**.
 The default is 15 seconds.
11. (Optional) Repeat this procedure for IPv6.
12. Click **Apply** to save the configuration and apply the change.



Command line

Active recovery can be configured for both IPv4 and IPv6. These instructions are for IPv4; to configure IPv6 active recovery, replace **ipv4** in the command line with **ipv6**.

1. Log into the EX15 command line as a user with full Admin access rights.
 Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the command line, type **config** to enter configuration mode:

```
> config
(config)>
```

3. Create a new WAN or WWAN, or edit an existing one:

- To create a new WAN or WWAN, see [Configure a Wide Area Network \(WAN\)](#) or [Configure a Wireless Wide Area Network \(WWAN\)](#).
- To edit an existing WAN or WWAN, change to the WAN or WWAN's node in the configuration schema. For example, for a WAN or WWAN named **my_wan**, change to the **my_wan** node in the configuration schema:

```
(config)> network interface my_wan
(config network interface my_wan)>
```

4. Enable SureLink.

SureLink can be enabled for both IPv4 and IPv6 configurations. By default, SureLink is enabled for IPv4 for the preconfigured WAN (wan) and WWAN (modemwwan2). It is disabled for IPv6.

When SureLink is configured for Wireless WANs, SureLink tests are only run if the cellular modem is connected and has an IP address. Use the **SIM failover** options to configure the EX15 device to automatically recover the modem in the event that it cannot obtain an IP address. See [Configure a Wireless Wide Area Network \(WWAN\)](#) for details about **SIM failover**.

```
(config network interface my_wan> ipv4 surelink enable true
(config network interface my_wan)>
```

5. Add a test target:

```
(config network interface my_wan)> add ipv4 surelink target end
(config network interface my_wan ipv4 surelink target 0)>
```

6. Set the test type:

```
(config network interface my_wan ipv4 surelink target 0)> test value
(config network interface my_wan ipv4 surelink target 0)>
```

where *value* is one of:

- **ping:** Tests connectivity by sending an ICMP echo request to a specified hostname or IP address.

- Specify the hostname or IP address:

```
(config network interface my_wan ipv4 surelink target 0)> ping_
host host
(config network interface my_wan ipv4 surelink target 0)>
```

- (Optional) Set the size, in bytes, of the ping packet:

```
(config network interface my_wan ipv4 surelink target 0)> ping_
size [num]
(config network interface my_wan ipv4 surelink target 0)>
```

- **dns:** Tests connectivity by sending a DNS query to the specified DNS server.
 - Specify the DNS server. Allowed value is the IP address of the DNS server.

```
(config network interface my_wan ipv4 surelink target 0)> dns_
server ip_address
(config network interface my_wan ipv4 surelink target 0)>
```

- **dns_configured:** Tests connectivity by sending a DNS query to the DNS servers configured for this interface.
- **http:** Tests connectivity by sending an HTTP or HTTPS GET request to the specified URL.
 - Specify the url:

```
(config network interface my_wan ipv4 surelink target 0)> http_url
value
(config network interface my_wan ipv4 surelink target 0)>
```

where *value* uses the format **http[s]://hostname/[path]**

- **interface_down:** The interface is considered to be down based on the interfaces down time, and the amount of time an initial connection to the interface takes before this test is considered to have failed.
 - (Optional) Set the amount of time that the interface can be down before this test is considered to have failed:

```
(config network interface my_wan ipv4 surelink target 0)>
interface_down_time value
(config network interface my_wan ipv4 surelink target 0)>
```

where *value* is any number of weeks, days, hours, minutes, or seconds, and takes the format **number{w|d|h|m|s}**.

For example, to set **interface_down_time** to ten minutes, enter either **10m** or **600s**:

```
(config network interface my_wan ipv4 surelink target 0)>
interface_down_time 600s
(config network interface my_wan ipv4 surelink target 0)>
```

The default is 60 seconds.

- (Optional) Set the amount of time to wait for an initial connection to the interface before this test is considered to have failed:

```
(config network interface my_wan ipv4 surelink target 0)>
interface_timeout value
(config network interface my_wan ipv4 surelink target 0)>
```

where *value* is any number of weeks, days, hours, minutes, or seconds, and takes the format **number{w|d|h|m|s}**.

For example, to set **interface_timeout** to ten minutes, enter either **10m** or **600s**:

```
(config network interface my_wan ipv4 surelink target 0)>
interface_timeout 600s
(config network interface my_wan ipv4 surelink target 0)>
```

The default is 60 seconds.

(Optional) Repeat to add additional test targets.

7. Optional active recovery configuration parameters:

- a. Move back two levels in the configuration by typing `..` `..`:

```
(config network interface my_wan ipv4 surelink target 0)> .. ..
(config network interface my_wan ipv4 surelink>
```

- b. To configure the device to restart the interface when its connection is considered to have failed:

```
(config network interface my_wan ipv4 surelink)> restart enable
(config network interface my_wan ipv4 surelink>
```

This is useful for interfaces that may regain connectivity after restarting, such as a cellular modem.

- c. To configure the device to reboot when the interface is considered to have failed:

```
(config network interface my_wan ipv4 surelink)> reboot enable
(config network interface my_wan ipv4 surelink>
```

Note If both the **restart** and **reboot** parameters are enabled, the **reboot** parameter takes precedence.

- d. Set the **interval** between connectivity tests:

```
(config network interface my_wan ipv4 surelink)> interval value
(config network interface my_wan ipv4 surelink>
```

where *value* is any number of weeks, days, hours, minutes, or seconds, and takes the format **number{w|d|h|m|s}**.

For example, to set **interval** to ten minutes, enter either **10m** or **600s**:

```
(config network interface my_wan ipv4 surelink)> interval 600s
(config network interface my_wan ipv4 surelink>
```

The default is 15 minutes.

- e. If more than one test target is configured, determine whether the interface should fail over based on the failure of one of the test targets, or all of the test targets:

```
(config network interface my_wan ipv4 surelink)> success_condition value
(config network interface my_wan ipv4 surelink>
```

Where *value* is either **one** or **all**.

- f. Set the number of probe attempts before the WAN is considered to have failed:

```
(config network interface my_wan ipv4 surelink)> attempts num
(config network interface my_wan ipv4 surelink>
```

The default is **3**.

- g. Set the amount of time that the device should wait for a response to a probe attempt before considering it to have failed:

```
(config network interface my_wan ipv4 surelink)> timeout value
(config network interface my_wan ipv4 surelink>
```

where *value* is any number of weeks, days, hours, minutes, or seconds, and takes the format **number{w|d|h|m|s}**.

For example, to set **timeout** to ten minutes, enter either **10m** or **600s**:

```
(config network interface my_wan ipv4 surelink)> timeout 600s
(config network interface my_wan ipv4 surelink)>
```

The default is 15 seconds.

8. (Optional) Repeat this procedure for IPv6.
9. Save the configuration and apply the change:

```
(config network interface my_wan ipv4 surelink)> save
Configuration saved.
>
```

10. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

Configure the device to reboot when a failure is detected

Using SureLink, you can configure the EX15 device to reboot when it has determined that an interface has failed.

Required configuration items

- Enable SureLink.
SureLink can be enabled for both IPv4 and IPv6 configurations. By default, SureLink is enabled for IPv4 for the preconfigured WAN (**WAN**) and WWAN (**Modem**). It is disabled for IPv6.
When SureLink is configured for Wireless WANs, SureLink tests are only run if the cellular modem is connected and has an IP address. Use the **SIM failover** options to configure the EX15 device to automatically recover the modem in the event that it cannot obtain an IP address. See [Configure a Wireless Wide Area Network \(WWAN\)](#) for details about **SIM failover**.
- Enable device reboot upon interface failure.
- The type of probe test to be performed, either:
 - Ping: Requires the hostname or IP address of the host to be pinged.
 - DNS query: You can perform a DNS query to a named DNS server, or to the DNS servers configured for the WAN.

- HTTP or HTTPS test: Requires the URL of the host to be tested.
- Interface status: Determines if the interface has an IP address assigned to it, that the physical link is up, and that a route is present to send traffic out of the network interface.

Additional configuration items

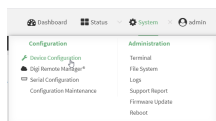
- See [Configure SureLink active recovery to detect WAN/WWAN failures](#) for optional SureLink configuration parameters.

To configure the EX15 device to reboot when an interface has failed:

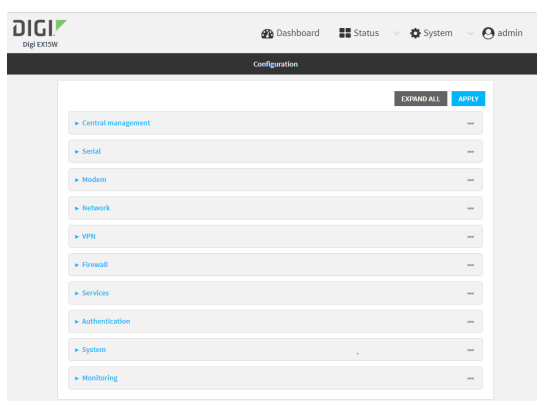
WebUI

SureLink can be configured for both IPv4 and IPv6.

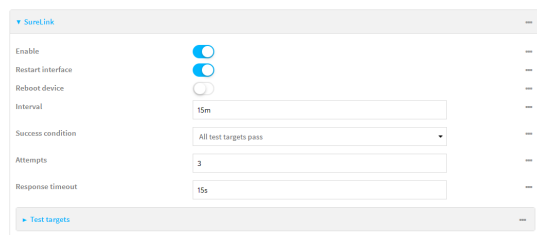
1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.



3. Click **Network > Interfaces**.
4. Create a new interface or select an existing one:
 - To create a new interface, see [Configure a LAN](#), [Configure a Wide Area Network \(WAN\)](#), or [Configure a Wireless Wide Area Network \(WWAN\)](#).
 - To edit an existing interface, click to expand the appropriate interface.
5. After creating or selecting the interface, click **IPv4** (or **IPv6**) > **SureLink**.



6. **Enable** SureLink.

SureLink can be enabled for both IPv4 and IPv6 configurations. By default, SureLink is enabled for IPv4 for the preconfigured WAN (**WAN**) and WWAN (**Modem**). It is disabled for IPv6.

When SureLink is configured for Wireless WANs, SureLink tests are only run if the cellular modem is connected and has an IP address. Use the **SIM failover** options to configure the EX15 device to automatically recover the modem in the event that it cannot obtain an IP address. See [Configure a Wireless Wide Area Network \(WWAN\)](#) for details about **SIM failover**.

7. Enable **Reboot device**.

Note If both the **Restart interface** and **Reboot device** parameters are enabled, the **Reboot device** parameter takes precedence.

8. Click to expand **Test targets**.
9. For **Add Test Target**, click **+**.



10. Select the **Test type**:
 - **Ping test**: Tests connectivity by sending an ICMP echo request to the hostname or IP address specified in **Ping host**. You can also optionally change the number of bytes in the **Ping payload size**.
 - **DNS test**: Tests connectivity by sending a DNS query to the specified **DNS server**.
 - **HTTP test**: Tests connectivity by sending an HTTP or HTTPS GET request to the URL specified in **Web servers**. The URL should take the format of **http[s]://hostname/[path]**.
 - **Test DNS servers configured for this interface**: Tests connectivity by sending a DNS query to the DNS servers configured for this interface.
 - **Test the interface status**: The interface is considered to be down based on:
 - **Down time**: The amount of time that the interface can be down before this test is considered to have failed.
Allowed values are any number of weeks, days, hours, minutes, or seconds, and take the format **number{w|d|h|m|s}**.
For example, to set **Down time** to ten minutes, enter **10m** or **600s**.
The default is 60 seconds.
 - **Initial connection time**: The amount of time to wait for an initial connection to the interface before this test is considered to have failed.
Allowed values are any number of weeks, days, hours, minutes, or seconds, and take the format **number{w|d|h|m|s}**.
For example, to set **Initial connection time** to ten minutes, enter **10m** or **600s**.
The default is 60 seconds.
11. Optional active recovery configuration parameters:
 - a. Change the **Interval** between connectivity tests.
Allowed values are any number of weeks, days, hours, minutes, or seconds, and take the format **number{w|d|h|m|s}**.
For example, to set **Interval** to ten minutes, enter **10m** or **600s**.
The default is 15 minutes.
 - b. If more than one test target is configured, for **Success condition**, determine whether the interface should fail over based on the failure of one of the test targets, or all of the test targets.
 - c. For **Attempts**, type the number of probe attempts before the WAN is considered to have failed.

- d. For **Response timeout**, type the amount of time that the device should wait for a response to a probe attempt before considering it to have failed.
Allowed values are any number of weeks, days, hours, minutes, or seconds, and take the format **number{w|d|h|m|s}**.

For example, to set **Response timeout** to ten minutes, enter **10m** or **600s**.

The default is 15 seconds.

12. (Optional) Repeat this procedure for IPv6.
13. Click **Apply** to save the configuration and apply the change.



Command line

Active recovery can be configured for both IPv4 and IPv6. These instructions are for IPv4; to configure IPv6 active recovery, replace **ipv4** in the command line with **ipv6**.

1. Log into the EX15 command line as a user with full Admin access rights.
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
 2. At the command line, type **config** to enter configuration mode:
-
- ```
> config
(config)>
```
- 
3. Create a new interface, or edit an existing one:
    - To create a new interface, see [Configure a LAN](#), [Configure a Wide Area Network \(WAN\)](#), or [Configure a Wide Area Network \(WAN\)](#) or [Configure a Wireless Wide Area Network \(WWAN\)](#).
    - To edit an existing interface, change to the interface's node in the configuration schema. For example, for a interface named **my\_wan**, change to the **my\_wan** node in the configuration schema:

---

```
(config)> network interface my_wan
(config network interface my_wan)>
```

---

4. Enable SureLink.

SureLink can be enabled for both IPv4 and IPv6 configurations. By default, SureLink is enabled for IPv4 for the preconfigured WAN (wan) and WWAN (modemwwan2). It is disabled for IPv6.

When SureLink is configured for Wireless WANs, SureLink tests are only run if the cellular modem is connected and has an IP address. Use the **SIM failover** options to configure the EX15 device to automatically recover the modem in the event that it cannot obtain an IP address. See [Configure a Wireless Wide Area Network \(WWAN\)](#) for details about **SIM failover**.

---

```
(config network interface my_wan> ipv4 surelink enable true
(config network interface my_wan)>
```

---

5. Set the device to reboot when the interface is considered to have failed:

```
(config network interface my_wan ipv4 surelink)> reboot true
(config network interface my_wan ipv4 surelink>
```

**Note** If both the **restart** and **reboot** parameters are enabled, the **reboot** parameter takes precedence.

6. Add a test target:

```
(config network interface my_wan)> add ipv4 surelink target end
(config network interface my_wan ipv4 surelink target 0)>
```

7. Set the test type:

```
(config network interface my_wan ipv4 surelink target 0)> test value
(config network interface my_wan ipv4 surelink target 0)>
```

where *value* is one of:

- **ping:** Tests connectivity by sending an ICMP echo request to a specified hostname or IP address.

- Specify the hostname or IP address:

```
(config network interface my_wan ipv4 surelink target 0)> ping_
host host
(config network interface my_wan ipv4 surelink target 0)>
```

- (Optional) Set the size, in bytes, of the ping packet:

```
(config network interface my_wan ipv4 surelink target 0)> ping_
size [num]
(config network interface my_wan ipv4 surelink target 0)>
```

- **dns:** Tests connectivity by sending a DNS query to the specified DNS server.
- Specify the DNS server. Allowed value is the IP address of the DNS server.

```
(config network interface my_wan ipv4 surelink target 0)> dns_
server ip_address
(config network interface my_wan ipv4 surelink target 0)>
```

- **dns\_configured:** Tests connectivity by sending a DNS query to the DNS servers configured for this interface.
- **http:** Tests connectivity by sending an HTTP or HTTPS GET request to the specified URL.
- Specify the url:

```
(config network interface my_wan ipv4 surelink target 0)> http_url
value
(config network interface my_wan ipv4 surelink target 0)>
```

where *value* uses the format **http[s]://hostname/[path]**



- **interface\_up**: The interface is considered to be down based on the interfaces down time, and the amount of time an initial connection to the interface takes before this test is considered to have failed.
  - (Optional) Set the amount of time that the interface can be down before this test is considered to have failed:

---

```
(config network interface my_wan ipv4 surelink target 0)>
interface_down_time value
(config network interface my_wan ipv4 surelink target 0)>
```

---

where *value* is any number of weeks, days, hours, minutes, or seconds, and takes the format **number{w|d|h|m|s}**.

For example, to set **interface\_down\_time** to ten minutes, enter either **10m** or **600s**:

---

```
(config network interface my_wan ipv4 surelink target 0)>
interface_down_time 600s
(config network interface my_wan ipv4 surelink target 0)>
```

---

The default is 60 seconds.

- (Optional) Set the amount of time to wait for an initial connection to the interface before this test is considered to have failed:

---

```
(config network interface my_wan ipv4 surelink target 0)>
interface_timeout value
(config network interface my_wan ipv4 surelink target 0)>
```

---

where *value* is any number of weeks, days, hours, minutes, or seconds, and takes the format **number{w|d|h|m|s}**.

For example, to set **interface\_timeout** to ten minutes, enter either **10m** or **600s**:

---

```
(config network interface my_wan ipv4 surelink target 0)>
interface_timeout 600s
(config network interface my_wan ipv4 surelink target 0)>
```

---

The default is 60 seconds.

(Optional) Repeat to add additional test targets.

8. Optional active recovery configuration parameters:

- a. Move back two levels in the configuration by typing **.. ..**:

---

```
(config network interface my_wan ipv4 surelink target 0)>
(config network interface my_wan ipv4 surelink>
```

---

- b. Set the **Interval** between connectivity tests:

---

```
(config network interface my_wan ipv4 surelink)> interval value
(config network interface my_wan ipv4 surelink>
```

---

where *value* is any number of weeks, days, hours, minutes, or seconds, and takes the format **number{w|d|h|m|s}**.

For example, to set **interval** to ten minutes, enter either **10m** or **600s**:

---

```
(config network interface my_wan ipv4 surelink)> interval 600s
(config network interface my_wan ipv4 surelink)>
```

---

The default is 15 minutes.

- c. If more than one test target is configured, determine whether the interface should fail over based on the failure of one of the test targets, or all of the test targets:

---

```
(config network interface my_wan ipv4 surelink)> success_condition value
(config network interface my_wan ipv4 surelink)>
```

---

Where *value* is either **one** or **all**.

- d. Set the number of probe attempts before the WAN is considered to have failed:

---

```
(config network interface my_wan ipv4 surelink)> attempts num
(config network interface my_wan ipv4 surelink)>
```

---

The default is **3**.

- e. Set the amount of time that the device should wait for a response to a probe attempt before considering it to have failed:

---

```
(config network interface my_wan ipv4 surelink)> timeout value
(config network interface my_wan ipv4 surelink)>
```

---

where *value* is any number of weeks, days, hours, minutes, or seconds, and takes the format **number{w|d|h|m|s}**.

For example, to set **timeout** to ten minutes, enter either **10m** or **600s**:

---

```
(config network interface my_wan ipv4 surelink)> timeout 600s
(config network interface my_wan ipv4 surelink)>
```

---

The default is 15 seconds.

9. (Optional) Repeat this procedure for IPv6.
10. Save the configuration and apply the change:

---

```
(config network interface my_wan ipv4 surelink)> save
Configuration saved.
>
```

---

11. Type **exit** to exit the Admin CLI.

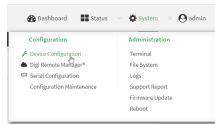
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Disable SureLink

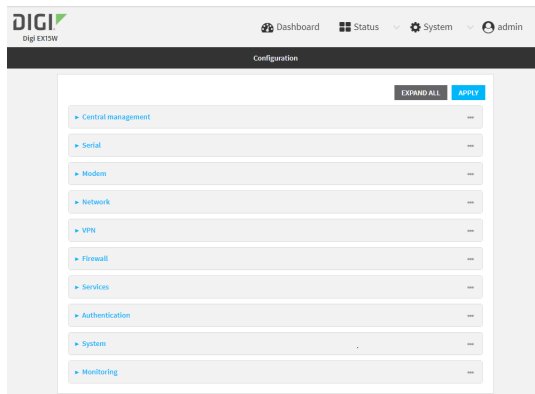
If your device uses a private APN with no Internet access, or your device has a restricted wired WAN connection that doesn't allow DNS resolution, follow this procedure to disable the default SureLink connectivity tests. You can also disable DNS lookup or other internet activity, while retaining the SureLink interface test.



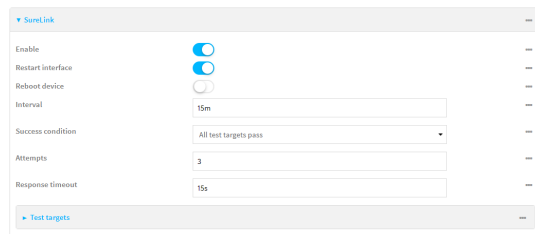
1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.



3. Click **Network > Interfaces**.
4. Select the appropriate WAN or WWAN on which SureLink should be disabled..
5. After selecting the WAN or WWAN, click **IPv4 > SureLink**.



6. Toggle off **Enable** to disable SureLink.
7. Click **Apply** to save the configuration and apply the change.



## Command line

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.

- At the command line, type **config** to enter configuration mode:

```
> config
(config)>
```

- Change to the WAN or WWAN's node in the configuration schema. For example, to disable SureLink for the Modem interface:

```
(config)> network interface modem
(config network interface modem)>
```

- Disable SureLink:

```
(config network interface modem> ipv4 surelink enable false
(config network interface modem)>
```

- Save the configuration and apply the change:

```
(config network interface my_wwan ipv4 surelink)> save
Configuration saved.
>
```

- Type **exit** to exit the Admin CLI.

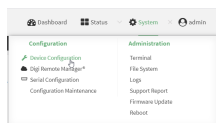
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

### Disable DNS lookup

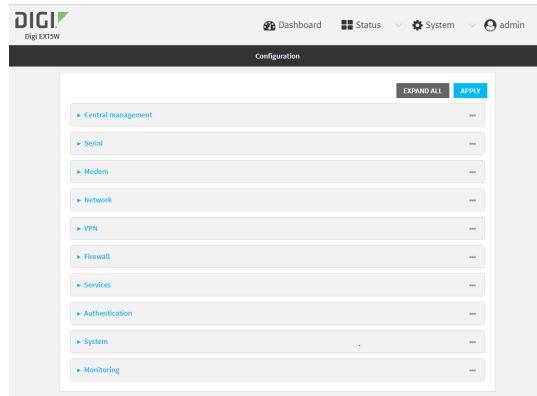
Alternatively, you can disable DNS lookup or other internet activity for device that use a private APN with no Internet access, or that have restricted wired WAN connections that do not allow DNS resolution, while retaining the SureLink interface test. The SureLink interface test determines if the interface has an IP address assigned to it, that the physical link is up, and that a route is present to send traffic out of the network interface.

## WebUI

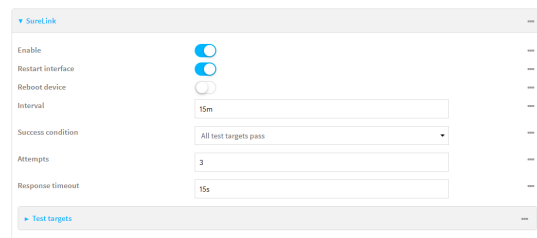
- Log into the EX15 WebUI as a user with full Admin access rights.
- On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



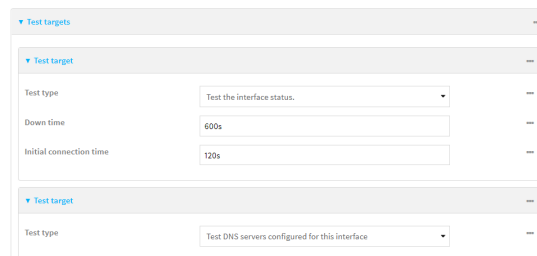
The **Configuration** window is displayed.



3. Click **Network > Interfaces**.
4. Select the appropriate WAN or WWAN on which SureLink should be disabled..
5. After selecting the WAN or WWAN, click **IPv4 > SureLink**.



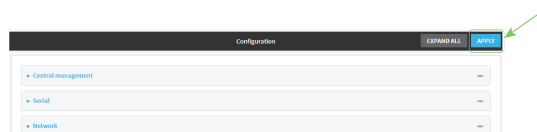
6. Click to expand **Test targets**.
7. Click to expand the second test target. This test target has its **Test type** set to **Test DNS servers configured for this interface**.



8. Click the menu icon (...) next to the target and select **Delete**.



9. Click **Apply** to save the configuration and apply the change.



## Command line

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.

2. At the command line, type **config** to enter configuration mode:

---

```
> config
(config)>
```

---

3. Change to WAN or WWAN's node in the configuration schema. For example, to disable SureLink for an interface named my\_wan:

---

```
(config)> network interface my_wan
(config network interface my_wan)>
```

---

4. Determine the index number of the target:

---

```
(config network interface my_wan)> show ipv4 surelink target
0
 interface_down_time 600s
 interface_timeout 120s
 test interface_up
1
 test dns_configured
(config network interface my_wan)>
```

---

5. Delete the target:

---

```
(config network interface my_wan> del ipv4 surelink target 1
(config network interface my_wan)>
```

---

6. Save the configuration and apply the change:

---

```
(config network interface my_wan ipv4 surelink)> save
Configuration saved.
>
```

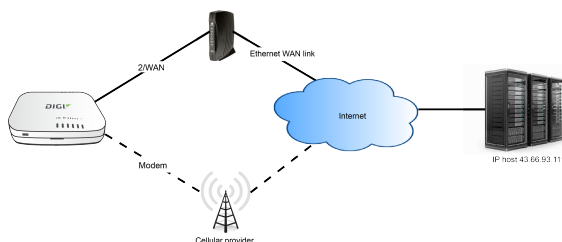
---

7. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Example: Use a ping test for WAN failover from Ethernet to cellular

In this example configuration, the **WAN** interface serves as the primary WAN, while the cellular **Modem** interface serves as the backup WAN.

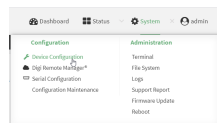


In this example configuration, SureLink is used over for the **WAN** interface to send a probe packet of size **256** bytes to the IP host **43.66.93.111** every **10** seconds. If there are three consecutive failed responses, the EX15 device brings the **WAN** interface down and starts using the **Modem** interface. It continues to regularly test the connection to **WAN**, and when tests on **WAN** succeed, the device falls back to **ETH1**.

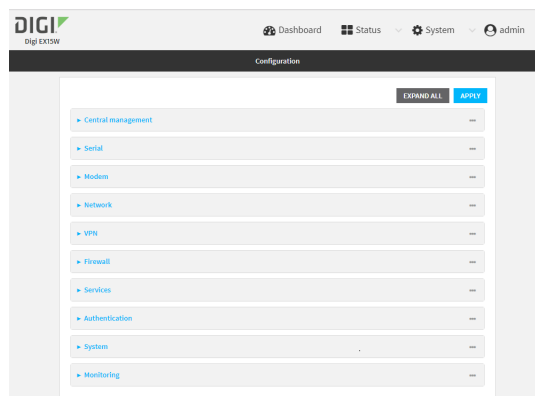
To achieve this WAN failover from the **WAN** to the **Modem** interface, the WAN failover configuration is:

## WebUI

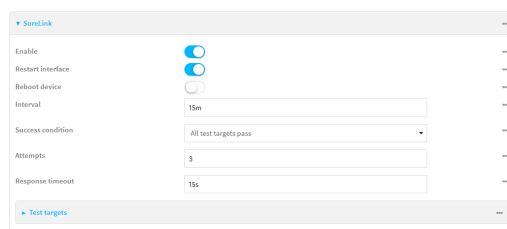
1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



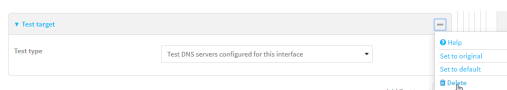
The **Configuration** window is displayed.



3. Configure active recovery on **WAN**:
  - a. Click **Network > Interface > WAN > IPv4 > SureLink**.



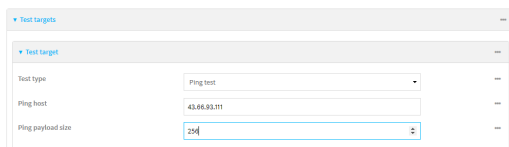
- b. For **Interval**, type **10s**.
- c. Click to expand **Test targets**.
- d. Delete the existing test targets:  
Click the menu icon (...) next to each target and select **Delete**.



- e. For **Add Test Target**, click **+**.



- f. For **Test type**, select **Ping test**.  
 g. For **Ping host**, type **43.66.93.111**.  
 h. For **Ping payload size**, type **256**.



4. Repeat the above step for **Modem** to enable SureLink on that interface.  
 5. Click **Apply** to save the configuration and apply the change.



## Command line

- Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
- At the command line, type **config** to enter configuration mode:

```
> config
(config)>
```

- Configure SureLink on **WAN**:

- Set the interval to ten seconds:

```
(config)> network interface wan ipv4 surelink interval 10s
(config)>
```

- Delete the existing test targets:

```
(config network interface wan> del ipv4 surelink target 0
(config network interface wan> del ipv4 surelink target 1
(config network interface wan)>
```

- Add a test target:

```
(config)> add network interface wan ipv4 surelink target end
(config network interface wan ipv4 surelink target 0)>
```

- Set the probe type to ping:



---

```
(config network interface wan ipv4 surelink target 0)> test ping
(config network interface wan ipv4 surelink target 0)>
```

---

- e. Set the packet size to 256 bytes:

---

```
(config network interface wan ipv4 surelink target 0)> ping_size 256
(config network interface wan ipv4 surelink target 0)>
```

---

- f. Set the host to ping:

---

```
(config network interface wan ipv4 surelink target 0)> ping_host
43.66.93.111
(config network interface wan ipv4 surelink target 0)>
```

---

- Repeat the above step for the cellular **Modem** (modem) interface to enable SureLink on that interface.
- Save the configuration and apply the change:

---

```
(config)> save
Configuration saved.
>
```

---

- Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Using Ethernet devices in a WAN

The EX15 device has two Ethernet devices, named **1/PoE** and **2/WAN**. You can use these Ethernet interfaces as a WAN when connecting to the Internet, through a device such as a cable modem:



By default, the **2/WAN** Ethernet device is configured as a WAN, named **WAN**, with both DHCP and NAT enabled and using the **External** firewall zone. This means you should be able to connect to the Internet by connecting the **2/WAN** Ethernet port to another device that already has an internet connection.

The **1/PoE** device is configured either as a LAN interface, named **LAN**, or, for a wireless-enabled EX15W device, as part of a bridge named **LAN** that is used by the **LAN** interface, which uses the **Internal** firewall zone.

## Using cellular modems in a Wireless WAN (WWAN)

The EX15 supports one cellular modem, named **Modem**, which is included in a preconfigured Wireless WAN, also named **Modem**.

The cellular modem can have only one active SIM slot at any one time. For example, **Modem** can have either SIM1 or SIM2 up at one time.

Typically, you configure SIM1 of the cellular modem as the primary cellular interface, and SIM2 as the backup cellular interface. In this way, if the EX15 device cannot connect to the network using SIM1, it automatically fails over to SIM2. EX15 devices automatically use the correct cellular module firmware for each carrier when switching SIMs.

## Configure cellular modem

Configuring the EX15's cellular modem involves configuring the following items:

### Required configuration items

- Enable the cellular modem.  
The cellular modem is enabled by default.
- Configure the criteria used to determine which modem this modem configuration applies to.
- Determine the SIM slot that will be used when connecting to the cellular network.
- Configure the maximum number of interfaces that can use the modem.
- Enable carrier switching, which allows the modem to automatically match the carrier for the active SIM.  
Carrier switching is enabled by default.
- Configure the access technology.
- Determine which cellular antennas to use.

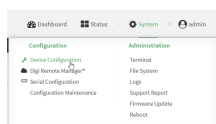
### Additional configuration items

- If **Active SIM slot** is set to **Any**, determine the preferred SIM slot.  
In the event of a failover to a non-preferred SIM, or if manual SIM switching is used to switch to a non-preferred SIM, the modem will attempt to reconnect to the SIM in the preferred SIM slot.

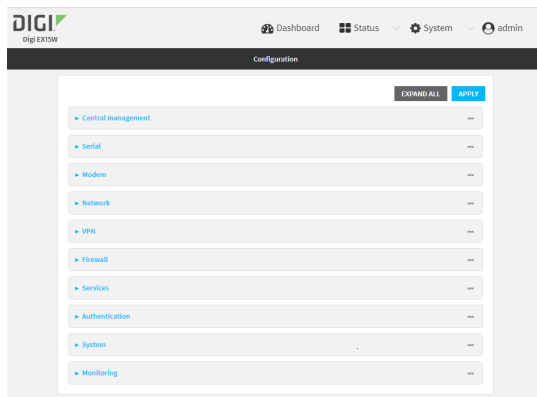
To configure the modem:

## WebUI

1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.



- Click **Network > Modems > Modem**.

- Modem are enabled by default. Click to toggle **Enable** to off to disable.
- For **Match modem by**, select the matching criteria used to determine if this modem configuration applies to the currently attached modem:
  - **Any modem**: Applies this configuration to any modem that is attached.
  - **IMEI**: Applies this configuration only to a modem that matches the identified IMEI.
    - If **IMEI** is selected, for **Match IMEI**, type the IMEI of the modem that this configuration should be applied to.
  - **Port**: Applies this configuration to a modem attached to the identified physical port.
    - If **Port** is selected, for **Match Port**, select the modem's port.

The default is **Any modem**.

- For **Active SIM slot**, select the SIM slot that should be used by the modem, or select **Any** to use any SIM slot. The default is **Any**.
- If **Active SIM slot** is set to **Any**, for **Preferred SIM slot**, select the SIM slot that should be considered the preferred slot for this modem, or select **None**. In the event of a failover to a non-preferred SIM, or if manual SIM switching is used to switch to a non-preferred SIM, the modem will attempt to reconnect to the SIM in the preferred SIM slot. **None** is the default.
- For Maximum number of interfaces, type the number of interfaces that can be configured to use this modem. This is used when using [dual-APN SIMs](#). The default is **1**.
- Enable **Carrier switching** to allow the modem to automatically match the carrier for the active SIM. **Carrier switching** is enabled by default.
- For **Access technology**, select the type of cellular technology that this modem should use to access the cellular network, or select **All technologies** to configure the modem to use the best available technology. The default is **All technologies**.
- For **Antennas**, select whether the modem should use the main antenna, the auxiliary antenna, or both the main and auxiliary antennas.
- Click **Apply** to save the configuration and apply the change.



## Command line

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the command line, type **config** to enter configuration mode:

---

```
> config
(config)>
```

---

3. Modem configurations are enabled by default. To disable:

---

```
(config)> network modem modem enable false
(config)>
```

---

4. Set the matching criteria used to determine if this modem configuration applies to the currently attached modem:

---

```
(config)> network modem modem match value
(config)>
```

---

where *value* is one of the following:

- **any**: Applies this configuration to any modem that is attached.
- **imei**: Applies this configuration only to a modem that matches the identified IMEI.
  - If **imei** is used, set the IMEI of the modem that this configuration should be applied to:

---

```
(config)> network modem modem imei value
(config)>
```

---

where *value* is the IMEI of the modem.

- **port**: Applies this configuration to a modem attached to the identified physical port.
  - If **port** is used, set modem's port:
    - a. Determine available ports and correct syntax by using the **?**:

---

```
(config)> network modem modem port ?
```

---

Match port: The physical port that the modem device is attached to.

Format:

/device/usb/modem/module

Default value: /device/usb/modem/module

Current value: /device/usb/modem/module

---

---

```
(config)> network modem modem port
```

---

- b. Set the port:

---

```
(config)> network modem modem port /device/usb/modem/module
(config)>
```

---

The default is **any**.

5. Set the SIM slot that should be used by the modem:

---

```
(config)> network modem modem sim_slot value
(config)>
```

---

where *value* is one of the following:

- **any**: Uses either SIM slot.
- **1**: Uses the first SIM slot.
- **2**: Uses the second SIM slot.

The default is **any**.

6. If **sim\_slot** is set to **any**, set the SIM slot that should be considered the preferred slot for this modem:

---

```
(config)> network modem modem sim_slot_preference value
(config)>
```

---

where *value* is one of the following:

- **none**: Does not consider either SIM slot to be the preferred slot.
- **1**: Configures the first SIM slot as the preferred SIM slot.
- **2**: Configures the second SIM slot as the preferred SIM slot.

In the event of a failover to a non-preferred SIM, or if manual SIM switching is used to switch to a non-preferred SIM, the modem will attempt to reconnect to the SIM in the preferred SIM slot. The default is **none**.

7. Set the maximum number of interfaces. This is used when using [dual-APN SIMs](#). The default is **1**.

---

```
(config)> network modem modem max_intf int
(config)>
```

---

8. Carrier switching allows the modem to automatically match the carrier for the active SIM. **Carrier switching** is enabled by default. To disable:

---

```
(config)> network modem modem carrier_switch false
(config)>
```

---

9. Set the type of cellular technology that this modem should use to access the cellular network:

---

```
(config)> network modem modem access_tech value
(config)>
```

---

Available options for *value* vary depending on the modem type. To determine available options:

---

```
(config)> network modem modem access_tech ?
```

---

Access technology: The cellular network technology that the modem may use.

Format:

2G

3G

4G

4GM

4GT

all

Default value: all

Current value: all

---

```
(config)>
```

---

The default is **all**, which uses the best available technology.

10. Set whether the modem should use the main antenna, the auxiliary antenna, or both the main and auxiliary antennas:

---

```
(config)> network modem modem antenna value
(config)>
```

---

where *value* is one of the following:

- **main**
- **aux**
- **both**

11. Save the configuration and apply the change:

---

```
(config)> save
Configuration saved.
>
```

---

12. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

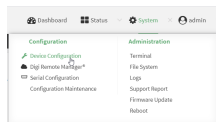
### Configure cellular modem APNs

The EX15 device uses a preconfigured list of Access Point Names (APNs) when attempting to connect to a cellular carrier for the first time. After the device has successfully connected, it will remember the correct APN. As a result, it is generally not necessary to configure APNs. However, you can configure the system to use a specified APN.

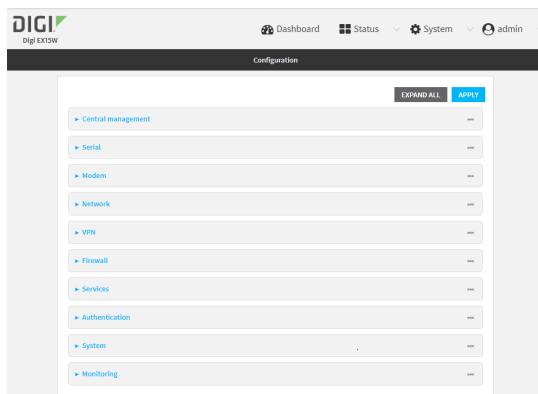
To configure the APN:



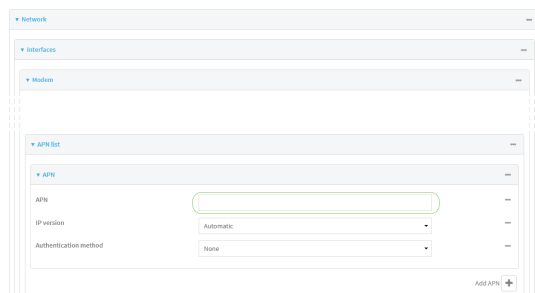
1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.



3. Click **Network > Interfaces > Modem > APN list > APN**.



4. For **APN**, type the Access Point Name (APN) to be used when connecting to the cellular carrier.
5. (Optional) **IP version**:

For **IP version**, select one of the following:

- **Automatic**: Requests both IPv4 and IPv6 address.
- **IPv4**: Requests only an IPv4 address.
- **IPv6**: Requests only an IPv6 address.

The default is **Automatic**.

6. (Optional) **Authentication method**:

For **Authentication method**, select one of the following:

- **None**: No authentication is required.
- **Automatic**: The device will attempt to connect using CHAP first, and then PAP.
- **CHAP**: Uses the Challenge Handshake Authentication Profile (CHAP) to authenticate.
- **PAP**: Uses the Password Authentication Profile (PAP) to authenticate.

If **Automatic**, **CHAP**, or **PAP** is selected, enter the **Username** and **Password** required to authenticate.

The default is **None**.

7. To add additional APNs, for **Add APN**, click **+** and repeat the preceding instructions.
8. (Optional) To configure the device to bypass its preconfigured APN list and only use the configured APNs, enable **APN list only**.

9. Click **Apply** to save the configuration and apply the change.

## Command line

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the command line, type **config** to enter configuration mode:

```
> config
(config)>
```

3. At the config prompt, type:

```
(config)> network interface modem modem apn 0 apn value
(config)>
```

where *value* is the APN for the SIM card.

4. (Optional) To add additional APNs:
  - a. Use the **add** command to add a new APN entry. For example:

```
(config)> add network interface modem modem apn end
(config network interface modem modem apn 1)>
```

- b. Set the value of the APN:

```
(config network interface modem modem apn 1)> apn value
(config network interface modem modem apn 1)>
```

where *value* is the APN for the SIM card.

5. (Optional) Set the IP version:



---

```
(config)> network interface modem modem apn 0 ip_version version
(config)>
```

---

where *version* is one of the following:

- **auto**: Requests both IPv4 and IPv6 address.
- **ipv4**: Requests only an IPv4 address.
- **ipv6**: Requests only an IPv6 address.

The default is **auto**.

6. (Optional) Set the authentication method:

---

```
(config)> network interface modem modem apn 0 auth method
(config)>
```

---

where *method* is one of the following:

- **none**: No authentication is required.
- **auto**: The device will attempt to connect using CHAP first, and then PAP.
- **chap**: Uses the Challenge Handshake Authentication Profile (CHAP) to authenticate.
- **pap**: Uses the Password Authentication Profile (PAP) to authenticate.

If **auto**, **chap**, or **pap** is selected, enter the **Username** and **Password** required to authenticate:

---

```
(config)> network interface modem modem apn 0 username name
(config)> network interface modem modem apn 0 password pwd
(config)>
```

---

The default is **none**.

7. (Optional) To configure the device to bypass its preconfigured APN list and only use the configured APNs:

---

```
(config)> network interface modem modem apn_lock true
(config)>
```

---

8. Save the configuration and apply the change:

---

```
(config)> save
Configuration saved.
>
```

---

9. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

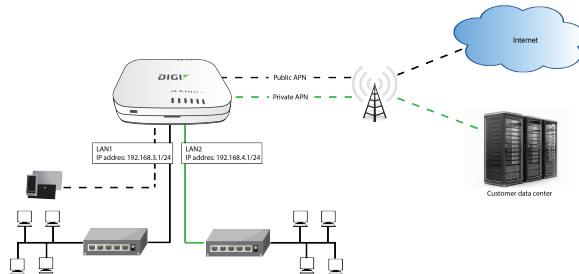
### Configure dual APNs

Some cellular carriers offer a dual APN feature that allows a SIM card to be provisioned with two separate APNs that can be used simultaneously. For example, Verizon offers this service as its Split Data Routing feature. This feature provides two separate networking paths through a single cellular modem and SIM card, and allows for configurations such as:

- Segregating public and private traffic, including policy-based routes to ensure that your internal network traffic always goes through the private connection.

- Separation of untrusted Internet traffic from trusted internal network traffic.
- Secure connection to internal customer network without using a VPN.
- Separate billing structures for public and private traffic.
- Site-to-site networking, without the overhead of tunneling for each device.

In the following example configuration, all traffic on LAN1 is routed through the public APN to the internet, and all traffic on LAN2 is routed through the private APN to the customer's data center:

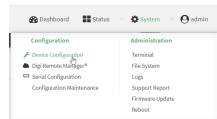


To accomplish this, we will create separate WWAN interfaces that use the same modem but use different APNs, and then use routing roles to forward traffic to the appropriate WWAN interface.

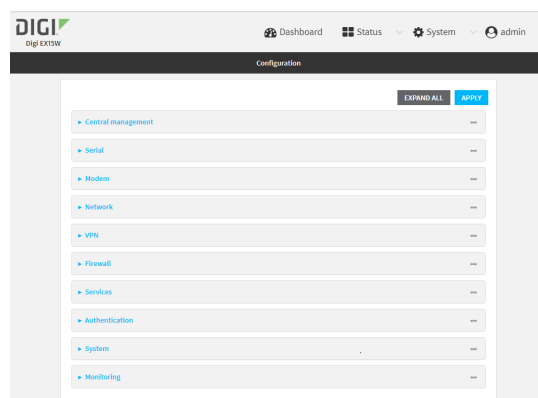
**Note** Dual-APN connections with the Telit LE910-NAV2 module when using a Verizon SIM are not supported. Using an AT&T SIM with the Telit LE910-NAV2 module is supported. The Telit LE910-NAV2 module is used in the 1002-CM04 CORE modem.

## WebUI

1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.



3. Increase the maximum number of interfaces allowed for the modem:
  - a. Click **Network > Modems > Modem**.
  - b. For **Maximum number of interfaces**, type **2**.

The screenshot shows the 'Modem' configuration page. The 'Maximum number of interfaces' field is highlighted with a green circle, and a green arrow points to the value '2'.

4. Create the WWAN interfaces:
 

In this example, we will create two interfaces named **WWAN\_Public** and **WWAN\_Private**.

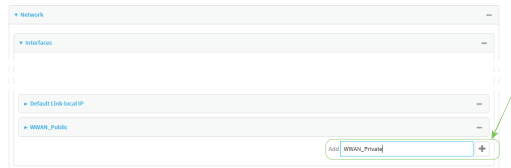
  - a. Click **Network > Interfaces**.
  - b. For **Add Interface**, type **WWAN\_Public** and click **+**.

The screenshot shows the 'Network > Interfaces' page. The 'Add Interface' button is highlighted with a green circle, and a green arrow points to the value 'WWAN\_Public'.

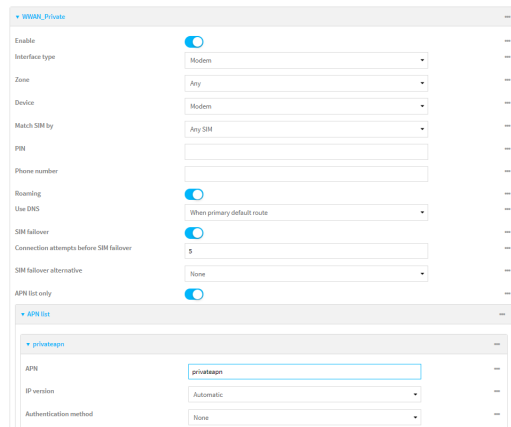
- c. For **Interface type**, select **Modem**.
- d. For **Zone**, select **External**.
- e. For **Device**, select **Modem**.
- f. (Optional): Configure the public APN. If the public APN is not configured, the EX15 will attempt to determine the APN.
  - i. Click to expand **APN list > APN**.
  - ii. For **APN**, type the public APN for your cellular carrier.

The screenshot shows the 'WWAN\_Public' configuration page. The 'APN' field is highlighted with a green circle, and a green arrow points to the value 'vzwinternet'.

- g. For **Add Interface**, type **WWAN\_Private** and click **+**.



- h. For **Interface type**, select **Modem**.
- i. For **Zone**, select **External**.
- j. For **Device**, select **Modem**.
- This should be the same modem selected for the **WWAN\_Public** WWAN.
- k. Enable **APN list only**.
- l. Click to expand **APN list > APN**.
- m. For **APN**, type the private APN provided to you by your cellular carrier.



5. Create the routing policies. For example, to route all traffic from LAN1 through the public APN, and LAN2 through the private APN:
- Click **Network > Routes > Policy-based routing**.
  - Click the **+** to add a new route policy.



- For **Label**, enter **Route through public APN**.
- For **Interface**, select **Interface: WWAN\_Public**.
- Configure the source address:
  - Click to expand **Source address**.
  - For **Type**, select **Interface**.
  - For **Interface**, select **LAN1**.

- f. Configure the destination address:
  - i. Click to expand **Destination address**.
  - ii. For **Type**, select **Interface**.
  - iii. For **Interface**, select **Interface: WWAN\_Public**.

- g. Click the **+** to add another route policy.
- h. For **Label**, enter **Route through private APN**.
- i. For **Interface**, select **Interface: WWAN\_Private**.
- j. Configure the source address:
  - i. Click to expand **Source address**.
  - ii. For **Type**, select **Interface**.
  - iii. For **Interface**, select **LAN2**.
- k. Configure the destination address:
  - i. Click to expand **Destination address**.
  - ii. For **Type**, select **Interface**.
  - iii. For **Interface**, select **Interface: WWAN\_Private**.

6. Click **Apply** to save the configuration and apply the change.



## Command line

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.

2. At the command line, type **config** to enter configuration mode:

---

```
> config
(config)>
```

---

3. Set the maximum number of interfaces for the modem:

---

```
(config)> network modem modem max_intf 2
(config)>
```

---

4. Create the WWAN interfaces:

- a. Create the **WWANPublic** interface:

---

```
(config)> add network interface WWANPublic
(config network interface WWANPublic)>
```

---

- b. Set the interface type to modem:

---

```
(config network interface WWANPublic)> type modem
(config network interface WWANPublic)>
```

---

- c. Set the modem device:

---

```
(config network interface WWANPublic)> modem device modem
(config network interface WWANPublic)>
```

---

- d. (Optional): Set the public APN. If the public APN is not configured, the EX15 will attempt to determine the APN.

---

```
(config network interface WWANPublic)> modem apn public_apn
(config network interface WWANPublic)>
```

---

- e. Use to periods (..) to move back one level in the configuration:

---

```
(config network interface WWANPublic)> ..
(config network interface)>
```

---

- f. Create the **WWANPrivate** interface:

---

```
(config network interface)> add WWANPrivate
(config network interface WWANPrivate)>
```

---

- g. Set the interface type to modem:

---

```
(config network interface WWANPrivate)> type modem
(config network interface WWANPrivate)>
```

---

- h. Set the modem device:

---

```
(config network interface WWANPrivate)> modem device modem
(config network interface WWANPrivate)>
```

---

- i. Enable **APN list only**:

---

```
(config network interface WWANPrivate)> apn_lock true
(config network interface WWANPrivate)>
```

---

- j. Set the private APN:

---

```
(config network interface WWANPublic)> modem apn private_apn
(config network interface WWANPublic)>
```

---

5. Create the routing policies. For example, to route all traffic from LAN1 through the public APN, and LAN2 through the private APN:

- a. Add a new routing policy:

---

```
(config)> add network route policy end
(config network route policy 0)>
```

---

- b. Set the label that will be used to identify this route policy:

---

```
(config network route policy 0)> label "Route through public apn"
(config network route policy 0)>
```

---

- c. Set the interface:

---

```
(config network route policy 0)> interface /network/interface/WWANPublic
(config network route policy 0)>
```

---

- d. Configure the source address:

- i. Set the source type to **interface**:

---

```
(config network route policy 0)> src type interface
(config network route policy 0)>
```

---

- ii. Set the interface to **LAN1**:

---

```
(config network route policy 0)> src interface LAN1
(config network route policy 0)>
```

---

- e. Configure the destination address:

- i. Set the type to **interface**:

---

```
(config network route policy 0)> dst type interface
(config network route policy 0)>
```

---

- ii. Set the interface to **WWANPublic** :

---

```
(config network route policy 0)> interface
/network/interface/WWANPublic
(config network route policy 0)>
```

---

- f. Use to periods (..) to move back one level in the configuration:

```
(config nnetwork route policy 0)> ..
(config nnetwork route policy)>
```

- g. Add a new routing policy:

```
(config network route policy)> add end
(config network route policy 1)>
```

- h. Set the label that will be used to identify this route policy:

```
(config network route policy 1)> label "Route through private apn"
(config network route policy 1)>
```

- i. Set the interface:

```
(config network route policy 1)> interface
/network/interface/WWANPrivate
(config network route policy 1)>
```

- j. Configure the source address:

- i. Set the source type to **interface**:

```
(config network route policy 1)> src type interface
(config network route policy 1)>
```

- ii. Set the interface to **LAN2**:

```
(config network route policy 1)> src interface LAN2
(config network route policy 1)>
```

- k. Configure the destination address:

- i. Set the type to **interface**:

```
(config network route policy 1)> dst type interface
(config network route policy 1)>
```

- ii. Set the interface to **WWANPrivate** :

```
(config network route policy 1)> interface
/network/interface/WWANPrivate
(config network route policy 1)>
```

6. Save the configuration and apply the change:

```
(config network route policy 1)> save
Configuration saved.
>
```

7. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.



## Configure manual carrier selection

By default, your EX15 automatically selects the most appropriate cellular carrier based on the SIM that is in use and the status of available carriers in your area.

Alternately, you can configure the devices to manually select the carrier, based on the Network PLMN ID. You can also configure the device to use manual carrier selection and fall back to automatic carrier selection if connecting to the manually-configured carrier fails.

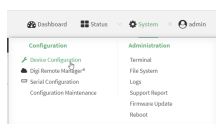
You can also use the [modem scan](#) command at the command line to scan for available carriers and determine their PLMN ID.

### Required configuration items

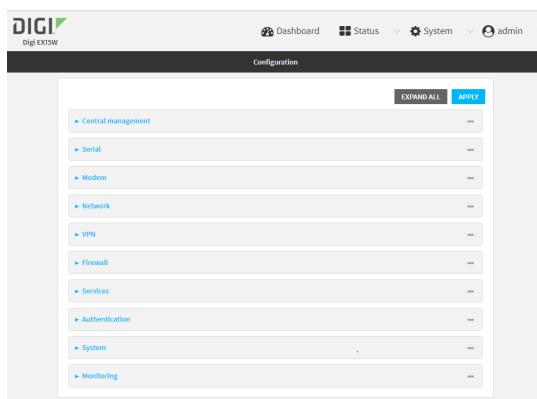
- Select **Manual** or **Manual/Automatic** carrier selection mode.
- The **Network PLMN ID**.

## WebUI

1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.



3. Click **Network > Interfaces > Modem**.
4. For **Carrier selection mode**, select one of the following:
  - **Automatic**—The device automatically selects the carrier based on your SIM and cellular network status.
  - **Manual**—The device will only connect to the carrier identified in the **Network PLMN ID**. If the carrier is not available, no cellular connection will be established.
  - **Manual/Automatic**—The device will attempt to connect to the carrier identified in the **Network PLMN ID**. If the carrier is not available, the device will fall back to using automatic carrier selection.

5. If **Manual** or **Manual/Automatic** are selected for **Carrier section mode**, enter the **Network PLMN ID**.

**Note** You can use the [modem scan](#) command at the Admin CLI to scan for available carriers and determine their PLMN ID. See [Scan for available cellular carriers](#) for details.

6. Click **Apply** to save the configuration and apply the change.

## Command line

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the command line, type **config** to enter configuration mode:

```
> config
(config)>
```

3. At the config prompt, type:

```
(config)> network interface modem modem operator_mode value
(config)>
```

where *value* is one of:

- **automatic**—The device automatically selects the carrier based on your SIM and cellular network status.
- **manual**—The device will only connect to the carrier identified in the **Network PLMN ID**. If the carrier is not available, no cellular connection will be established.

- **manual\_automatic**—The device will attempt to connect to the carrier identified in the **Network PLMN ID**. If the carrier is not available, the device will fall back to using automatic carrier selection.
4. If carrier section mode is set to **manual** or **manual\_automatic**, set the network PLMN ID:

---

```
(config)> network interface modem modem operator plmn_ID
(config)>
```

---

**Note** You can use the [modem scan](#) command at the Admin CLI to scan for available carriers and determine their PLMN ID. See [Scan for available cellular carriers](#) for details.

---

5. Save the configuration and apply the change:

---

```
(config)> save
Configuration saved.
>
```

---

6. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

### Scan for available cellular carriers

You can scan for available carriers and determine their network PLMN ID by using the [modem scan](#) command at the Admin CLI.

1. Log into the EX15 command line as a user with Admin access.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the Admin CLI prompt, type:

---

```
> modem scan
```

---

Issuing network scan, this may take some time...

| Status    | Carrier  | PLMN ID | Technology |
|-----------|----------|---------|------------|
| -----     | -----    | -----   | -----      |
| Available | AT&T     | 310410  | 4G         |
| Available | T-Mobile | 310260  | 3G         |
| Available | T-Mobile | 310260  | 4G         |
| Available | Verizon  | 311480  | 4G         |
| Available | 311 490  | 311490  | 4G         |
| Available | 313 100  | 313100  | 4G         |

```
>
```

---

### Show cellular status and statistics

You can view a summary status for all cellular modems, or view detailed status and statistics for a specific modem.



1. Log into the EX15 WebUI as a user with Admin access.
2. On the menu, click **Status**.
3. Under **Connections**, click **Modems**.

The modem status window is displayed



## Command line

1. Log into the EX15 command line as a user with Admin access.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.

2. Use the `show modem` command:

- To view a status summary for the modem:

---

```
> show modem
```

| Modem | SIM       | Status    | APN   | Signal Strength |
|-------|-----------|-----------|-------|-----------------|
| ----- | -----     | -----     | ----- | -----           |
| modem | 1 (ready) | connected | 1234  | Good (-84 dBm)  |

```
>
```

---

- To view detailed status and statistics, use the `show modem name name` command:

---

```
> show modem name modem
```

```
modem: [Telit] LM940
```

```

IMEI : 781154796325698
Manufacturer : Telit
Model : LM940
FW Version : 24.01.541_ATT
Revision : 24.01.541
```

```
Status
```

```

```

```
State : connected
APN : 1234
Signal Strength : Good (-85 dBm)
Bars : 2/5
Access Mode : 4G
Temperature : 34C
IP address (IPv4) : 10.200.1.2
Gateway (IPv4) : 10.200.1.1
```

```
SIM
```

```

```

```
SIM Slot : 1
SIM Status : ready
IMSI : 21685216482134
ICCID : 26587956542156312312
```

---

---

SIM Provider : AT&T

---

>

---

### Unlock a SIM card

A SIM card can be locked if a user tries to set an invalid PIN for the SIM card too many times. In addition, some cellular carriers require a SIM PIN to be added before the SIM card can be used. If the SIM card is locked, the EX15 device cannot make a cellular connection.

### Command line

To unlock a SIM card:

1. Log into the EX15 command line as a user with Admin access.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the Admin CLI prompt, use the **modem** command to set a new PIN for the SIM card:

---

```
> modem puk unlock puk_code new_pin modem_name
>
```

---

For example, to unlock a SIM card in the modem named **modem** with PUK code **12345678**, and set the new SIM PIN to **1234**:

---

```
> modem puk unlock 12345678 1234 modem
>
```

---

3. Type **exit** to exit the Admin CLI.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

---

**Note** If the SIM remains in a locked state after using the unlock command, contact your cellular carrier.

---

### Signal strength for 4G cellular connections

For 4G connections, the **RSRP** value determines signal strength.

- **Excellent:** > -90 dBm
- **Good:** -90 dBm to -105 dBm
- **Fair:** -106 dBm to -115 dBm
- **Poor:** -116 dBm to -120 dBm:
- **No service:** < -120 dBm

See [Show cellular status and statistics](#) for procedures to view this information.

### Signal strength for 3G and 2G cellular connections

For 3G and 2G cellular connections, the current **RSSI** value determines signal strength.

- **Excellent:** > -70 dBm
- **Good:** -70 dBm to -85 dBm
- **Fair:** -86 dBm to -100 dBm
- **Poor:** < -100 dBm to -109 dBm
- **No service:** -110 dBm

See [Show cellular status and statistics](#) for procedures to view this information.

### ***Tips for improving cellular signal strength***

If the signal strength LEDs or the signal quality for your device indicate **Poor** or **No service**, try the following things to improve signal strength:

- Move the EX15 device to another location.
- Try connecting a different set of antennas, if available.
- Purchase a Digi Antenna Extender Kit:
  - [Antenna Extender Kit, 1m](#)
  - [Antenna Extender Kit, 3m](#)

### ***AT command access***

To run AT commands from the EX15 command line:

#### **Command line**

1. Log into the EX15 command line as a user with Admin access.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the Admin CLI prompt, type **modem at-interactive** and press **Enter**. Type **n** if you do not want exclusive access. This allows you to send AT commands to the device while still allowing the device to connect, disconnect, and/or reconnect to the cellular network.
3. At the Admin CLI prompt, use the [modem](#) command to begin an interactive AT command session:

---

```
> modem at-interactive
```

---

```
Do you want exclusive access to the modem? (y/n) [y]:
```

---

4. Type **n** if you do not want exclusive access. This allows you to send AT commands to the device while still allowing the device to connect, disconnect, and/or reconnect to the cellular network. The following is an example interactive AT command:

---

```
> modem at-interactive
```

---

```
Do you want exclusive access to the modem? (y/n) [y]: n
Starting terminal access to modem AT commands.
Note that the modem is still in operation.
```

---

---

To quit enter '~.' ('~~.' if using an ssh client) and press ENTER

Connected

ati

Manufacturer: Sierra Wireless, Incorporated

Model: MC7455

Revision: SWI9X30C\_02.24.03.00 r6978 CARMD-EV-FRMWR2 2017/03/02 13:36:45

MEID: 35907206045169

IMEI: 359072060451693

IMEI SV: 9

FSN: LQ650551070110

+GCAP: +CGSM

OK

---

5. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Configure a Wide Area Network (WAN)

Configuring a Wide Area Network (WAN) involves configuring the following items:

### ***Required configuration items***

- The interface type: **Ethernet**.
- The firewall zone: **External**.
- The network device or bridge that is used by the WAN.
- Configure the WAN as a DHCP client.

### ***Additional configuration items***

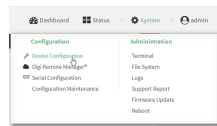
- Additional IPv4 configuration:
  - The metric for IPv4 routes associated with the WAN.
  - The relative weight for IPv4 routes associated with the WAN.
  - The IPv4 management priority of the WAN. The active interface with the highest management priority will have its address reported as the preferred contact address for central management and direct device access.
  - The IPv4 Maximum Transmission Unit (MTU) of the WAN.
  - When to use DNS servers for this interface.
  - Whether to include the EX15 device's hostname in DHCP requests.
  - SureLink active recovery configuration. See [Configure SureLink active recovery to detect WAN/WWAN failures](#) for further information.
- IPv6 configuration:
  - The metric for IPv6 routes associated with the WAN.
  - The relative weight for IPv6 routes associated with the WAN.
  - The IPv6 management priority of the WAN. The active interface with the highest management priority will have its address reported as the preferred contact address for central management and direct device access.
  - The IPv6 Maximum Transmission Unit (MTU) of the WAN.
  - When to use DNS servers for this interface.
  - Whether to include the EX15 device's hostname in DHCP requests.
  - Active recovery configuration. See [Configure SureLink active recovery to detect WAN/WWAN failures](#) for further information.
- MAC address blacklist and whitelist.

To create a new WAN or edit an existing WAN:

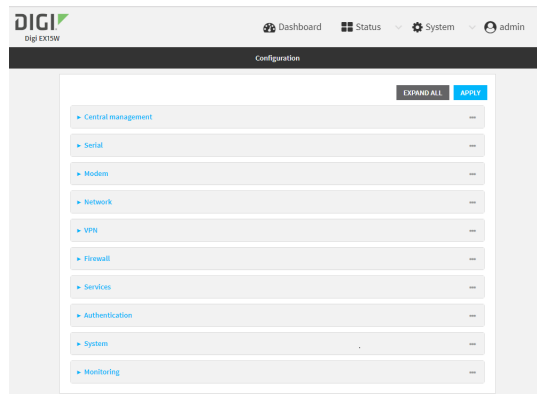




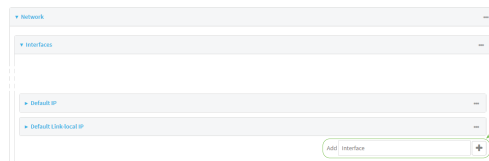
1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.

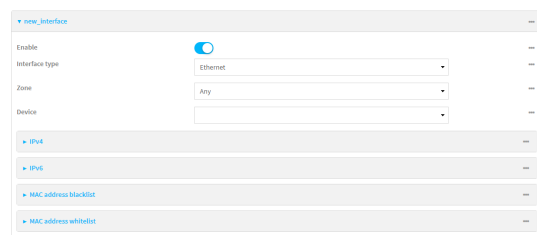


3. Click **Network > Interfaces**.
4. Create the WAN or select an existing WAN:
  - To create a new WAN, for **Add interface**, type a name for the WAN and click **+**.



- To edit an existing WAN, click to expand the WAN.

The Interface configuration window is displayed.



New WANs are enabled by default. To disable, click **Enable**.

5. For **Interface type**, leave at the default setting of **Ethernet**.
6. For **Zone**, select **External**.
7. For **Device**, select an Ethernet device, a Wi-Fi client, or a bridge. See [Bridging](#) for more information about bridging.

8. Configure IPv4 settings:
  - a. Click to expand **IPv4**.

IPv4 support is enabled by default.
  - b. For **Type**, select **DHCP address**.
  - c. Optional IPv4 configuration items:
    - i. Set the **Metric**.

See [Configure WAN/WWAN priority and default route metrics](#) for further information about metrics.
    - ii. For **Weight**, type the relative weight for default routes associated with this interface. For multiple active interfaces with the same metric, **Weight** is used to load balance traffic to the interfaces.
    - iii. Set the **Management priority**. This determines which interface will have priority for central management activity. The interface with the highest number will be used.
    - iv. Set the **MTU**.
    - v. For **Use DNS**, select one of the following:
      - **Always**: DNS will always be used for this WAN; when multiple interfaces have the same DNS server, the interface with the lowest metric will be used for DNS requests.
      - **When primary default route**: Only use the DNS servers provided for this interface when the interface is the primary route.
      - **Never**: Never use DNS servers for this interface.
    - vi. Enable **DHCP Hostname** to instruct the EX15 device to include the device's system name with DHCP requests as the Client FQDN option. The DHCP server can then be configured to register the device's hostname and IP address with an associated DNS server.
      - See [RFC4702](#) for further information about DHCP server support for the Client FQDN option.
      - See [Configure system information](#) for information about setting the EX15 device's system name.
  - d. See [Configure SureLink active recovery to detect WAN/WWAN failures](#) for information about configuring **Active recovery**.
9. (Optional) Configure IPv6 settings:
  - a. Click to expand **IPv6**.
  - b. **Enable** IPv6 support.
  - c. For **Type**, select **DHCPv6 address**.
  - d. For **Prefix length**, type the minimum length of the prefix to assign to this LAN. If the minimum length is not available, then a longer prefix will be used.
  - e. For **Prefix ID**, type the identifier used to extend the prefix to the assigned length. Leave blank to use a random identifier.
  - f. Set the **Metric**.

See [Configure WAN/WWAN priority and default route metrics](#) for further information about metrics.

- g. For **Weight**, type the relative weight for default routes associated with this interface. For multiple active interfaces with the same metric, **Weight** is used to load balance traffic to the interfaces.
  - h. Set the **Management priority**. This determines which interface will have priority for central management activity. The interface with the highest number will be used.
  - i. Set the **MTU**.
  - j. For **Use DNS**:
    - **Always**: DNS will always be used for this WAN; when multiple interfaces have the same DNS server, the interface with the lowest metric will be used for DNS requests.
    - **When primary default route**: Only use the DNS servers provided for this interface when the interface is the primary route.
    - **Never**: Never use DNS servers for this interface.
  - k. Enable **DHCP Hostname** to instruct the EX15 device to include the device's system name with DHCP requests as the Client FQDN option. The DHCP server can then be configured to register the device's hostname and IP address with an associated DNS server.
    - See [RFC4702](#) for further information about DHCP server support for the Client FQDN option.
    - See [Configure system information](#) for information about setting the EX15 device's system name.
10. (Optional) Click to expand **MAC address blacklist**.  
Incoming packets will be dropped from any devices whose MAC addresses is included in the **MAC address blacklist**.
- a. Click to expand **MAC address blacklist**.
  - b. For **Add MAC address**, click **+**.
  - c. Type the **MAC address**.
11. (Optional) Click to expand **MAC address whitelist**.  
If there whitelist entries are specified, incoming packets will only be accepted from the listed MAC addresses.
- a. Click to expand **MAC address whitelist**.
  - b. For **Add MAC address**, click **+**.
  - c. Type the **MAC address**.
12. Click **Apply** to save the configuration and apply the change.



## Command line

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.

2. At the command line, type **config** to enter configuration mode:

---

```
> config
(config)>
```

---

3. Create a new WAN or edit an existing one:

- To create a new WAN named **my\_wan**:

---

```
(config)> add network interface my_wan
(config network interface my_wan)>
```

---

- To edit an existing WAN named **my\_wan**, change to the **my\_wan** node in the configuration schema:

---

```
(config)> network interface my_wan
(config network interface my_wan)>
```

---

4. Set the appropriate firewall zone:

---

```
(config network interface my_wan)> zone zone
(config network interface my_wan)>
```

---

See [Firewall configuration](#) for further information.

5. Select an Ethernet device, a Wi-Fi device, or a bridge. See [Bridging](#) for more information about bridging.

- a. Enter **device ?** to view available devices and the proper syntax.

---

```
(config network interface my_wan)> device ?
```

Device: The network device used by this network interface.

Format:

```
/network/device/lan
/network/device/wan
/network/device/loopback
/network/bridge/lan
/network/wireless/ap/digi_ap
```

Current value:

---

```
(config network interface my_wan)> device
```

---

- b. Set the device for the LAN:

---

```
(config network interface my_wan)> device device
(config network interface my_wan)>
```

---

6. Configure IPv4 settings:

- IPv4 support is enabled by default. To disable:

---

```
(config network interface my_wan)> ipv4 enable false
(config network interface my_wan)>
```

---

- Configure the WAN to be a DHCP client:

---

```
(config network interface my_wan)> ipv4 type dhcp
(config network interface my_wan)>
```

---

- a. Optional IPv4 configuration items:

- i. Set the IP metric:

---

```
(config network interface my_wan)> ipv4 metric num
(config network interface my_wan)>
```

---

See [Configure WAN/WWAN priority and default route metrics](#) for further information about metrics.

- ii. Set the relative weight for default routes associated with this interface. For multiple active interfaces with the same metric, the weight is used to load balance traffic to the interfaces.

---

```
(config network interface my_wan)> ipv4 weight num
(config network interface my_wan)>
```

---

- iii. Set the management priority. This determines which interface will have priority for central management activity. The interface with the highest number will be used.

---

```
(config network interface my_wan)> ipv4 mgmt num
(config network interface my_wan)>
```

---

- iv. Set the MTU:

---

```
(config network interface my_wan)> ipv4 mtu num
(config network interface my_wan)>
```

---

- v. Configure how to use DNS:

---

```
(config network interface my_wan)> ipv4 use_dns value
(config network interface my_wan)>
```

---

where *value* is one of:

- **always:** DNS will always be used for this WAN; when multiple interfaces have the same DNS server, the interface with the lowest metric will be used for DNS requests.
  - **primary:** Only use the DNS servers provided for this interface when the interface is the primary route.
  - **never:** Never use DNS servers for this interface.
- vi. Enable DHCP Hostname to instruct the EX15 device to include the device's system name with DHCP requests as the Client FQDN option. The DHCP server can then be configured to register the device's hostname and IP address with an associated DNS server.

---

```
(config network interface my_wan)> ipv4 dhcp_hostname true
(config network interface my_wan)>
```

---

- See [RFC4702](#) for further information about DHCP server support for the Client FQDN option.
  - See [Configure system information](#) for information about setting the EX15 device's system name.
- b. See [Configure SureLink active recovery to detect WAN/WWAN failures](#) for information about configuring active recovery.
7. (Optional) Configure IPv6 settings:
- a. Enable IPv6 support:

---

```
(config network interface my_wan)> ipv6 enable true
(config network interface my_wan)>
```

---

- b. Set the IPv6 type to DHCP:

---

```
(config network interface my_wan)> ipv6 type dhcpv6
(config network interface my_wan)>
```

---

- c. Generally, the default settings for IPv6 support are sufficient. You can view the default IPv6 settings by using the question mark (?):

---

```
(config network interface my_wan)> ipv6 ?
```

---

IPv6

| Parameters    | Current Value |                     |
|---------------|---------------|---------------------|
| -----         |               |                     |
| dhcp_hostname | false         | DHCP Hostname       |
| enable        | true          | Enable              |
| metric        | 0             | Metric              |
| mgmt          | 0             | Management priority |
| mtu           | 1500          | MTU                 |
| type          | dhcpv6        | Type                |
| use_dns       | always        | Use DNS             |
| weight        | 10            | Weight              |

Additional Configuration

---

connection\_monitor      Active recovery

---

```
(config network interface my_wan)>
```

---

- d. Modify any of the remaining default settings as appropriate. For example, to change the metric:

---

```
(config network interface my_wan)> ipv6 metric 1
(config network interface my_wan)>
```

---

If the minimum length is not available, then a longer prefix will be used.

See [Configure WAN/WWAN priority and default route metrics](#) for further information about metrics.

8. Save the configuration and apply the change:

---

```
(config network interface my_wan)> save
Configuration saved.
>
```

---

9. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Configure a Wireless Wide Area Network (WWAN)

Configuring a Wireless Wide Area Network (WWAN) involves configuring the following items:

### Required configuration items

- The interface type: **Modem**.
- The firewall zone: **External**.
- The cellular modem that is used by the WWAN.

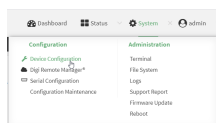
### Additional configuration items

- SIM selection for this WWAN.
- The SIM PIN.
- The SIM phone number for SMS connections.
- Enable or disable roaming.
- DNS options.
- SIM failover configuration.
- APN configuration.
- The custom gateway/netmask.
- IPv4 configuration:
  - The metric for IPv4 routes associated with the WAN.
  - The relative weight for IPv4 routes associated with the WAN.
  - The IPv4 management priority of the WAN. The active interface with the highest management priority will have its address reported as the preferred contact address for central management and direct device access.
  - The IPv4 Maximum Transmission Unit (MTU) of the WAN.
  - SureLink active recovery configuration. See [Configure SureLink active recovery to detect WAN/WWAN failures](#) for further information.

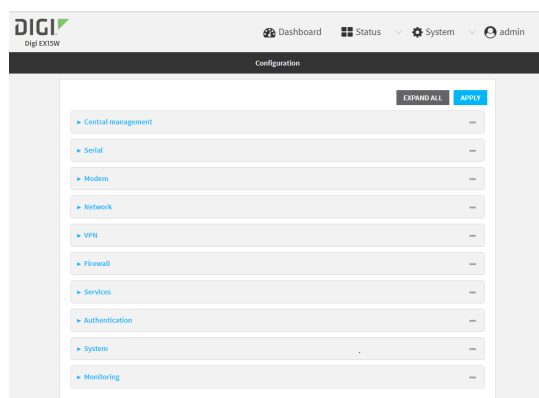
- IPv6 configuration:
  - The metric for IPv6 routes associated with the WAN.
  - The relative weight for IPv6 routes associated with the WAN.
  - The IPv6 management priority of the WAN. The active interface with the highest management priority will have its address reported as the preferred contact address for central management and direct device access.
  - The IPv6 Maximum Transmission Unit (MTU) of the WAN.
  - SureLink active recovery configuration. See [Configure SureLink active recovery to detect WAN/WWAN failures](#) for further information.

## WebUI

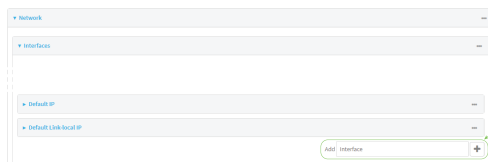
1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.



3. Click **Network > Interfaces**.
4. Create the WWAN or select an existing WWAN:
  - To create a new WWAN, for **Add interface**, type a name for the WWAN and click **+**.



- To edit an existing WWAN, click to expand the WWAN.  
New WWANs are enabled by default. To disable, click **Enable**.



5. For **Interface type**, select **Modem**.

6. For **Zone**, select **External**.
7. For **Device**, select a cellular modem.
8. Optional WWAN configuration items:
- For **Match SIM by**, select a SIM matching criteria to determine when this WWAN should be used:
    - If **SIM slot** is selected, for **Match SIM slot**, select which SIM slot must be in active for this WWAN to be used.
    - If **Carrier** is selected, for **Match SIM carrier**, select which cellular carrier must be in active for this WWAN to be used.
    - If **PLMN identifier** is selected, for **Match PLMN identifier**, type the PLMN id that must be in active for this WWAN to be used.
    - If **IMSI** is selected, for **Match IMSI**, type the International Mobile Subscriber Identity (IMSI) that must be in active for this WWAN to be used.
    - If **ICCID** is selected, for **Match ICCID**, type the unique SIM card ICCID that must be in active for this WWAN to be used.
  - Type the **PIN** for the SIM. Leave blank if no PIN is required.
  - Type the **Phone number** for the SIM, for SMS connections.  
Normally, this should be left blank. It is only necessary to complete this field if the SIM does not have a phone number or if the phone number is incorrect.
  - Roaming** is enabled by default. Click to disable.
  - For **Use DNS**:
    - **Always**: DNS will always be used for this WWAN; when multiple interfaces have the same DNS server, the interface with the lowest metric will be used for DNS requests.
    - **When primary default route**: Only use the DNS servers provided for this WWAN when the WWAN is the primary route.
    - **Never**: Never use DNS servers for this WWAN.

The default setting is **When primary default route**.
  - SIM failover** is enabled by default, which means that the modem will automatically fail over from the active SIM to the next available SIM when the active SIM fails to connect. If

enabled:

- i. For **Connection attempts before SIM failover**, type the number of times that the device should attempt to connect to the active SIM before failing over to the next available SIM.
  - ii. For **SIM failover alternative**, configure how SIM failover will function if automatic SIM switching is unavailable:
    - **None**: The device will perform no alternative action if automatic SIM switching is unavailable.
    - **Reset modem**: The device will reset the modem if automatic SIM switching is unavailable.
    - **Reboot device**: The device will reboot if automatic SIM switching is unavailable.
9. For **APN list** and **APN list only**, the EX15 device uses a preconfigured list of Access Point Names (APNs) when attempting to connect to a cellular carrier for the first time. After the device has successfully connected, it will remember the correct APN. As a result, it is generally not necessary to configure APNs. See [Configure cellular modem APNs](#) for further information and instructions for setting an APN.
10. (Optional) To configure the IP address of a custom gateway or a custom netmask:
  - a. Click **Custom gateway** to expand.
  - b. Click **Enable**.
  - c. For **Gateway/Netmask**, enter the IP address and netmask of the custom gateway. To override only the gateway netmask, but not the gateway IP address, use all zeros for the IP address. For example, **0.0.0.0./32** will use the network-provided gateway, but with a /32 netmask.
11. Optional IPv4 configuration items:
  - a. Click **IPv4** to expand.
  - b. IPv4 support is **Enabled** by default. Click to disable.
  - c. Set the **Metric**.  
See [Configure WAN/WWAN priority and default route metrics](#) for further information about metrics.
  - d. For **Weight**, type the relative weight for default routes associated with this interface. For multiple active interfaces with the same metric, **Weight** is used to load balance traffic to the interfaces.
  - e. Set the **Management priority**. This determines which interface will have priority for central management activity. The interface with the highest number will be used.
  - f. Set the **MTU**.
  - g. See [Configure SureLink active recovery to detect WAN/WWAN failures](#) for information about configuring **Active recovery**.
12. Optional IPv6 configuration items:
  - a. Click **IPv6** to expand.
  - b. IPv6 support is **Enabled** by default. Click to disable.

- c. Set the **Metric**.  
See [Configure WAN/WWAN priority and default route metrics](#) for further information about metrics.
  - d. For **Weight**, type the relative weight for default routes associated with this interface. For multiple active interfaces with the same metric, **Weight** is used to load balance traffic to the interfaces.
  - e. Set the **Management priority**. This determines which interface will have priority for central management activity. The interface with the highest number will be used.
  - f. Set the **MTU**.
  - g. See [Configure SureLink active recovery to detect WAN/WWAN failures](#) for information about configuring **Active recovery**.
1. Click **Apply** to save the configuration and apply the change.



## Command line

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the command line, type **config** to enter configuration mode:

```
> config
(config)>
```

3. Create a new WWAN or edit an existing one:

- To create a new WWAN named **my\_wwan**:

```
(config)> add network interface my_wwan
(config network interface my_wwan)>
```

- To edit an existing WWAN named **my\_wwan**, change to the my\_wwan node in the configuration schema:

```
(config)> network interface my_wwan
(config network interface my_wwan)>
```

4. Set the appropriate firewall zone:

```
(config network interface my_wwan)> zone zone
(config network interface my_wwan)>
```

See [Firewall configuration](#) for further information.

5. Select a cellular modem:
  - a. Enter **modem device ?** to view available modems and the proper syntax.

---

```
(config network interface my_wwan)> modem device ?
```

Device: The modem used by this network interface.

Format:

modem

Current value:

---

```
(config network interface my_wwan)> device
```

---

- b. Set the device:

---

```
(config network interface my_wwan)> modem device modem
```

```
(config network interface my_wwan)>
```

---

6. Optional WWAN configuration items:
  - a. Set the SIM matching criteria to determine when this WWAN should be used:

---

```
(config network interface my_wwan)> modem match value
```

```
(config network interface my_wwan)>
```

---

Where *value* is one of:

- **any**
- **carrier**

Set the cellular carrier must be in active for this WWAN to be used:

- i. Use **?** to determine available carriers:

---

```
(config network interface my_wwan)> modem carrier
```

Match SIM carrier: The SIM carrier match criteria. This interface is applied when the SIM card is provisioned from the carrier.

Format:

AT&T

Rogers

Sprint

T-Mobile

Telstra

Verizon

Vodafone

other

Default value: AT&T

Current value: AT&T

---

```
(config network interface my_wwan)>
```

---

- ii. Set the carrier:

---

```
(config network interface my_wwan)> modem carrier value
(config network interface my_wwan)>
```

---

■ **iccid**

Set the unique SIM card ICCID that must be in active for this WWAN to be used:

---

```
(config network interface my_wwan)> modem iccid ICCID
(config network interface my_wwan)>
```

---

■ **imsi**

Set the International Mobile Subscriber Identity (IMSI) that must be in active for this WWAN to be used:

---

```
(config network interface my_wwan)> modem imsi IMSI
(config network interface my_wwan)>
```

---

■ **plmn\_id**

Set the PLMN id that must be in active for this WWAN to be used:

---

```
(config network interface my_wwan)> modem plmn_id PLMN_ID
(config network interface my_wwan)>
```

---

■ **sim\_slot**

Set which SIM slot must be in active for this WWAN to be used:

---

```
(config network interface my_wwan)> modem sim_slot value
(config network interface my_wwan)>
```

---

where *value* is either **1** or **2**.

- b. Set the PIN for the SIM. Leave blank if no PIN is required.

---

```
(config network interface my_wwan)> modem pin value
(config network interface my_wwan)>
```

---

- c. Set the phone number for the SIM, for SMS connections:

---

```
(config network interface my_wwan)> modem phone num
(config network interface my_wwan)>
```

---

Normally, this should be left blank. It is only necessary to complete this field if the SIM does not have a phone number or if the phone number is incorrect.

- d. Roaming is enabled by default. To disable:

---

```
(config network interface my_wwan)> modem roaming false
(config network interface my_wwan)>
```

---

- e. Configure when the WWAN's DNS servers will be used:

---

```
(config network interface my_wwan)> modem dns value
(config network interface my_wwan)>
```

---

Where *value* is one of:

- **always:** DNS will always be used for this WWAN; when multiple interfaces have the same DNS server, the interface with the lowest metric will be used for DNS requests.
- **never:** Never use DNS servers for this WWAN.
- **primary:** Only use the DNS servers provided for this WWAN when the WWAN is the primary route.

The default setting is **primary**.

- f. SIM failover is enabled by default, which means that the modem will automatically fail over from the active SIM to the next available SIM when the active SIM fails to connect. To disable:

---

```
(config network interface my_wwan)> modem sim_failover false
(config network interface my_wwan)>
```

---

If enabled:

- i. Set the number of times that the device should attempt to connect to the active SIM before failing over to the next available SIM:

---

```
(config network interface my_wwan)> modem sim_failover_retries num
(config network interface my_wwan)>
```

---

The default setting is **5**.

- ii. Configure how SIM failover will function if automatic SIM switching is unavailable:

---

```
(config network interface my_wwan)> modem sim_failover_alt value
(config network interface my_wwan)>
```

---

where *value* is one of:

- **none:** The device will perform no alternative action if automatic SIM switching is unavailable.
- **reset:** The device will reset the modem if automatic SIM switching is unavailable.
- **reboot:** The device will reboot if automatic SIM switching is unavailable.

7. The EX15 device uses a preconfigured list of Access Point Names (APNs) when attempting to connect to a cellular carrier for the first time. After the device has successfully connected, it will remember the correct APN. As a result, it is generally not necessary to configure APNs. See [Configure cellular modem APNs](#) for further information and instructions for setting an APN.

8. (Optional) To configure the IP address of a custom gateway or a custom netmask:

- a. Enable the custom gateway:

---

```
(config network interface my_wwan)> modem custom_gw enable true
(config network interface my_wwan)>
```

---

- b. Set the IP address and netmask of the custom gateway:

---

```
(config network interface my_wwan)> modem custom_gw gateway ip_
address/netmask
(config network interface my_wwan)> modem custom_gw
```

---

To override only the gateway netmask, but not the gateway IP address, use all zeros for the IP address. For example, **0.0.0.0/32** will use the network-provided gateway, but with a /32 netmask.

9. Optional IPv4 configuration items:

- a. IPv4 support is enabled by default. To disable:

---

```
(config network interface my_wwan)> ipv4 enable false
(config network interface my_wwan)>
```

---

- b. Set the metric:

---

```
(config network interface my_wwan)> ipv4 metric num
(config network interface my_wwan)>
```

---

See [Configure WAN/WWAN priority and default route metrics](#) for further information about metrics.

- c. Set the relative weight for default routes associated with this interface. For multiple active interfaces with the same metric, the weight is used to load balance traffic to the interfaces.

---

```
(config network interface my_wwan)> ipv4 weight num
(config network interface my_wwan)>
```

---

- d. Set the management priority. This determines which interface will have priority for central management activity. The interface with the highest number will be used.

---

```
(config network interface my_wwan)> ipv4 mgmt num
(config network interface my_wwan)>
```

---

- e. Set the MTU:

---

```
(config network interface my_wwan)> ipv4 mtu num
(config network interface my_wwan)>
```

---

- f. See [Configure SureLink active recovery to detect WAN/WWAN failures](#) for information about configuring active recovery.

10. Optional IPv6 configuration items:

- a. Click **IPv6** to expand.
- b. IPv6 support is enabled by default. To disable:

---

```
(config network interface my_wwan)> ipv6 enable false
(config network interface my_wwan)>
```

---

- c. Set the metric.

---

```
(config network interface my_wwan)> ipv6 metric num
(config network interface my_wwan)>
```

---

See [Configure WAN/WWAN priority and default route metrics](#) for further information about metrics.

- d. Set the relative weight for default routes associated with this interface. For multiple active interfaces with the same metric, the weight is used to load balance traffic to the interfaces.

---

```
(config network interface my_wwan)> ipv6 weight num
(config network interface my_wwan)>
```

---

- e. Set the management priority. This determines which interface will have priority for central management activity. The interface with the highest number will be used.

---

```
(config network interface my_wwan)> ipv6 mgmt num
(config network interface my_wwan)>
```

---

- f. Set the **MTU**.

---

```
(config network interface my_wwan)> ipv6 mtu num
(config network interface my_wwan)>
```

---

- g. See [Configure SureLink active recovery to detect WAN/WWAN failures](#) for information about configuring active recovery.

1. Save the configuration and apply the change:

---

```
(config)> save
Configuration saved.
>
```

---

2. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Show WAN and WWAN status and statistics

### WebUI

1. Log into the EX15 WebUI as a user with Admin access.
2. From the menu, click **Status**.
3. Under **Networking**, click **Interfaces**.



## Command line

1. Log into the EX15 command line as a user with Admin access.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. Enter the **show network** command at the Admin CLI prompt:

---

```
> show network
```

| Interface        | Proto | Status | Address                         |
|------------------|-------|--------|---------------------------------|
| defaultip        | IPv4  | up     | 192.168.210.1/24                |
| defaultlinklocal | IPv4  | up     | 169.254.100.100/16              |
| lan              | IPv4  | up     | 192.168.2.1/24                  |
| lan              | IPv6  | up     | fd00:2704::1/48                 |
| loopback         | IPv4  | up     | 127.0.0.1/8                     |
| wan              | IPv4  | up     | 10.10.10.10/24                  |
| wan              | IPv6  | up     | fe00:2404::240:f4ff:fe80:120/64 |
| modem            | IPv4  | up     | 10.200.1.101/30                 |
| modem            | IPv6  | down   |                                 |

---

```
>
```

3. Enter **show network interface name** at the Admin CLI prompt to display additional information about a specific WAN. For example, to display information about WAN, enter **show network interface wan**:

---

```
> show network interface wan
```

### wan1 Interface Status

```

Device : wan
Zone : external

IPv4 Status : up
IPv4 Type : dhcp
IPv4 Address(es) : 10.10.10.10/24
IPv4 Gateway : 10.10.10.1
IPv4 MTU : 1500
IPv4 Metric : 1
IPv4 Weight : 10
IPv4 DNS Server(s) : 10.10.10.2, 10.10.10.3

IPv6 Status : up
IPv6 Type : dhcpv6
IPv6 Address(es) : fe00:2404::240:f4ff:fe80:120/64
IPv6 Gateway : ff80::234:f3ff:ff0e:4320
IPv6 MTU : 1500
IPv6 Metric : 1
IPv6 Weight : 10
IPv6 DNS Server(s) : fd00:244::1, fe80::234:f3f4:fe0e:4320
```

---

---

>

---

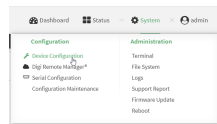
4. Type **exit** to exit the Admin CLI.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Delete a WAN or WWAN

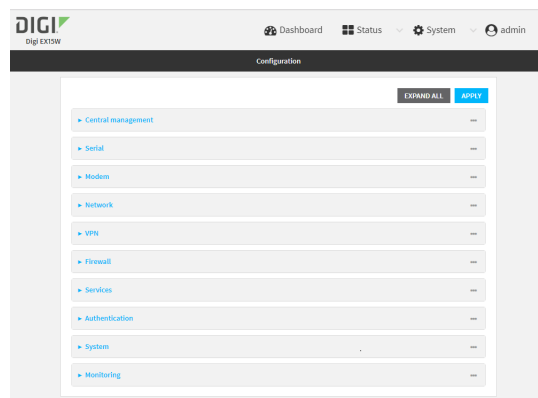
Follow this procedure to delete any WANs and WWANs that have been added to the system. You cannot delete the preconfigured WAN, **WAN**, or the preconfigured WWAN, **Modem**.

### WebUI

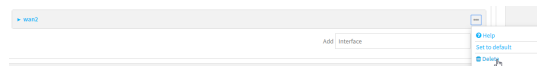
1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



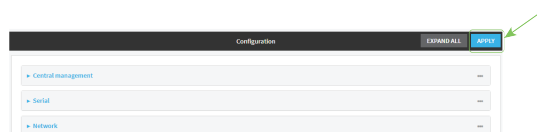
The **Configuration** window is displayed.



3. Click **Network > Interfaces**.
4. Click the menu icon (...) next to the name of the WAN or WWAN to be deleted and select **Delete**.



5. Click **Apply** to save the configuration and apply the change.



### Command line

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.

2. At the command line, type **config** to enter configuration mode:

---

```
> config
(config)>
```

---

3. Use the **del** command to delete the WAN or WWAN. For example, to delete a WWAN named my\_wwan:

---

```
(config)> del network interface my_wwan
```

---

4. Save the configuration and apply the change:

---

```
(config)> save
Configuration saved.
>
```

---

5. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Local Area Networks (LANs)

The EX15 device is preconfigured with the following Local Area Networks (LANs):

| Interface type                  | Preconfigured interfaces                                                         | Devices                                                                       | Default configuration                                                                                                                                                  |
|---------------------------------|----------------------------------------------------------------------------------|-------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Local Area Network (LAN)</b> | <ul style="list-style-type: none"> <li>■ <b>LAN</b></li> </ul>                   | <ul style="list-style-type: none"> <li>■ Ethernet: <b>1/PoE</b></li> </ul>    | <ul style="list-style-type: none"> <li>■ Passthrough mode</li> <li>■ Firewall zone: Internal</li> <li>■ LAN priority: Metric=5</li> <li>■ Surelink disabled</li> </ul> |
|                                 | <ul style="list-style-type: none"> <li>■ <b>Loopback</b></li> </ul>              | <ul style="list-style-type: none"> <li>■ Ethernet: <b>Loopback</b></li> </ul> | <ul style="list-style-type: none"> <li>■ Firewall zone: Loopback</li> <li>■ IP address: 127.0.0.1/8</li> </ul>                                                         |
|                                 | <ul style="list-style-type: none"> <li>■ <b>Default IP</b></li> </ul>            | <ul style="list-style-type: none"> <li>■ Bridge: <b>LAN</b></li> </ul>        | <ul style="list-style-type: none"> <li>■ Firewall zone: Setup</li> <li>■ IP address 192.168.210.1/24</li> </ul>                                                        |
|                                 | <ul style="list-style-type: none"> <li>■ <b>Default Link-local IP</b></li> </ul> | <ul style="list-style-type: none"> <li>■ Bridge: <b>LAN</b></li> </ul>        | <ul style="list-style-type: none"> <li>■ Firewall zone: Setup</li> <li>■ IP address 169.254.100.100/16</li> </ul>                                                      |

You can modify configuration settings for **LAN**, and you can create new LANs.

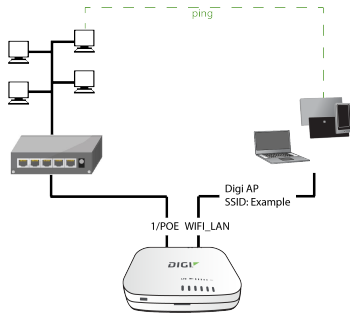
This section contains the following topics:

|                                         |     |
|-----------------------------------------|-----|
| About Local Area Networks (LANs) .....  | 130 |
| Configure a LAN .....                   | 130 |
| Example: Configure two LANs .....       | 136 |
| Show LAN status and statistics .....    | 146 |
| Delete a LAN .....                      | 147 |
| DHCP servers .....                      | 149 |
| Create a Virtual LAN (VLAN) route ..... | 165 |

## About Local Area Networks (LANs)

A Local Area Network (LAN) connects network devices together, such as Ethernet or Wi-Fi, in a logical Layer-2 network.

The following diagram shows a LAN connected to the **1/PoE** Ethernet device and the **Digi AP** access point (available for Wi-Fi enabled models only). Once the LAN is configured and enabled, the devices connected to the network interfaces can communicate with each other, as demonstrated by the **ping** commands.



## Configure a LAN

Configuring a Local Area Network (LAN) involves configuring the following items:

### Required configuration items

- The interface type: either **Ethernet**, **IP Passthrough**, or **PPPoE**.
- The firewall zone: **Internal**.
- The network device or bridge that is used by the LAN.
- The IPv4 address and subnet mask for the LAN. While it is not strictly necessary for a LAN to have an IP address, if you want to send traffic from other networks to the LAN, you must configure an IP address.

---

**Note** By default, the **LAN** interface is in Passthrough mode. To configure the interface as a LAN, first configure the interface to Router mode. See [Enable router mode](#) for information.

---

### Additional configuration items

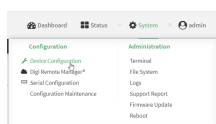
- Additional IPv4 configuration:
  - The metric for IPv4 routes associated with the LAN.
  - The relative weight for IPv4 routes associated with the LAN.
  - The IPv4 management priority of the LAN. The active interface with the highest management priority will have its address reported as the preferred contact address for central management and direct device access.
  - The IPv4 Maximum Transmission Unit (MTU) of the LAN.
  - IPv4 DHCP server configuration. See [DHCP servers](#) for more information.

- IPv6 configuration:
  - The metric for IPv6 routes associated with the LAN.
  - The relative weight for IPv6 routes associated with the LAN.
  - The IPv6 management priority of the LAN. The active interface with the highest management priority will have its address reported as the preferred contact address for central management and direct device access.
  - The IPv6 Maximum Transmission Unit (MTU) of the LAN.
  - The IPv6 prefix length and ID.
  - IPv6 DHCP server configuration. See [DHCP servers](#) for more information.
- MAC address blacklist and whitelist.

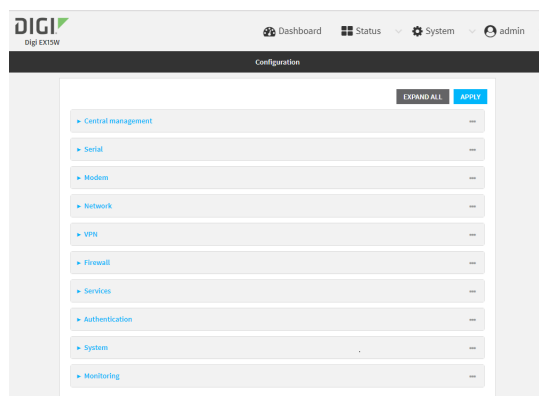
To create a new LAN or edit an existing LAN:

## WebUI

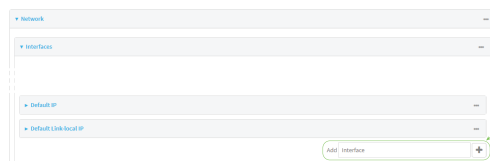
1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.



3. Click **Network > Interfaces**.
4. Create the LAN or select an existing LAN:
  - To create a new LAN, for **Add interface**, type a name for the LAN and click **+**.



- To edit an existing LAN, click to expand the LAN.

The Interface configuration window is displayed.

New LANs are enabled by default. To disable, click **Enable**.

5. For **Interface type**, leave at the default setting of **Ethernet**.
6. For **Zone**, select the appropriate firewall zone. See [Firewall configuration](#) for further information.
7. For **Device**, select an Ethernet device, a Wi-Fi access point, or a bridge. See [Bridging](#) for more information about bridging.
8. Configure IPv4 settings:
  - a. Click to expand **IPv4**.  
IPv4 support is enabled by default.
  - b. For **Type**, select **Static IP address**.
  - c. For **Address**, type the IP address and subnet of the LAN interface. Use the format *IPv4\_address/netmask*, for example, 192.168.2.1/24.
  - d. Optional IPv4 configuration items:
    - i. Set the **Metric**.
    - ii. For **Weight**, type the relative weight for default routes associated with this interface. For multiple active interfaces with the same metric, **Weight** is used to load balance traffic to the interfaces.
    - iii. Set the **Management priority**. This determines which interface will have priority for central management activity. The interface with the highest number will be used.
    - iv. Set the **MTU**.
  - e. Enable the DHCP server:
    - i. Click to expand **DHCP server**.
    - ii. Click **Enable**.  
See [DHCP servers](#) for information about configuring the DHCP server.
9. See [Configure DHCP relay](#) for information about configuring **DHCP relay**.
10. (Optional) Configure IPv6 settings:
  - a. Click to expand **IPv6**.
  - b. **Enable** IPv6 support.
  - c. For **Type**, select **IPv6 prefix delegation**.
  - d. For **Prefix length**, type the minimum length of the prefix to assign to this LAN. If the minimum length is not available, then a longer prefix will be used.
  - e. For **Prefix ID**, type the identifier used to extend the prefix to the assigned length. Leave blank to use a random identifier.
  - f. Set the **Metric**.



- g. For **Weight**, type the relative weight for default routes associated with this interface. For multiple active interfaces with the same metric, **Weight** is used to load balance traffic to the interfaces.
- h. Set the **Management priority**. This determines which interface will have priority for central management activity. The interface with the highest number will be used.
- i. Set the **MTU**.
11. (Optional) Click to expand **MAC address blacklist**.  
Incoming packets will be dropped from any devices whose MAC addresses is included in the **MAC address blacklist**.
  - a. Click to expand **MAC address blacklist**.
  - b. For **Add MAC address**, click **+**.
  - c. Type the **MAC address**.
12. (Optional) Click to expand **MAC address whitelist**.  
If there whitelist entries are specified, incoming packets will only be accepted from the listed MAC addresses.
  - a. Click to expand **MAC address whitelist**.
  - b. For **Add MAC address**, click **+**.
  - c. Type the **MAC address**.
13. Click **Apply** to save the configuration and apply the change.



## Command line

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the command line, type **config** to enter configuration mode:

```
> config
(config)>
```

3. Create a new LAN or edit an existing one:

- To create a new LAN named **my\_lan**:

```
(config)> add network interface my_lan
(config network interface my_lan)>
```

- To edit an existing LAN named **my\_lan**, change to the **my\_lan** node in the configuration schema:

```
(config)> network interface my_lan
(config network interface my_lan)>
```

4. Set the appropriate firewall zone:

---

```
(config network interface my_lan)> zone zone
(config network interface my_lan)>
```

---

See [Firewall configuration](#) for further information.

5. Select an Ethernet device, a Wi-Fi device, or a bridge. See [Bridging](#) for more information about bridging.
  - a. Enter **device ?** to view available devices and the proper syntax.

---

```
(config network interface my_lan)> device ?
```

---

Device: The network device used by this network interface.

Format:

```
/network/device/lan
/network/device/wan
/network/device/loopback
/network/bridge/lan
/network/wireless/ap/digi_ap
```

Current value:

---

```
(config network interface my_lan)> device
```

---

- b. Set the device for the LAN:

---

```
(config network interface my_lan)> device device
(config network interface my_lan)>
```

---

6. Configure IPv4 settings:

- IPv4 support is enabled by default. To disable:

---

```
(config network interface my_lan)> ipv4 enable false
(config network interface my_lan)>
```

---

- The LAN is configured by default to use a static IP address for its IPv4 configuration. To configure the LAN to be a DHCP client, rather than using a static IP address:

---

```
(config network interface my_lan)> ipv4 type dhcp
(config network interface my_lan)>
```

---

These instructions assume that the LAN will use a static IP address for its IPv4 configuration.

- a. Set the IPv4 address and subnet of the LAN interface. Use the format *IPv4\_address/netmask*, for example, 192.168.2.1/24.

---

```
(config network interface my_lan)> ipv4 address ip_address/netmask
(config network interface my_lan)>
```

---

- b. Optional IPv4 configuration items:

- i. Set the IP metric:

```
(config network interface my_lan)> ipv4 metric num
(config network interface my_lan)>
```

- ii. Set the relative weight for default routes associated with this interface. For multiple active interfaces with the same metric, the weight is used to load balance traffic to the interfaces.

```
(config network interface my_lan)> ipv4 weight num
(config network interface my_lan)>
```

- iii. Set the management priority. This determines which interface will have priority for central management activity. The interface with the highest number will be used.

```
(config network interface my_lan)> ipv4 mgmt num
(config network interface my_lan)>
```

- iv. Set the MTU:

```
(config network interface my_lan)> ipv4 mtu num
(config network interface my_lan)>
```

- c. Enable the DHCP server:

```
(config network interface my_lan)> ipv4 dhcp_server enable true
```

See [DHCP servers](#) for information about configuring the DHCP server.

7. (Optional) Configure IPv6 settings:

- a. Enable IPv6 support:

```
(config network interface my_lan)> ipv6 enable true
(config network interface my_lan)>
```

- b. Set the IPv6 type to DHCP:

```
(config network interface my_lan)> ipv6 type dhcpv6
(config network interface my_lan)>
```

- c. Generally, the default settings for IPv6 support are sufficient. You can view the default IPv6 settings by using the question mark (?):

```
(config network interface my_lan)> ipv6 ?
```

IPv6

| Parameters | Current Value |                     |
|------------|---------------|---------------------|
| -----      |               |                     |
| enable     | true          | Enable              |
| metric     | 0             | Metric              |
| mgmt       | 0             | Management priority |

|               |                   |               |
|---------------|-------------------|---------------|
| mtu           | 1500              | MTU           |
| prefix_id     | 1                 | Prefix ID     |
| prefix_length | 48                | Prefix length |
| type          | prefix_delegation | Type          |
| weight        | 10                | Weight        |

#### Additional Configuration

|                    |                 |
|--------------------|-----------------|
| connection_monitor | Active recovery |
| dhcpv6_server      | DHCPv6 server   |

```
(config network interface my_lan)>
```

View default settings for the IPv6 DHCP server:

```
(config network interface my_lan)> ipv6 dhcpv6_server ?
```

DHCPv6 server: The DHCPv6 server settings for this network interface.

| Parameters | Current Value |        |
|------------|---------------|--------|
| enable     | true          | Enable |

```
(config network interface my_lan)>
```

- d. Modify any of the remaining default settings as appropriate. For example, to change the minimum length of the prefix:

```
(config network interface my_lan)> ipv6 prefix_length 60
(config network interface my_lan)>
```

If the minimum length is not available, then a longer prefix will be used.

See [Configure WAN/WWAN priority and default route metrics](#) for further information about metrics.

8. Save the configuration and apply the change:

```
(config network interface my_lan)> save
Configuration saved.
>
```

9. Type **exit** to exit the Admin CLI.

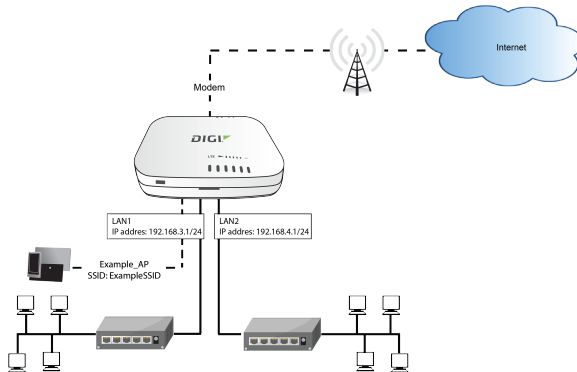
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Example: Configure two LANs

The default configuration of the EX15 consists of one WAN (named **ETH1**), one WWAN (**Modem**), and one LAN (**ETH2**). For EX15W Wi-Fi enabled devices, the default configuration of the **ETH2** uses a bridge that consists of two devices, the **ETH2** Ethernet device and the **Digi AP** Wi-Fi access point.

In this example, we will:

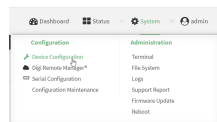
1. Create a new Wi-Fi access point (EX15W models only).
2. Create a new bridge that consists of the new access point and the **ETH1** device.  
In this configuration, the **ETH1** device will no longer be part of a WAN. Internet access will be provided by the cellular modem.
3. Create two new LANs:
  - **LAN1** will be configured to use the new bridge.
  - **LAN2** will be configured to use the **ETH2** device.



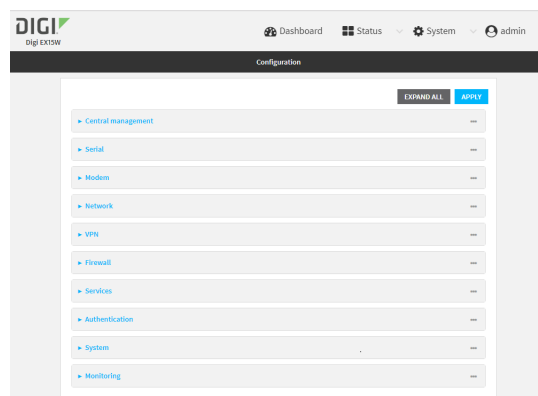
### Task one: Create a new access point (EX15W models only)

#### WebUI

1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.



3. Click **Network > Wi-Fi > Access points**.

- For **Add Wi-Fi access point**, type **Example\_AP** for the name of the new access point and click **+**.

The Wi-Fi access point configuration window is displayed.

- For **SSID**, type **Example\_SSID**.
- Type a **Pre-shared key** that clients will use to access the AP.

- Click **Apply** to save the configuration and apply the change.

## Command line

- Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
- At the command line, type **config** to enter configuration mode:

```
> config
(config)>
```

- Create a new access point:

```
(config)> add network wifi ap Example_AP
(config network wifi ap Example_AP)>
```

New access points are enabled by default.

- Set the SSID for the Wi-Fi access point. Up to 32 characters are allowed.

```
(config network wifi ap Example_AP)> ssid Example_SSID
(config network wifi ap Example_AP)>
```

SSID broadcasting is enabled by default for new access points.

- Set the security for the access point to WPA2:

```
(config network wifi ap Example_AP)> encryption type wpa2
(config network wifi ap Example_AP)>
```

- Set the password that clients will use when connecting to the access point:

```
(config network wifi ap Example_AP)> encryption key_psk2 password
(config network wifi ap Example_AP)>
```

- Save the configuration and apply the change:

```
(config network wireless ap Example_AP)> save
Configuration saved.
>
```

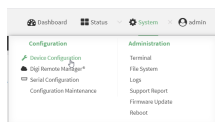
- Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

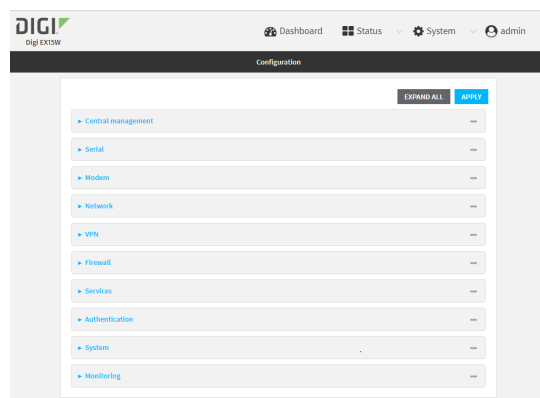
## Task two: Create a new bridge (EX15W )

### WebUI

- Log into the EX15 WebUI as a user with full Admin access rights.
- On the menu, click **System**. Under **Configuration**, click **Device Configuration**.

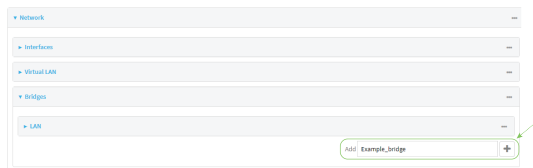


The **Configuration** window is displayed.



- Click **Network > Bridges**.

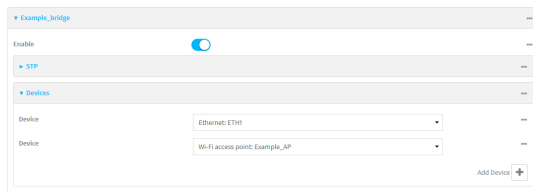
- For **Add Bridge**, type **Example\_bridge** and click **+**.



The new bridge configuration window is displayed.



- Click to expand **Devices**.
- For **Add Device**, click **+**.
- For Device, select **Ethernet: ETH1**.
- Click **+** again to add another device.
- For Device, select **Wi-Fi access point: Example\_AP**.



- (Optional) Enable Spanning Tree Protocol (STP).  
STP is used when using multiple LANs on the same device, to prevent bridge loops and other routing conflicts.
  - Click **STP**.
  - Click **Enable**.
  - For **Forwarding delay**, enter the number of seconds that the device will spend in each of the listening and learning states before the bridge begins forwarding data. The default is **2** seconds.
- Click **Apply** to save the configuration and apply the change.



## Command line

- Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.



2. At the command line, type **config** to enter configuration mode:

---

```
> config
(config)>
```

---

3. Create a new bridge:

---

```
(config)> add network bridge Example_bridge
(config network bridge Example_bridge)>
```

---

New access points are enabled by default.

4. Use the Tab key (twice) to determine available devices:

---

```
(config network bridge Example_bridge)> add device end [TAB][TAB]
/network/device/eth1 /network/device/eth2
/network/device/loopback /network/bridge/lan
/network/wifi/ap/digi_ap /network/wifi/ap/Example_AP
(config network bridge Example_bridge)> add device end /network/
```

---

5. Add the **eth1** Ethernet device:

---

```
(config network bridge Example_bridge)> add device end /network/device/eth1
(config network bridge Example_bridge)>
```

---

6. Add the **Example\_AP** Wi-Fi access point:

---

```
(config network bridge Example_bridge)> add device end
/network/wireless/ap/Example_AP
(config network bridge Example_bridge)>
```

---

7. (Optional) Enable Spanning Tree Protocol (STP).

STP is used when using multiple LANs on the same device, to prevent bridge loops and other routing conflicts.

- a. Enable STP:

---

```
(config network bridge Example_bridge)> stp enable true
```

---

- b. Set the number of seconds that the device will spend in each of the listening and learning states before the bridge begins forwarding data:

---

```
(config network bridge Example_bridge)> stp forward_delay num
(config)>
```

---

The default is **2** seconds.

8. Save the configuration and apply the change:

---

```
(config network bridge Example_bridge)> save
Configuration saved.
>
```

---

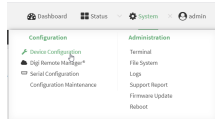
9. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

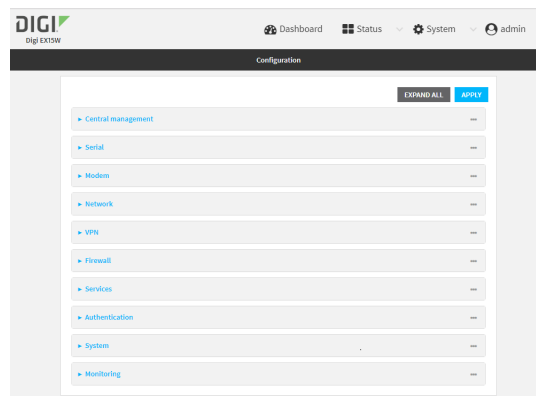
### Task three: Create the LANs

#### WebUI

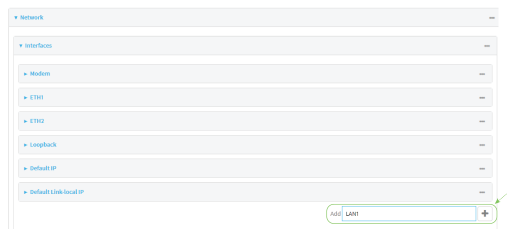
1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.



3. Create **LAN1**:
  - a. Click **Network > Interfaces**.
  - b. For **Add Interface**:, type **LAN1** and click **+**.



- c. For **Zone**, select **Internal**.
  - d. For **Device**:
    - If you are configuring a Wi-Fi enabled EX15W , select **Bridge: Example\_bridge**.
    - If you are configuring a non-Wi-Fi EX15, select **Ethernet: ETH1**.

- e. Click to expand **IPv4**.
  - f. For **Address**, type **192.168.3.1/24**.
  - g. Click to expand **DHCP server**.
  - h. Click **Enable**.
4. Create LAN2:
- a. Click **Network > Interfaces**.
  - b. For **Add Interface:**, type **LAN2** and click **+**.
  - c. For **Zone**, select **Internal**.
  - d. For **Device**, select **Ethernet: ETH2**.
  - e. Click to expand **IPv4**.
  - f. For **Address**, type **192.168.4.1/24**.
  - g. Click to expand **DHCP server**.
  - h. Click **Enable**.
5. Click **Apply** to save the configuration and apply the change.

## Command line

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the command line, type **config** to enter configuration mode:

```
> config
(config)>
```

3. Create the LAN1 interface:
  - a. Add the interface:

```
(config)> add network interface LAN1
(config network interface LAN1)>
```

## b. Configure the LAN1 interface:

- i. Enter **device ?** to view available devices and the proper syntax.

---

```
(config network interface LAN1)> device ?
```

Device: The network device used by this network interface.

Format:

```
/network/device/eth1
/network/device/eth2
/network/bridge/LAN
/network/bridge/Example_bridge
/network/wireless/ap/digi_ap
/network/wireless/ap/Example_AP
```

Current value:

---

```
(config network interface LAN1)> device
```

---

- ii. Set the device for the LAN1 interface:

- If you are configuring a Wi-Fi enabled EX15W, set the device to **/network/bridge/Example\_bridge**.

---

```
(config network interface LAN1)> device
/network/bridge/Example_bridge
(config network interface LAN1)>
```

---

- If you are configuring a non-Wi-Fi EX15, set the device to **/network/device/eth1**.

---

```
(config network interface LAN1)> device /network/device/eth1
(config network interface LAN1)>
```

---

c. Configure the firewall zone for the LAN1 interface to **internal**:

---

```
(config network interface LAN1)> zone internal
(config network interface LAN1)>
```

---

## d. Configure the IPv4 address for the LAN1 interface:

---

```
(config network interface LAN1)> ipv4 address 192.168.3.1/24
(config network interface LAN1)>
```

---

## e. Enable the DHCP server for the LAN1 interface:

---

```
(config network interface LAN1)> ipv4 dhcp_server enable true
(config network interface LAN1)>
```

---

## 4. Create the LAN2 interface:

- a. Add the interface:

---

```
(config)> add network interface LAN2
(config network interface LAN2)>
```

---

## b. Configure the LAN2 interface:

- i. Enter
- device ?**
- to view available devices and the proper syntax.

---

```
(config network interface LAN2)> device ?
```

Device: The network device used by this network interface.

Format:

```
/network/device/eth1
/network/device/eth2
/network/bridge/LAN
/network/bridge/Example_bridge
/network/wireless/ap/digi_ap
/network/wireless/ap/Example_AP
```

Current value:

---

```
(config network interface LAN2)> device
```

---

- ii. Set the device for the LAN2 interface:

---

```
(config network interface LAN2)> device /network/device/eth1
(config network interface LAN2)>
```

---

c. Configure the firewall zone for the LAN2 interface to **internal**:

---

```
(config network interface LAN2)> zone internal
(config network interface LAN2)>
```

---

## d. Configure the IPv4 address for the LAN2 interface:

---

```
(config network interface LAN2)> ipv4 address 192.168.4.1/24
(config network interface LAN2)>
```

---

## e. Enable the DHCP server for the LAN2 interface:

---

```
(config network interface LAN2)> ipv4 dhcp_server enable true
(config network interface LAN2)>
```

---

## 5. Save the configuration and apply the change:

---

```
(config network interface LAN2)> save
Configuration saved.
>
```

---

6. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

### Task four: Verify the new configuration

The final step in this example is to verify the new configuration.

1. Verify that LAN1 is operating correctly:
  - a. Connect a device to LAN1 through the **ETH1** Ethernet port, or by connecting to the Example\_AP Wi-Fi1 access point.
  - b. Verify that the device has been provided an IP address from the LAN DHCP server in the 192.168.3.\* subnet.
2. Verify that LAN2 is operating correctly:
  - a. Connect a device to LAN2 through the **ETH2** Ethernet port.
  - b. Verify that the device has been provided an IP address from the LAN2 DHCP server in the 192.168.4.\* subnet.

## Show LAN status and statistics

### WebUI

1. Log into the EX15 WebUI as a user with Admin access.
2. From the menu, click **Status**.
3. Under **Networking**, click **Interfaces**.

### Command line

1. Log into the EX15 command line as a user with Admin access.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. Enter the [show network](#) command at the Admin CLI prompt:

---

```
> show network
```

| Interface        | Proto | Status | Address                         |
|------------------|-------|--------|---------------------------------|
| defaultip        | IPv4  | up     | 192.168.210.1/24                |
| defaultlinklocal | IPv4  | up     | 169.254.100.100/16              |
| lan              | IPv4  | up     | 192.168.2.1/24                  |
| lan              | IPv6  | up     | fd00:2704::1/48                 |
| loopback         | IPv4  | up     | 127.0.0.1/8                     |
| wan              | IPv4  | up     | 10.10.10.10/24                  |
| wan              | IPv6  | up     | fe00:2404::240:f4ff:fe80:120/64 |
| modem            | IPv4  | up     | 10.200.1.101/30                 |
| modem            | IPv6  | down   |                                 |

---

```
>
```

---

3. Enter **show network interface name** at the Admin CLI prompt to display additional information about a specific LAN. For example, to display information about LAN, enter **show network interface lan**:

```
> show network interface lan

lan1 Interface Status

Device : lan
Zone : internal

IPv4 Status : up
IPv4 Type : static
IPv4 Address(es) : 192.168.2.1/24
IPv4 Gateway :
IPv4 MTU : 1500
IPv4 Metric : 5
IPv4 Weight : 10
IPv4 DNS Server(s) :

IPv6 Status : up
IPv6 Type : prefix
IPv6 Address(es) : fd00:2704::1/48
IPv6 Gateway :
IPv6 MTU : 1500
IPv6 Metric : 5
IPv6 Weight : 10
IPv6 DNS Server(s) :
```

>

4. Type **exit** to exit the Admin CLI.

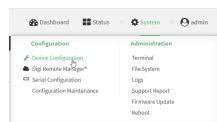
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Delete a LAN

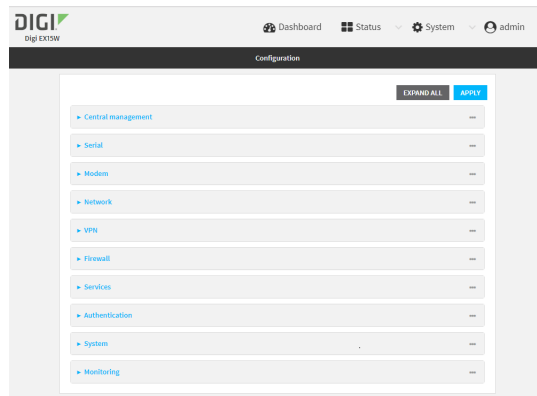
Follow this procedure to delete any LANs that have been added to the system. You cannot delete the preconfigured LAN, **LAN1**.

### WebUI

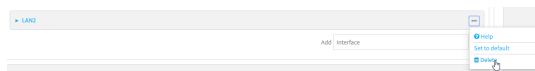
1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.



3. Click **Network > Interfaces**.
4. Click the menu icon (...) next to the name of the LAN to be deleted and select **Delete**.



5. Click **Apply** to save the configuration and apply the change.





## Command line

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the command line, type **config** to enter configuration mode:
 

---

```
> config
(config)>
```

---
3. Use the **del** command to delete the LAN. For example, to delete a LAN named my\_lan:
 

---

```
(config)> del network interface my_lan
```

---
4. Save the configuration and apply the change:
 

---

```
(config)> save
Configuration saved.
>
```

---
5. Type **exit** to exit the Admin CLI.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## DHCP servers

You can enable DHCP on your EX15 device to assign IP addresses to clients, using either:

- The DHCP server for the device's local network, which assigns IP addresses to clients on the device's local network. Addresses are assigned from a specified pool of IP addresses. For a local network, the device uses the DHCP server that has the IP address pool in the same IP subnet as the local network.  
When a host receives an IP configuration, the configuration is valid for a particular amount of time, known as the lease time. After this lease time expires, the configuration must be renewed. The host renews the lease time automatically.
- A DHCP relay server, which forwards DHCP requests from clients to a DHCP server that is running on a separate device.

### Configure a DHCP server

**Note** These instructions assume you are configuring the device to use its local DHCP server. For instructions about configuring the device to use a DHCP relay server, see [Configure DHCP relay](#).

#### Required configuration items

- Enable the DHCP server.

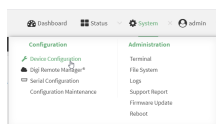
#### Additional configuration items

- The lease address pool: the range of IP addresses issued by the DHCP server to clients.
- Lease time: The length, in minutes, of the leases issued by the DHCP server.

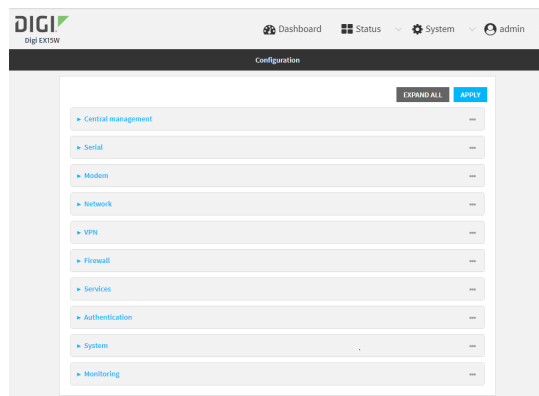
- The Maximum Transmission Units (MTU).
- The domain name suffix appended to host names.
- The IP gateway address given to clients.
- The IP addresses of the preferred and alternate Domain Name Server (DNS), NTP servers, and WINS servers that are given to clients.
- The TFTP server name.
- The filepath and name of the bootfile on the TFTP server.
- Custom DHCP options. See [Configure DHCP options](#) for information about custom DHCP options.
- Static leases. See [Map static IP addresses to hosts](#) for information about static leases.

## WebUI

1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.



3. Click **Network > Interfaces**.
4. Click to expand an existing LAN, or create a new LAN. See [Configure a LAN](#).
5. Click to expand **IPv4 > DHCP server**.
6. **Enable** the DHCP server.
7. (Optional) For **Lease time**, type the amount of time that a DHCP lease is valid.  
Allowed values are any number of weeks, days, hours, minutes, or seconds, and take the format **number{w|d|h|m|s}**.  
For example, to set **Lease time** to ten minutes, enter **10m** or **600s**.  
The default is 12 hours.
8. (Optional) For **Lease range start** and **Lease range end**, type the lowest and highest IP address that the DHCP server will assign to a client. This value represents the low order byte

of the address (the final triplet in an IPv4 address, for example, 192.168.2.**xxx**). The remainder of the IP address will be based on the LAN's static IP address as defined in the **Address** field. Allowed values are between **1** and **254**, and the default is **100** for **Lease range start** and **250** for **Lease range end**.

9. Optional DHCP server settings:
  - a. Click to expand **Advanced settings**.
  - b. For **Gateway**, select either:
    - **None**: No gateway is broadcast by the DHCP server. Client destinations must be resolvable without a gateway.
    - **Automatic**: Broadcasts the EX15 device's gateway.
    - **Custom**: Allows you to identify the IP address of a **Custom gateway** to be broadcast.

The default is **Automatic**.
  - c. For **MTU**,
    - **None**: An MTU of length **0** is broadcast. This is not recommended.
    - **Automatic**: No MTU is broadcast and clients will determine their own MTU.
    - **Custom**: Allows you to identify a **Custom MTU** to be broadcast.

The default is **Automatic**.
  - d. For **Domain name suffix**, type the domain name that should be appended to host names.
  - e. For **Primary** and **Secondary DNS**, **Primary** and **Secondary NTP server**, and **Primary** and **Secondary WINS server**, select either:
    - **None**: No server is broadcast.
    - **Automatic**: Broadcasts the EX15 device's server.
    - **Custom**: Allows you to identify the IP address of the server.
  - f. For **Bootfile name**, type the relative path and file name of the bootfile on the TFTP server.
  - g. For **TFTP server** name, type the IP address or host name of the TFTP server.
10. See [Configure DHCP options](#) for information about **Custom DHCP options**.
11. See [Map static IP addresses to hosts](#) for information about **Static leases**.
12. Click **Apply** to save the configuration and apply the change.



## Command line

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.

2. At the command line, type **config** to enter configuration mode:

---

```
> config
(config)>
```

---

3. Enable the DHCP server for an existing LAN. For example, to enable the DHCP server for a LAN named **my\_lan**:

---

```
(config)> network interface my_lan ipv4 dhcp_server enable true
(config)>
```

---

See [Configure a LAN](#) for information about creating a LAN.

4. (Optional) Set the amount of time that a DHCP lease is valid:

---

```
(config)> network interface my_lan ipv4 dhcp_server lease_time value
(config)>
```

---

where *value* is any number of weeks, days, hours, minutes, or seconds, and takes the format **number{w|d|h|m|s}**.

For example, to set **network interface my\_lan ipv4 dhcp\_server lease\_time** to ten minutes, enter either **10m** or **600s**:

---

```
(config)> network interface my_lan ipv4 dhcp_server lease_time 600s
(config)>
```

---

5. (Optional) Set the lowest IP address that the DHCP server will assign to a client. This value represents the low order byte of the address (the final triplet in an IPv4 address, for example, 192.168.2.**xxx**). The remainder of the IP address will be based on the LAN's static IP address as defined in the **address** parameter.

---

```
(config)> network interface my_lan ipv4 dhcp_server lease_start num
(config)>
```

---

Allowed values are between **1** and **254**, and the default is **100**.

6. (Optional) Set the highest IP address that the DHCP server will assign to a client:

---

```
(config)> network interface my_lan ipv4 dhcp_server lease_end num
(config)>
```

---

Allowed values are between **1** and **254**, and the default is **250**.

7. Optional DHCP server settings:

- a. Click to expand **Advanced settings**.
- b. Determine how the DHCP server should broadcast the gateway server:

---

```
(config)> network interface my_lan ipv4 dhcp_server advanced gateway
value
(config)>
```

---

where **value** is one of:

- **none**: No gateway is broadcast by the DHCP server. Client destinations must be resolvable without a gateway.

- **auto:** Broadcasts the EX15 device's gateway.
- **custom:** Allows you to identify the IP address of a custom gateway to be broadcast:

---

```
(config)> network interface my_lan ipv4 dhcp_server advanced
gateway_custom ip_address
(config)>
```

---

The default is **auto**.

- c. Determine how the DHCP server should broadcast the the MTU:

---

```
(config)> network interface my_lan ipv4 dhcp_server advanced mtu value
(config)>
```

---

where **value** is one of:

- **none:** An MTU of length **0** is broadcast. This is not recommended.
- **auto:** No MTU is broadcast and clients will determine their own MTU.
- **custom:** Allows you to identify a custom MTU to be broadcast:

---

```
(config)> network interface my_lan ipv4 dhcp_server advanced mtu_
custom mtu
(config)>
```

---

The default is **auto**.

- d. Set the domain name that should be appended to host names:

---

```
(config)> network interface my_lan ipv4 dhcp_server advanced domain_
suffix name
(config)>
```

---

- e. Set the IP address or host name of the primary and secondary DNS, the primary and secondary NTP server, and the primary and secondary WINS servers:

---

```
(config)> network interface my_lan ipv4 dhcp_server advanced primary_dns
value
(config)> network interface my_lan ipv4 dhcp_server advanced secondary_
dns value
(config)> network interface my_lan ipv4 dhcp_server advanced primary_ntp
value
(config)> network interface my_lan ipv4 dhcp_server advanced secondary_
ntp value
(config)> network interface my_lan ipv4 dhcp_server advanced primary_
wins value
(config)> network interface my_lan ipv4 dhcp_server advanced secondary_
wins value
(config)>
```

---

where **value** is one of:

- **none:** No server is broadcast.
- **auto:** Broadcasts the EX15 device's server.

- **custom:** Allows you to identify the IP address of the server. For example:

---

```
(config)> network interface my_lan ipv4 dhcp_server advanced
primary_dns_custom ip_address
(config)>
```

---

The default is **auto**.

- Set the IP address or host name of the TFTP server:

---

```
(config)> network interface my_lan ipv4 dhcp_server advanced nftp_server
ip_address
(config)>
```

---

- Set the relative path and file name of the bootfile on the TFTP server:

---

```
(config)> network interface my_lan ipv4 dhcp_server advanced bootfile
filename
(config)>
```

---

- See [Configure DHCP options](#) for information about custom DHCP options.
- See [Map static IP addresses to hosts](#) for information about static leases.
- Save the configuration and apply the change:

---

```
(config network interface my_lan ipv4 dhcp_server advanced static_lease 0)>
save
Configuration saved.
>
```

---

- Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

### ***Map static IP addresses to hosts***

You can configure the DHCP server to assign static IP addresses to specific hosts.

#### ***Required configuration items***

- IP address that will be mapped to the device.
- MAC address of the device.

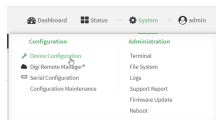
#### ***Additional configuration items***

- A label for this instance of the static lease.

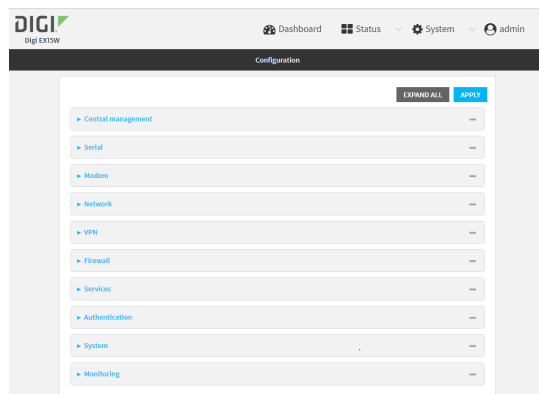
To map static IP addresses:



1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.



3. Click **Network > Interfaces**.
4. Click to expand an existing LAN, or create a new LAN. See [Configure a LAN](#).
5. Click to expand **IPv4 > DHCP server > Advanced settings > Static leases**.
6. For **Add Static lease**, click **+**.
7. Type the **MAC address** of the device associated with this static lease.
8. Type the **IP address** for the static lease.

**Note** The IP address here should be outside of the DHCP server's configured lease range. See [Configure a DHCP server](#) for further information about the lease range.

9. (Optional) For **Hostname**, type a label for the static lease. This does not have to be the device's actual hostname.
10. Repeat for each additional DHCP static lease.
11. Click **Apply** to save the configuration and apply the change.



## Command line

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.

2. At the command line, type **config** to enter configuration mode:

```
> config
(config)>
```

3. Add a static lease to the DHCP server configuration for an existing LAN. For example, to add static lease to a LAN named **my\_lan**:

```
(config)> add network interface my_lan ipv4 dhcp_server advanced static_lease end
(config network interface my_lan ipv4 dhcp_server advanced static_lease 0)>
```

See [Configure a LAN](#) for information about creating a LAN.

4. Set the MAC address of the device associated with this static lease, using the colon-separated format:

```
(config network interface my_lan ipv4 dhcp_server advanced static_lease 0)>
mac 00:40:D0:13:35:36
(config network interface my_lan ipv4 dhcp_server advanced static_lease 0)>
```

5. Set the IP address for the static lease:

```
(config network interface my_lan ipv4 dhcp_server advanced static_lease 0)>
ip 10.01.01.10
(network interface my_lan ipv4 dhcp_server advanced static_lease 0)>
```

**Note** The IP address here should be outside of the DHCP server's configured lease range. See [Configure a DHCP server](#) for further information about the lease range.

6. (Optional) Set a label for this static lease:

```
(config network interface my_lan ipv4 dhcp_server advanced static_lease 0)>
name label
(config network interface my_lan ipv4 dhcp_server advanced static_lease 0)>
```

7. Save the configuration and apply the change:

```
(config network interface my_lan ipv4 dhcp_server advanced static_lease 0)>
save
Configuration saved.
>
```

8. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

### **Show current static IP mapping**

To view your current static IP mapping:





1. Log into the EX15 WebUI as a user with Admin access.
2. On the main menu, click **Status**
3. Under **Networking**, click **DHCP Leases**.

### Command line

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the command line, type **config** to enter configuration mode:

---

```
> config
(config)>
```

---

3. Show the static lease configuration. For example, to show the static leases for a lan named **my\_lan**:

---

```
(config)> show network interface my_lan ipv4 dhcp_server advanced static_lease
0
 ip 192.168.2.10
 mac BF:C3:46:24:0E:D9
 no name
1
 ip 192.168.2.11
 mac E3:C1:1F:65:C3:0E
 no name
(config)>
```

---

4. Type **cancel** to exit configuration mode:

---

```
(config)> cancel
>
```

---

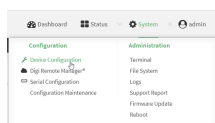
5. Type **exit** to exit the Admin CLI.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

### Delete static IP mapping entries

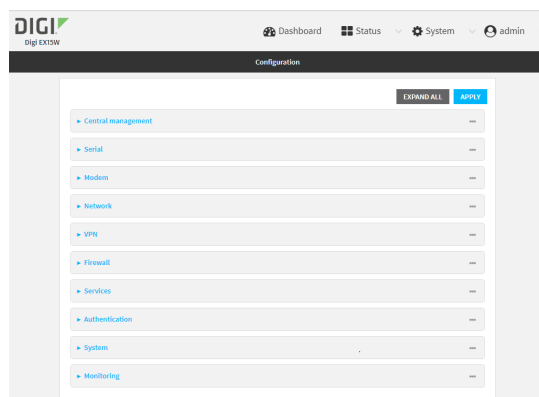
To delete a static IP entry:

### WebUI

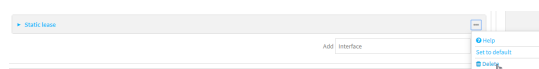
1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.



3. Click **Network > Interfaces**.
4. Click to expand an existing LAN.
5. Click to expand **IPv4 > DHCP server > Advanced settings > Static leases**.
6. Click the menu icon (...) next to the name of the static lease to be deleted and select **Delete**.



7. Click **Apply** to save the configuration and apply the change.



## Command line

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the command line, type **config** to enter configuration mode:

```
> config
(config)>
```

3. Show the static lease configuration. For example, to show the static leases for a lan named **my\_lan**:

```
(config)> show network interface my_lan ipv4 dhcp_server advanced static_lease
0
 ip 192.168.2.10
 mac BF:C3:46:24:0E:D9
 no name
1
 ip 192.168.2.11
```

---

```
mac E3:C1:1F:65:C3:0E
no name
(config)>
```

---

4. Use the **del index\_number** command to delete a static lease. For example, to delete the static lease for the device listed in the above output with a mac address of BF:C3:46:24:0E:D9 (index number 0):

---

```
(config)> del network interface lan1 ipv4 dhcp_server advanced static_lease
0
(config)>
```

---

5. Save the configuration and apply the change:

---

```
(config)> save
Configuration saved.
>
```

---

6. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

### **Configure DHCP options**

You can configure DHCP servers running on your EX15 device to send certain specified DHCP options to DHCP clients. You can also set the user class, which enables you to specify which specific DHCP clients will receive the option. You can also force the command to be sent to the clients.

DHCP options can be set on a per-LAN basis, or can be set for all LANs. A total of 32 DHCP options can be configured.

#### **Required configuration items**

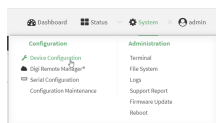
- DHCP option number.
- Value for the DHCP option.

#### **Additional configuration items**

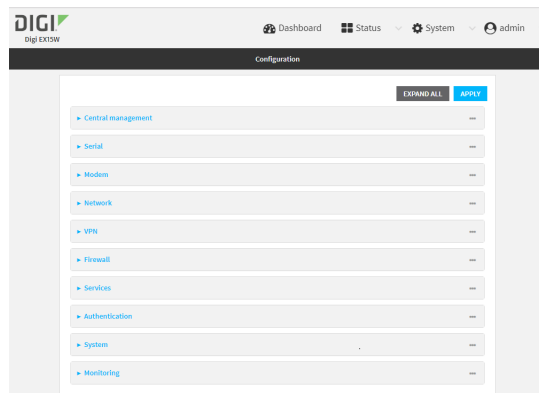
- The data type of the value.
- Force the option to be sent to the DHCP clients.
- A label for the custom option.

## WebUI

1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.



3. Click **Network > Interfaces**.
4. Click to expand an existing LAN, or create a new LAN. See [Configure a LAN](#).
5. Click to expand **IPv4 > DHCP server > Advanced settings > Custom DHCP option**.
6. For **Add Custom option**, click **+**.  
Custom options are enabled by default. To disable, uncheck **Enable**.
7. For **Option number**, type the DHCP option number.
8. For **Value**, type the value of the DHCP option.
9. (Optional) For **Label**, type a label for the custom option.
10. (Optional) If **Forced send** is enabled, the DHCP option will always be sent to the client, even if the client does not ask for it.
11. (Optional) For **Data type**, select the data type that the option uses. If the incorrect data type is selected, the device will send the value as a string.
12. Click **Apply** to save the configuration and apply the change.



## Command line

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.

2. At the command line, type **config** to enter configuration mode:

---

```
> config
(config)>
```

---

3. Add a custom DHCP option to the DHCP server configuration for an existing LAN. For example, to add static lease to a LAN named **my\_lan**:

---

```
(config)> add network interface my_lan ipv4 dhcp_server advanced custom_
option end
(config network interface my_lan ipv4 dhcp_server advanced custom_option
0)>
```

---

See [Configure a LAN](#) for information about creating a LAN.

4. Custom options are enabled by default. To disable:

---

```
(config network interface my_lan ipv4 dhcp_server advanced custom_option
0)> enable false
(config network interface my_lan ipv4 dhcp_server advanced custom_option
0)>
```

---

5. Set the option number for the DHCP option:

---

```
(config network interface my_lan ipv4 dhcp_server advanced custom_option
0)> option 210
(config network interface my_lan ipv4 dhcp_server advanced custom_option
0)>
```

---

6. Set the value for the DHCP option:

---

```
(config network interface my_lan ipv4 dhcp_server advanced custom_option
0)> value_str value
(network interface my_lan ipv4 dhcp_server advanced custom_option 0)>
```

---

7. (Optional) Set a label for this custom option:

---

```
(config network interface my_lan ipv4 dhcp_server advanced custom_option
0)> name label
(config network interface my_lan ipv4 dhcp_server advanced custom_option
0)>
```

---

8. (Optional) To force the DHCP option to always be sent to the client, even if the client does not ask for it:

---

```
(config network interface my_lan ipv4 dhcp_server advanced custom_option
0)> force true
(config network interface my_lan ipv4 dhcp_server advanced custom_option
0)>
```

---

9. (Optional) Set the data type that the option uses.

If the incorrect data type is selected, the device will send the value as a string.

---

```
(config network interface my_lan ipv4 dhcp_server advanced custom_option
0)> datatype value
(config network interface my_lan ipv4 dhcp_server advanced custom_option
0)>
```

---

where *value* is one of:

- **1byte**
- **2byte**
- **4byte**
- **hex**
- **ipv4**
- **str**

The default is **str**.

10. Save the configuration and apply the change:

---

```
(config network interface my_lan ipv4 dhcp_server advanced custom_option
0)> save
Configuration saved.
>
```

---

11. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

### **Configure DHCP relay**

DHCP relay allows a router to forward DHCP requests from one LAN to a separate DHCP server, typically connected to a different LAN.

For the EX15 device, DHCP relay is configured by providing the IP address of a DHCP relay server, rather than an IP address range. If both the DHCP relay server and an IP address range are specified, DHCP relay is used, and the specified IP address range is ignored.

Multiple DHCP relay servers can be provided for each LAN. If multiple relay servers are provided, DHCP requests are forwarded to all servers without waiting for a response. Clients will typically use the IP address from the first DHCP response received.

Configuring DHCP relay involves the following items:

#### **Required configuration items**

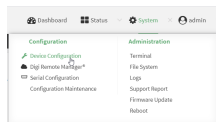
- Disable the DHCP server, if it is enabled.
- IP address of the primary DHCP relay server, to define the relay server that will respond to DHCP requests.

#### **Additional configuration items**

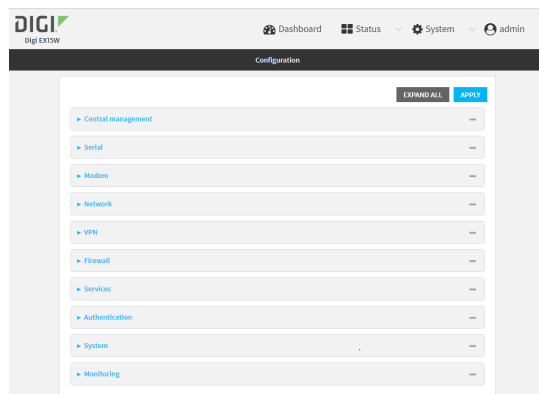
- IP address of additional DHCP relay servers.



1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.



3. Click **Network > Interfaces**.
4. Click to expand an existing LAN, or create a new LAN. See [Configure a LAN](#).
5. Disable the DHCP server, if it is enabled:
  - a. Click to expand **IPv4 > DHCP server**.
  - b. Click **Enable** to toggle off the DHCP server.
6. Click to expand **DHCP relay**.
7. For **Add DHCP Server**:, click **+**.
8. For **DHCP server address**, type the IP address of the relay server.
9. Repeat for each additional DHCP relay server.
10. Click **Apply** to save the configuration and apply the change.



## Command line

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the command line, type **config** to enter configuration mode:

```
> config
(config)>
```

3. Add a DHCP relay server to an existing LAN. For example, to add a server to a LAN named **my\_lan**:

---

```
(config)> add network interface my_lan ipv4 dhcp_relay end
(config network interface lan1 my_lan dhcp_relay 0)>
```

---

See [Configure a LAN](#) for information about creating a LAN.

4. Set the IP address of the DHCP relay server:

---

```
(config network interface my_lan ipv4 dhcp_relay 0)> address 10.10.10.10
(config network interface my_lan ipv4 dhcp_relay 0)>
```

---

5. (Optional) Add additional DHCP relay servers:

- a. Move back one step in the configuration schema by typing two periods (..):

---

```
(config network interface my_lan ipv4 dhcp_relay 0)> ..
(config network interface my_lan ipv4 dhcp_relay)>
```

---

- b. Add the next server:

---

```
(config network interface lan1 ipv4 dhcp_relay)> add end
(config network interface lan1 ipv4 dhcp_relay 1)>
```

---

- c. Set the IP address of the DHCP relay server:

---

```
(config network interface my_lan ipv4 dhcp_relay 1)> address 10.10.10.11
(config network interface my_lan ipv4 dhcp_relay 1)>
```

---

- d. Repeat for each additional relay server.

1. Disable the DHCP server, if it is enabled:

---

```
(config network interface my_lan ipv4 dhcp_relay 1)> dhcp_server
enable false
(config network interface my_lan ipv4 dhcp_relay 1)>
```

---

6. Save the configuration and apply the change:

---

```
(config network interface lan1 ipv4 dhcp_relay 1)> save
Configuration saved.
>
```

---

7. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

### **Show DHCP server status and settings**

View DHCP status to monitor which devices have been given IP configuration by the EX15 device and to diagnose DHCP issues.



**WebUI**



1. Log into the EX15 WebUI as a user with Admin access.
2. On the main menu, click **Status**
3. Under **Networking**, click **DHCP Leases**.

### Command line

1. Log into the EX15 command line as a user with Admin access.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. Enter the `show dhcp-lease` command at the Admin CLI prompt:

---

```
> show dhcp-lease
```

| IP Address    | Hostname      | Expires |
|---------------|---------------|---------|
| -----         | -----         | -----   |
| 192.168.2.194 | MTK-ENG-USER1 |         |
| 192.168.2.195 | MTK-ENG-USER2 |         |

```
>
```

---

3. Type **exit** to exit the Admin CLI.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Create a Virtual LAN (VLAN) route

Virtual LANs (VLANs) allow splitting a single physical LAN into separate Virtual LANs. This is useful for security reasons, and also helps to reduce broadcast traffic on the LAN.

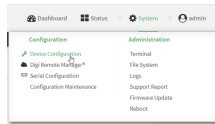
### Required configuration items

- Device to be assigned to the VLAN.
- The VLAN ID. The TCP header uses the VLAN ID to identify the destination VLAN for the packet.

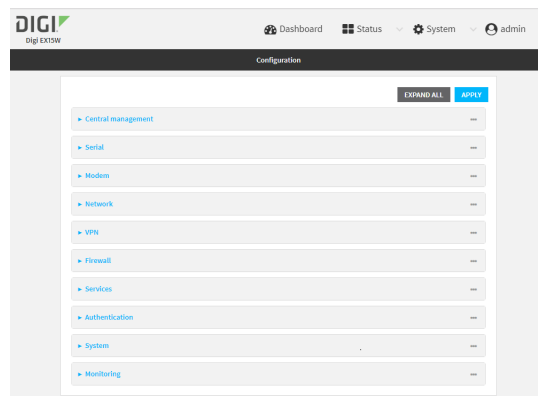
To create a VLAN:

## WebUI

1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.



3. Click **Network > Virtual LAN**.
4. Type a name for the VLAN and click **+**.
5. Select the **Device**.
6. Type or select a unique numeric **ID** for the VLAN ID.
7. Click **Apply** to save the configuration and apply the change.



## Command line

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.

2. At the command line, type **config** to enter configuration mode:

---

```
> config
(config)>
```

---

3. Add the VLAN:

---

```
(config)> add network vlan name
(config)>
```

---

4. Set the device to be used by the VLAN:

- a. View a list of available devices:

---

```
(config network vlan vlan1)> device ?
```

Device: The Ethernet device to use for this virtual LAN

Format:

```
/network/device/wan
/network/device/lan
/network/device/loopback
/network/vlan/vlan1
/network/bridge/lan
/network/wireless/ap/digi_ap
```

Current value:

---

```
(config network vlan vlan1)>
```

---

- b. Add the device:

---

```
(config network vlan vlan1)> device /network/device/
(config network vlan vlan1)>
```

---

5. Set the VLAN ID:

---

```
(config network vlan vlan1)> id value
```

---

where *value* is an integer between **1** and **4095**.

6. Save the configuration and apply the change:

---

```
(config network vlan vlan1)> save
Configuration saved.
>
```

---

7. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

# Bridging

Bridging is a mechanism to create a single network consisting of multiple devices, such as Ethernet devices and wireless access points.

By default, the EX15 has the following preconfigured bridges:

| Interface type                    | Preconfigured interfaces | Devices                                                          | Default configuration |
|-----------------------------------|--------------------------|------------------------------------------------------------------|-----------------------|
| <b>Bridges</b> (Wi-Fi model only) | ■ Bridge: <b>LAN</b>     | ■ Ethernet: <b>2/WAN</b><br>■ Wi-Fi access point: <b>Digi AP</b> | ■ Disabled            |

You can modify configuration settings for the existing bridge, and you can create new bridges. This section contains the following topics:

|                                         |     |
|-----------------------------------------|-----|
| Edit the preconfigured LAN bridge ..... | 169 |
| Configure a bridge .....                | 172 |

## Edit the preconfigured LAN bridge

### Required configuration items

- Enable or disable the bridge.
- Modify the devices included in the bridge.

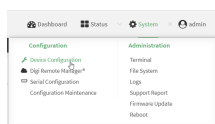
### Additional configuration items

- Enable Spanning Tree Protocol (STP).

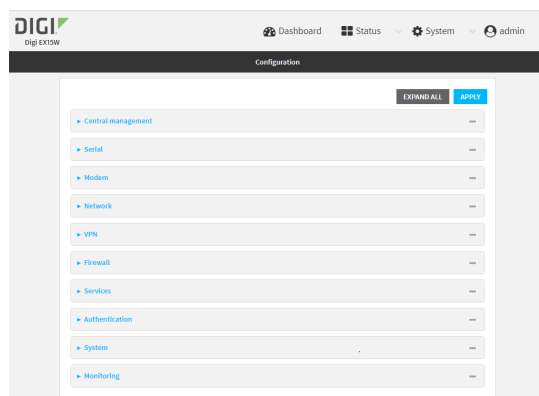
To edit the preconfigured **LAN** bridge:

### WebUI

1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.



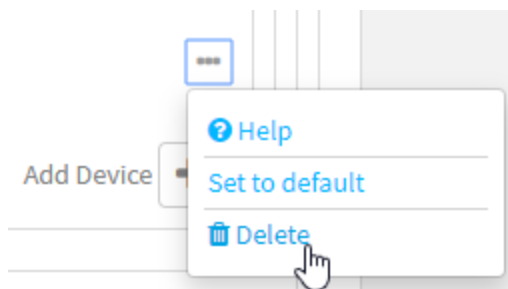
3. Click **Network > Bridges > LAN**.
4. The **LAN** bridge is enabled by default. To disable, uncheck **Enable**.
5. Modify the list of devices that are a part of the bridge. By default, the **LAN** bridge includes the following devices:
  - Ethernet: 2/WAN
  - Wi-Fi access point: Digi AP

---

**Note** The MAC address of the bridge is taken from the first available device in the list.

---

- a. To delete a device from the bridge, click the down arrow (▼) next to the field label and select **Delete**.



- b. To add a device, for **Add device**, click **+** and select the **Device**.
6. (Optional) Enable Spanning Tree Protocol (STP).  
STP is used when using multiple LANs on the same device, to prevent bridge loops and other routing conflicts.
  - a. Click **STP**.
  - b. Click **Enable**.
  - c. For **Forwarding delay**, enter the number of seconds that the device will spend in each of the listening and learning states before the bridge begins forwarding data. The default is **2** seconds.
7. Click **Apply** to save the configuration and apply the change.



## Command line

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the command line, type **config** to enter configuration mode:

```
> config
(config)>
```

3. The **LAN** bridge is enabled by default.

- To disable:

```
(config)> network bridge lan enable false
(config)>
```

- To enable if it has been disabled:

```
(config)> network bridge lan enable true
(config)>
```

4. Modify the list of devices that are a part of the bridge. By default, the **LAN** bridge includes the following devices:

- Ethernet: 2/WAN
- Wi-Fi access point: Digi AP

---

**Note** The MAC address of the bridge is taken from the first available device in the list.

---

a. To delete a device from the bridge:

i. Determine the index numbers of the devices included with the bridge:

---

```
(config)> show network bridge lan device
0 /network/device/eth2
1 /network/wireless/ap/digi_ap
(config)>
```

---

ii. Use the index number to delete the appropriate device. For example, to delete the **Digi AP** Wi-Fi access point from the bridge:

---

```
(config)> del network bridge lan device 1
(config)>
```

---

**Note** If you are deleting multiple devices from the bridge, the device index may be reordered after each deletion. As a result, best practice is to perform a **show network bridge lan1 device** command after each device is deleted to determine the new index numbering.

---

b. Add devices to the bridge:

i. Determine available devices:

---

```
(config network bridge my_bridge)> interface lan device ?
```

Device: The network device used by this network interface.

Format:

```
/network/device/lan
/network/device/wan
/network/device/loopback
/network/bridge/lan
/network/wireless/ap/digi_ap
```

Default value: /network/bridge/lan

Current value: /network/bridge/lan

---

```
(config network bridge my_bridge)>
```

---

ii. Add the appropriate device. For example, to add the **Digi AP** Wi-Fi access point:

---

```
(config network bridge my_bridge)> add device end
/network/wireless/ap/digi_ap
(config)>
```

---

5. (Optional) Enable Spanning Tree Protocol (STP).

STP is used when multiple LANs are configured on the same device, to prevent bridge loops and other routing conflicts.

- a. Enable STP:

---

```
(config)> network bridge lan stp enable true
```

---

- b. Set the number of seconds that the device will spend in each of the listening and learning states before the bridge begins forwarding data:

---

```
(config)> network bridge lan stp forward_delay num
(config)>
```

---

The default is **2** seconds.

6. Save the configuration and apply the change:

---

```
(config)> save
Configuration saved.
>
```

---

7. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Configure a bridge

### Required configuration items

- A name for the bridge.  
Bridges are enabled by default.
- Devices to be included in the bridge.

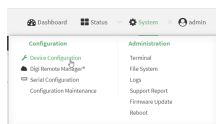
### Additional configuration items

- Enable Spanning Tree Protocol (STP).

To create a bridge:

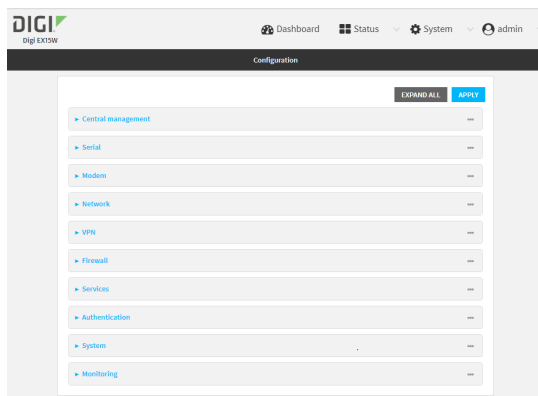
### WebUI

1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.





3. Click **Network > Bridges**.
4. For **Add Bridge**, type a name for the bridge and click **+**.
5. Bridges are enabled by default. To disable, uncheck **Enable**.
6. Add devices to the bridge:
  - a. Click to expand **Devices**.
  - b. For **Add device**, click **+**.
  - c. Select the **Device**.
  - d. Repeat to add additional devices.

---

**Note** The MAC address of the bridge is taken from the first available device in the list.

---

7. (Optional) Enable Spanning Tree Protocol (STP).  
STP is used when using multiple LANs on the same device, to prevent bridge loops and other routing conflicts.
  - a. Click **STP**.
  - b. Click **Enable**.
  - c. For **Forwarding delay**, enter the number of seconds that the device will spend in each of the listening and learning states before the bridge begins forwarding data. The default is **2** seconds.
8. Click **Apply** to save the configuration and apply the change.



## Command line

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.

2. At the command line, type **config** to enter configuration mode:

---

```
> config
(config)>
```

---

3. Create the bridge:

---

```
(config)> add network bridge my_bridge
(config network bridge my_bridge)>
```

---

4. Bridges are enabled by default.

- To disable:

---

```
(config network bridge my_bridge)> enable false
(config network bridge my_bridge)>
```

---

- To enable if it has been disabled:

---

```
(config network bridge my_bridge)> enable true
(config network bridge my_bridge)>
```

---

5. Add devices to the bridge:

- a. Determine available devices:

---

```
(config network bridge my_bridge)> interface lan device ?
```

Device: The network device used by this network interface.

Format:

```
/network/device/lan
/network/device/wan
/network/device/loopback
/network/bridge/lan
/network/wireless/ap/digi_ap
```

Default value: /network/bridge/lan

Current value: /network/bridge/lan

---

```
(config network bridge my_bridge)>
```

---

- b. Add the appropriate device. For example, to add the **Digi AP** Wi-Fi access point:

---

```
(config network bridge my_bridge)> add device end
/network/wireless/ap/digi_ap
(config)>
```

---



---

**Note** The MAC address of the bridge is taken from the first available device in the list.

---

6. (Optional) Enable Spanning Tree Protocol (STP).

STP is used when using multiple LANs on the same device, to prevent bridge loops and other routing conflicts.

a. Enable STP:

---

```
(config network bridge my_bridge)> stp enable true
```

---

b. Set the number of seconds that the device will spend in each of the listening and learning states before the bridge begins forwarding data:

---

```
(config network bridge my_bridge)> stp forward_delay num
(config)>
```

---

The default is **2** seconds.

7. Save the configuration and apply the change:

---

```
(config)> save
Configuration saved.
>
```

---

8. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Serial port

---

EX15 devices have a single serial port that provides access to the command-line interface.

Use an RS-232 serial cable to establish a serial connection from your EX15 to your local laptop or PC. Use a terminal emulator program to establish the serial connection. The terminal emulator's serial connection must be configured to match the configuration of the EX15 device's serial port. The default serial port configuration is:

- **Enabled**
- **Serial mode:** Login
- **Label:** None
- **Baud rate:** 9600
- **Data bits:** 8
- **Parity:** None
- **Stop bits:** 1
- **Flow control:** None

## Configure the serial port

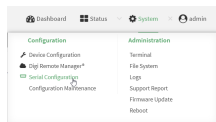
By default, the EX15 serial port is configured as follows:

- **Enabled**
- **Serial mode:** Login
- **Label:** None
- **Baud rate:** 9600
- **Data bits:** 8
- **Parity:** None
- **Stop bits:** 1
- **Flow control:** None

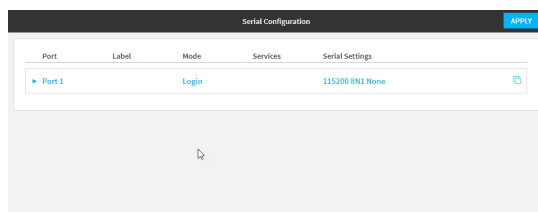
To change the configuration to match the serial configuration of the device to which you want to connect:



1. Log into the EX15 WebUI as a user with Admin access.
2. On the menu, click **System**. Under **Configuration**, click **Serial Configuration**.

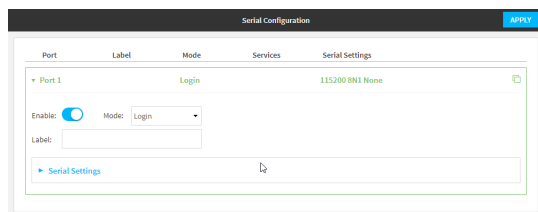


The **Serial Configuration** page is displayed.



**Note** You can also configure the serial port by using **Device Configuration > Serial**. Changes made by using either **Device Configuration** or **Serial Configuration** will be reflected in both.

3. Click to expand **Port 1**.

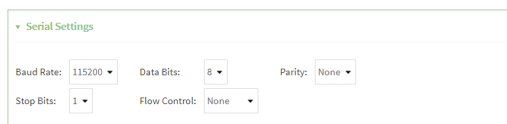


The serial port is enabled by default. To disable, toggle off **Enable**.

4. For **Mode**, one of the following:
  - **Login**: Allows the user to log into the device through the serial port.
  - **Remote access**: Allows for remote access to another device that is connected to the serial port.
  - **Application**: Provides access to the serial device from Python applications. See [Use Python to access serial ports](#) for information about creating Python applications that access the serial port.
  - **Modbus**: Allows you to use the serial port for Modbus.

The default is **Login**.

5. (Optional) For **Label**, enter a label that will be used when referring to this port.
6. If **Login**, **Remote Access**, or **Modbus** is selected for **Mode**:
  - a. Click to expand **Serial Settings**.



- b. For **Baud rate**, select the baud rate used by the device to which you want to connect.

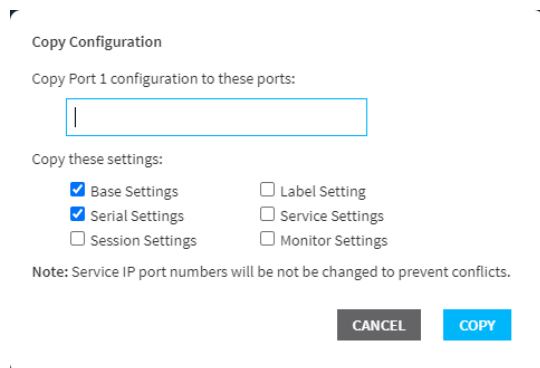
- c. For **Data bits**, select the number of data bits used by the device to which you want to connect.
  - d. For **Parity**, select the type of parity used by the device to which you want to connect.
  - e. For **Stop bits**, select the number of stop bits used by the device to which you want to connect.
  - f. For **Flow control**, select the type of flow control used by the device to which you want to connect.
7. (Optional) If Remote Access is selected for **Mode**:
    - a. Click to expand **Service Settings**.

All service settings are disabled by default. Click available options to toggle them to enabled, and set the IP ports as appropriate.

- b. Click to expand **Session Settings**.

- c. Enable **Exclusive access** to limit access to the serial port to a single active session.
  - d. For **Escape sequence**, type the characters used to start an escape sequence. If no characters are defined, the escape sequence is disabled. The default is **~b**.
  - e. For **History size**, type or select the number of bytes of output from the serial port that are written to buffer. These bytes are redisplayed when a user connects to the serial port. The default is **4000** bytes.
  - f. For **Idle timeout**, type the amount of time to wait before disconnecting due to user inactivity.
1. Click to expand **Monitor Settings**.

- a. Enable **CTS** to monitor CTS (Clear to Send) changes on this port.
  - b. Enable **DCD** to monitor DCD (Data Carrier Detect) changes on this port.
8. (Optional) Copy the serial port's configuration by clicking the  (copy) icon. The **Copy Configuration** window displays.



Copy Configuration

Copy Port 1 configuration to these ports:

Copy these settings:

☒ Base Settings      ☐ Label Setting

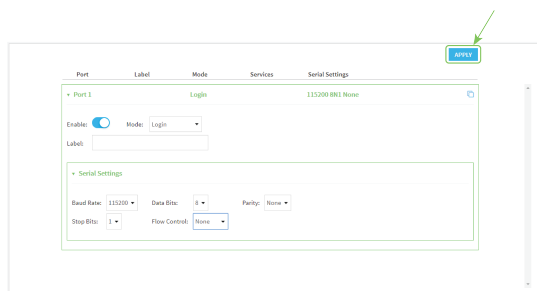
☒ Serial Settings      ☐ Service Settings

☐ Session Settings      ☐ Monitor Settings

Note: Service IP port numbers will be not be changed to prevent conflicts.

- For **Copy Port 1 configuration to these ports:**, type the names of the ports that the configuration should be copied to.
  - For **Copy these settings**, select the types of settings that should be copied to the selected ports.
  - Click **Copy**.
- Click **Apply** to save the configuration and apply the change.

The **Apply** button is located at the top of the WebUI page. You may need to scroll to the top of the page to locate it.



Port 1 configuration page. The 'Apply' button is highlighted with a green arrow at the top right. The page shows settings for Port 1, including a tab for 'Serial Settings' which is currently selected. The 'Serial Settings' section includes fields for Baud Rate (115200), Data Bits (8), Parity (None), Stop Bits (1), and Flow Control (None).

## Command line

- Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
- At the command line, type **config** to enter configuration mode:

```
> config
(config)>
```

- The serial port is enabled by default. To disable:

```
(config)> serial port1 enable false
(config)>
```

## 4. Set the mode:

---

```
(config)> serial port1 mode mode
(config)>
```

---

where *mode* is either:

- **login**: Allows the user to log into the device through the serial port.
- **remote**: Allows for remote access to another device that is connected to the serial port.
- **application**: Provides access to the serial device from Python applications. See [Use Python to access serial ports](#) for information about creating Python applications that access the serial port.
- **modbus**: Allows you to use the serial port for Modbus.

The default is **login**.

## 5. (Optional) Set a label that will be used when referring to this port.

---

```
(config)> serial port1 label label
(config)>
```

---

6. If **mode** is set to **login** or **remote**:

## a. Set the baud rate used by the device to which you want to connect:

---

```
(config)> serial port1 baudrate rate
(config)>
```

---

## b. Set the number of data bits used by the device to which you want to connect:

---

```
(config)> serial port1 databits bits
(config)>
```

---

## c. Set the type of parity used by the device to which you want to connect:

---

```
(config)> serial port1 parity parity
(config)>
```

---

Allowed values are:

- **even**
- **odd**
- **none**

The default is **none**.

## d. Set the stop bits used by the device to which you want to connect:

---

```
(config)> serial port1 stopbits bits
(config)>
```

---

## e. Set the type of flow control used by the device to which you want to connect:

---

```
(config)> serial port1 flow type
(config)
```

---



Allowed values are:

- **none**
- **rts/cts**
- **xon/xoff**

The default is **none**.

7. If **mode** is set to **remote**:

- a. Set the characters used to start an escape sequence:

---

```
(config)> serial port1 escape string
(config)
```

---

If no characters are defined, the escape sequence is disabled. The default is **~b**.

- b. Limit access to the serial port to a single active session:

---

```
(config)> serial port1 exclusive true
(config)
```

---

- c. Set the number of bytes of output from the serial port that are written to buffer. These bytes are redisplayed when a user connects to the serial port.

---

```
(config)> serial port1 history bytes
(config)
```

---

The default is **4000** bytes.

- d. Set the amount of time to wait before disconnecting due to user inactivity:

---

```
(config)> serial port1 idle_timeout value
(config)
```

---

where *value* is any number of weeks, days, hours, minutes, or seconds, and takes the format ***number*{*w*|*d*|*h*|*m*|*s*}**.

For example, to set **idle\_timeout** to ten minutes, enter either **10m** or **600s**:

---

```
(config)> serial port1 idle_timeout 600s
(config)
```

---

The default is **15m**.

- e. (Optional) Enable monitoring of CTS (Clear to Send) changes on this port:

---

```
(config)> serial port1 monitor cts true
(config)
```

---

- f. (Optional) Enable monitoring of DCD (Data Carrier Detect) changes on this port:

---

```
(config)> serial port1 monitor dcd true
(config)
```

---

## g. Configure TCP access to this port:

## i. Set the connection type:

---

```
(config serial USB_port)> service tcp conn_type value
(config serial USB_port)>
```

---

where *value* is one of:

- i. **tcp**: The TCP connection is unencrypted.
- ii. **tls**: The TCP connection uses Transport Layer Security (TLS) encryption.
- iii. **tls\_auth**: The TCP connection uses TLS encryption with authentication.

## ii. Enable TCP access:

---

```
(config serial USB_port)> service tcp enable true
(config serial USB_port)>
```

---

## iii. Set the TCP port:

---

```
(config serial USB_port)> service tcp port port
(config serial USB_port)>
```

---

## iv. (Optional) Configure the access control list to limit access to the TCP connection:

## ■ To limit access to specified IPv4 addresses and networks:

---

```
(config serial USB_port)> add service tcp acl address end
value
(config serial USB_port)>
```

---

Where *value* can be:

- A single IP address or host name.
- A network designation in CIDR notation, for example, 192.168.1.0/24.
- **any**: No limit to IPv4 addresses that can access the tcp port.

Repeat this step to list additional IP addresses or networks.

## ■ To limit access to specified IPv6 addresses and networks:

---

```
(config serial USB_port)> add service tcp acl address6 end
value
(config serial USB_port)>
```

---

Where *value* can be:

- A single IP address or host name.
- A network designation in CIDR notation, for example, 2001:db8::/48.
- **any**: No limit to IPv6 addresses that can access the tcp port.

Repeat this step to list additional IP addresses or networks.

## ■ To limit access to hosts connected through a specified interface on the EX15 device:

---

```
(config serial USB_port)> add service tcp acl interface end
value
(config serial USB_port)>
```

---

Where *value* is an interface defined on your device.

Display a list of available interfaces:

Use ... **network interface ?** to display interface information:

Repeat this step to list additional interfaces.

- To limit access based on firewall zones:

---

```
(config serial USB_port)> add service tcp acl zone end value
```

---

Where *value* is a firewall zone defined on your device, or the **any** keyword.

Display a list of available firewall zones:

Type ... **firewall zone ?** at the config prompt:

---

```
(config serial USB_port)> ... firewall zone ?
```

Zones: A list of groups of network interfaces that can be referred to by packet filtering rules and access control lists.

Additional Configuration

-----

```
any
dynamic_routes
edge
external
internal
ipsec
loopback
setup
```

---

```
(config serial USB_port)>
```

---

Repeat this step to list additional firewall zones.

- v. (Optional) Enable mDNS. mDNS is a protocol that resolves host names in small networks that do not have a DNS server.

---

```
(config serial USB_port)> service tcp mdns enable true
(config serial USB_port)>
```

---

- h. Configure telnet access to this port:



**CAUTION!** This connection is not authenticated or encrypted.

---

## i. Enable telnet access:

---

```
(config serial USB_port)> service telnet enable false
(config serial USB_port)>
```

---

## ii. Set the telnet port:

---

```
(config serial USB_port)> service telnet port port
(config serial USB_port)>
```

---

## iii. (Optional) Configure the access control list to limit access to the telnet connection:

## ■ To limit access to specified IPv4 addresses and networks:

---

```
(config serial USB_port)> add service telnet acl address end
value
(config serial USB_port)>
```

---

Where *value* can be:

- A single IP address or host name.
- A network designation in CIDR notation, for example, 192.168.1.0/24.
- **any**: No limit to IPv4 addresses that can access the telnet port.

Repeat this step to list additional IP addresses or networks.

## ■ To limit access to specified IPv6 addresses and networks:

---

```
(config serial USB_port)> add service telnet acl address6 end
value
(config serial USB_port)>
```

---

Where *value* can be:

- A single IP address or host name.
- A network designation in CIDR notation, for example, 2001:db8::/48.
- **any**: No limit to IPv6 addresses that can access the telnet port.

Repeat this step to list additional IP addresses or networks.

## ■ To limit access to hosts connected through a specified interface on the EX15 device:

---

```
(config serial USB_port)> add service telnet acl interface end
value
(config serial USB_port)>
```

---

Where *value* is an interface defined on your device.

Display a list of available interfaces:

Use **... network interface ?** to display interface information:

Repeat this step to list additional interfaces.

- To limit access based on firewall zones:

---

```
(config serial USB_port)> add service telnet acl zone end
value
```

---

Where *value* is a firewall zone defined on your device, or the **any** keyword.

Display a list of available firewall zones:

Type **... firewall zone ?** at the config prompt:

---

```
(config serial USB_port)> ... firewall zone ?
```

---

Zones: A list of groups of network interfaces that can be referred to by packet filtering rules and access control lists.

Additional Configuration

-----

```
any
dynamic_routes
edge
external
internal
ipsec
loopback
setup
```

---

```
(config serial USB_port)>
```

---

Repeat this step to list additional firewall zones.

- iv. (Optional) Enable **mDNS**. mDNS is a protocol that resolves host names in small networks that do not have a DNS server.

---

```
(config serial USB_port)> service telnet mdns enable true
(config serial USB_port)>
```

---

- i. Configure ssh access to this port:

- i. Enable ssh access:

---

```
(config serial USB_port)> service ssh enable false
(config serial USB_port)>
```

---

- ii. Set the ssh port:

---

```
(config serial USB_port)> service ssh port port
(config serial USB_port)>
```

---

- iii. (Optional) Configure the access control list to limit access to the ssh connection:

- To limit access to specified IPv4 addresses and networks:

---

```
(config serial USB_port)> add service ssh acl address end
value
(config serial USB_port)>
```

---

Where *value* can be:

- A single IP address or host name.
- A network designation in CIDR notation, for example, 192.168.1.0/24.
- **any**: No limit to IPv4 addresses that can access the ssh port.

Repeat this step to list additional IP addresses or networks.

- To limit access to specified IPv6 addresses and networks:

---

```
(config serial USB_port)> add service ssh acl address6 end
value
(config serial USB_port)>
```

---

Where *value* can be:

- A single IP address or host name.
- A network designation in CIDR notation, for example, 2001:db8::/48.
- **any**: No limit to IPv6 addresses that can access the ssh port.

Repeat this step to list additional IP addresses or networks.

- To limit access to hosts connected through a specified interface on the EX15 device:

---

```
(config serial USB_port)> add service ssh acl interface end
value
(config serial USB_port)>
```

---

Where *value* is an interface defined on your device.

Display a list of available interfaces:

Use **... network interface ?** to display interface information:

Repeat this step to list additional interfaces.

- To limit access based on firewall zones:

---

```
(config serial USB_port)> add service ssh acl zone end value
```

---

Where *value* is a firewall zone defined on your device, or the **any** keyword.

Display a list of available firewall zones:

Type **... firewall zone ?** at the config prompt:

---

```
(config serial USB_port)> ... firewall zone ?
```

---

Zones: A list of groups of network interfaces that can be referred to by packet

---

---

filtering rules and access control lists.

Additional Configuration

---

any  
dynamic\_routes  
edge  
external  
internal  
ipsec  
loopback  
setup

(config serial USB\_port)>

---

Repeat this step to list additional firewall zones.

- iv. (Optional) Enable **mDNS**. mDNS is a protocol that resolves host names in small networks that do not have a DNS server.

---

```
(config serial USB_port)> service ssh mdns enable true
(config serial USB_port)>
```

---

8. Save the configuration and apply the change:

---

```
(config)> save
Configuration saved.
>
```

---

9. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Show serial status and statistics

To show the status and statistics for the serial port:

### WebUI

1. Log into the EX15 WebUI as a user with Admin access.
2. On the main menu, click **Status**
3. Under **Connections**, click **Serial**.

### Command line

1. Log into the EX15 command line as a user with Admin access.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.

2. Use the `show serial` command:

```
> show serial
```

| Label    | Port  | Enable | Mode  | Baudrate |
|----------|-------|--------|-------|----------|
| -----    | ----- | -----  | ----- | -----    |
| Serial 1 | port1 | true   | login | 9600     |

```
>
```

3. Type **exit** to exit the Admin CLI.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Log serial port messages

To display and configure the serial port log:

### WebUI

1. Log into the EX15 WebUI as a user with Admin access.
2. On the main menu, click **Status**
3. Under **Connections**, click **Serial**.
4. Click **Log**.  
The **Serial port log** window displays.
5. Click **Start** to start serial port logging.
6. Click **Stop** to stop serial port logging if it has been started.
7. Click **Refresh** to refresh the log display.
8. Click **Download** to download the serial port log.
9. (Optional) For **Log size**, configure the maximum allowed log size for the serial port log. The default is **65536**.



## Wi-Fi

---

This chapter applies to the EX15W Wi-Fi enabled model only.

This chapter contains the following topics:

|                                                                        |     |
|------------------------------------------------------------------------|-----|
| Wi-Fi configuration .....                                              | 190 |
| Use the default Wi-Fi access point .....                               | 191 |
| Configure the Wi-Fi radio's channel .....                              | 196 |
| Configure the Wi-Fi radio to support DFS channels in client mode ..... | 198 |
| Configure the Wi-Fi radio's band and protocol .....                    | 199 |
| Configure the Wi-Fi radio's transmit power .....                       | 201 |
| Configure a Wi-Fi access point with no security .....                  | 203 |
| Configure a Wi-Fi access point with personal security .....            | 208 |
| Configure a Wi-Fi access point with enterprise security .....          | 213 |
| Isolate Wi-Fi clients .....                                            | 221 |
| Configure a Wi-Fi client and add client networks .....                 | 228 |
| Show Wi-Fi access point status and statistics .....                    | 234 |
| Show Wi-Fi client status and statistics .....                          | 236 |

## Wi-Fi configuration

The Wi-Fi enabled EX15W device has one Wi-Fi radio. You can configure the Wi-Fi radio for Wi-Fi access point mode or Wi-Fi client mode. By default, the EX15W radio is configured to use access point mode.

### Default access point SSID and password

By default, the EX15 device has one access point enabled. The default SSID for the access points is:

**Digi-EX15W-serial\_number**

**Digi-EX15-serial\_number**

The password for the default access point is the unique password as found on the device's label.

Prior to saving any configuration changes to the device, you will need to configure the access point to change the default SSID and password. See [Reset default SSID and pre-shared key for the preconfigured Wi-Fi access point](#) for information about changing the default SSID and password.

### Default Wi-Fi configuration

The default Wi-Fi configuration of the EX15W device is:

■ Wi-Fi radio:

|                            | Default setting |
|----------------------------|-----------------|
| <b>Enabled or disabled</b> | Enabled         |
| <b>Frequency band</b>      | 2.4 GHz         |
| <b>TX power percentage</b> | 100             |
| <b>Access point mode</b>   | 802.11b/g/n     |
| <b>Channel</b>             | Automatic       |
| <b>Channel width</b>       | 20/40 MHz       |
| <b>Beacon interval</b>     | 100             |

■ Access point:

|                             | Default setting                                                                                                                                                   |
|-----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Name</b>                 | Digi AP                                                                                                                                                           |
| <b>Enabled or disabled</b>  | Enabled                                                                                                                                                           |
|                             | <b>Note</b> While the access point is enabled by default, see <a href="#">Use the default Wi-Fi access point</a> for procedures required to use the access point. |
| <b>SSID</b>                 | Digi-EX15W-serial_number                                                                                                                                          |
| <b>SSID broadcast</b>       | Enabled                                                                                                                                                           |
| <b>Encryption</b>           | WAP2 Personal (PSK)                                                                                                                                               |
| <b>Pre-shared key</b>       | The unique password printed on the bottom label of the device.                                                                                                    |
| <b>Group rekey interval</b> | 10 minutes                                                                                                                                                        |

■ Client mode connections: none.

## Use the default Wi-Fi access point

By default, the EX15 device comes with one preconfigured access point, **Digi AP**. The access point is enabled by default. However, because the access point is not a member of a LAN interface, if you connect to this access point, you will not be provided an IP address and will not have network access. To remedy this situation, you can either:

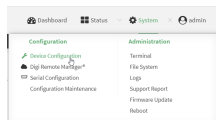
1. [Create a LAN interface for the access point.](#)
2. [Configure the existing LAN interface to include the access point.](#)

## Create a LAN interface for the access point

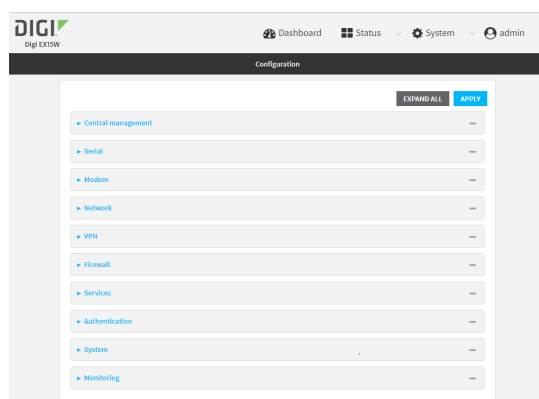
In this example procedure, we will create a new LAN interface, named **WiFi\_LAN**, and include the preconfigured access point in the new interface.

### WebUI

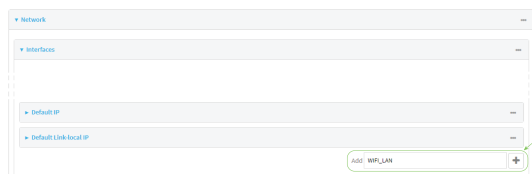
1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.



3. Click **Network > Interfaces**.
4. For **Add interface**, type **WiFi\_LAN** and click **+**.



5. For **Zone**, select **Internal**.
6. For **Device**, select Wi-Fi access point: **Digi AP**.
7. Click to expand **IPv4**.
8. For **Address**, type **192.168.2.1/24**.
9. Click to expand **DHCP server**.
10. Click **Enable**.

11. Click **Apply** to save the configuration and apply the change.

## Command line

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the command line, type **config** to enter configuration mode:

```
> config
(config)>
```

3. Create the new LAN:

```
(config)> add network interface WIFI_LAN
(config network interface WIFI_LAN)>
```

4. Set the zone to **internal**:

```
(config network interface WIFI_LAN)> zone internal
(config network interface WIFI_LAN)>
```

5. Set the device to **digi\_ap**:

```
(config network interface WIFI_LAN)> device /network/wifi/ap/digi_ap
(config network interface WIFI_LAN)>
```

6. Set the IPv4 address of the LAN:

```
(config network interface WIFI_LAN)> ipv4 address 192.168.2.1/24
(config network interface WIFI_LAN)>
```

7. Enable the DHCP server:

```
(config network interface WIFI_LAN)> ipv4 dhcp_server enable true
(config network interface WIFI_LAN)>
```

8. Save the configuration and apply the change:

```
(config)> save
Configuration saved.
>
```

9. Type **exit** to exit the Admin CLI.

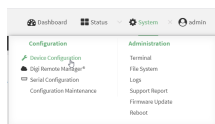
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Configure the existing LAN interface to include the access point

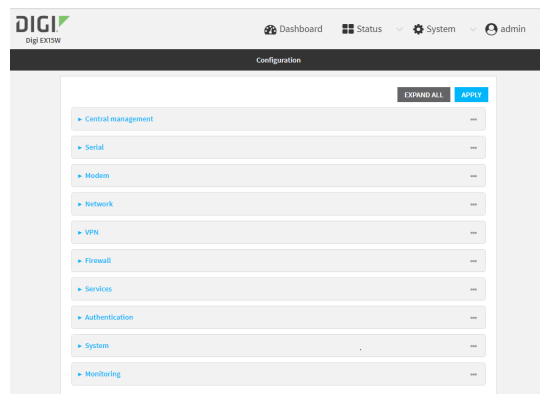
In this procedure, we will convert the EX15 device's default LAN from passthrough mode to router mode and assign the default bridge to the LAN.

### WebUI

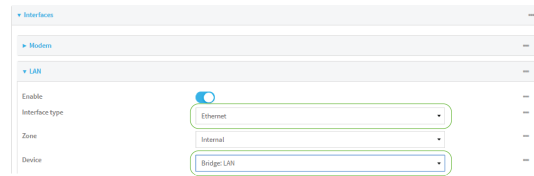
1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



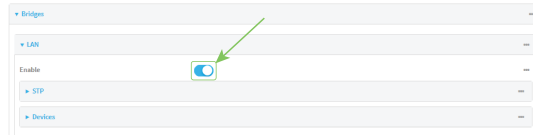
The **Configuration** window is displayed.



3. Click **Network > Interfaces > LAN**.
4. For **Interface type**, select **Ethernet**.
5. For **Device**, select **Bridge: LAN**.



6. Enable the bridge:
  - a. Click **Network > Bridges > LAN**.
  - b. Click **Enable**.



7. Click **Apply** to save the configuration and apply the change.



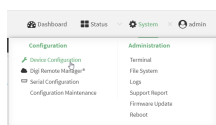
## Configure the Wi-Fi radio's channel

By default, the Wi-Fi radio is configured to automatically select the best channel to use with respect to other Wi-Fi networks. You can configure a specific channel to use for the Wi-Fi radio by using the following steps.

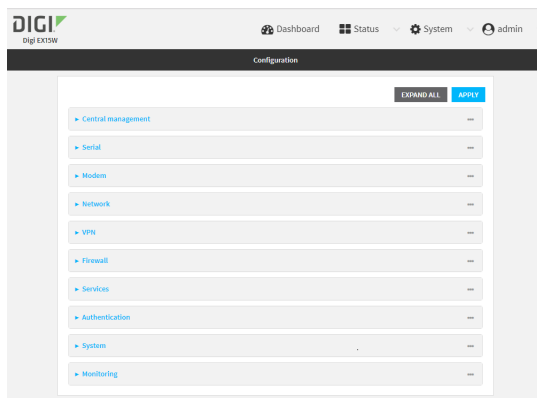
- **2.4 GHz band**—Channels 1 to 11 are supported. Channels 12, 13, and 14 are not supported.
- **5 GHz band**—By default, only non-Dynamic Frequency Selection (DFS) channels are supported. You can also enable support for DFS channels in client mode. See [Configure the Wi-Fi radio to support DFS channels in client mode](#) for information about enabling DFS support.

### WebUI

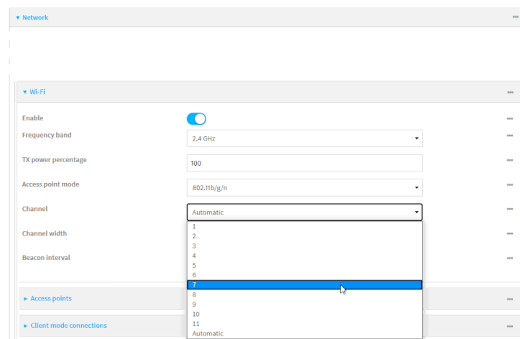
1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.



3. Click **Network > Wi-Fi**.
4. For **Channel**, select the channel. Only channels appropriate for the band are displayed.





- Click **Apply** to save the configuration and apply the change.



## Command line

- Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.

- At the command line, type **config** to enter configuration mode:

```
> config
(config)>
```

- Set the channel for the radio:

- Determine the band for the radio:

```
(config)> network wifi radio phy0 band
2400mhz
(config)>
```

- Set the channel for the Wi-Fi radio:

```
(config)> network wifi radio phy0 2400mhz channel value
(config)>
```

where *value* is:

- For 2.4 GHz:
  - **1** through **11**
  - **auto**
- For 5 GHz:
  - **36**
  - **40**
  - **44**
  - **48**
  - **auto**

- Save the configuration and apply the change:

```
(config)> save
Configuration saved.
>
```

- Type **exit** to exit the Admin CLI.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Configure the Wi-Fi radio to support DFS channels in client mode

Dynamic Frequency Selection (DFS) is a mechanism for Wi-Fi connections to use 5 GHz frequencies that are normally reserved for non-Wi-Fi proposes. Your EX15 can be configured to have one or more Wi-Fi clients that can connect to external Wi-Fi access points that support DFS channels, in addition to the non-DFS channels 36, 40, 44, 48, 149, 153, 157, 161, and 165. The Wi-Fi access point must also support connections on these channels.

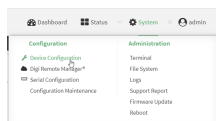
**Note** If DFS functionality is enabled, any access points enabled on the EX15 device will not be started.

### Required configuration items

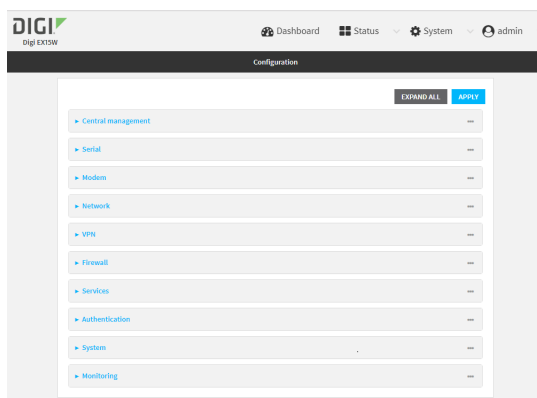
- Enable DFS support.
- One or more configured Wi-Fi clients. See [Configure a Wi-Fi client and add client networks](#) for details.

### WebUI

1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.



3. Click **Network > WiFi**.
4. For **Frequency band**, select **5 GHz**.
5. Click to enable **DFS Client Support**.

**Note** When **DFS Client Support** is enabled, any enabled access points that use this radio will not be started and cannot be used as access points.

- Click **Apply** to save the configuration and apply the change.



## Command line

- Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
- At the command line, type **config** to enter configuration mode:

```
> config
(config)>
```

- Set the channel for the radio:
  - Set the band for the radio to 5 GHz:

```
(config)> network wifi radio phy0 band 5000mhz
(config)>
```

- Enable DFS client support :

```
(config)> network wifi radio phy0 5000mhz dfs_client true
(config)>
```

**Note** When DFS client support is enabled, any enabled access points that use this radio will not be started and cannot be used as access points.

- Save the configuration and apply the change:

```
(config)> save
Configuration saved.
>
```

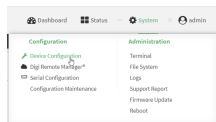
- Type **exit** to exit the Admin CLI.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Configure the Wi-Fi radio's band and protocol

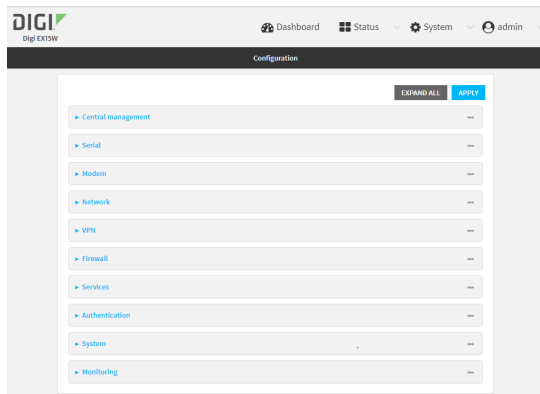
For Wi-Fi radios that support both 2.4 GHz and 5 GHz modes, you can configure the band. **Wi-Fi1 radio** defaults to use 2.4 GHz b/g/n band.

## WebUI

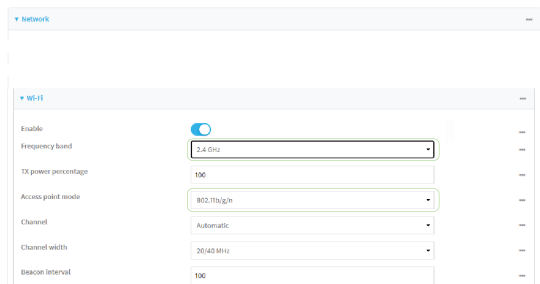
1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.



3. Click **Network > WiFi**.
4. For **Frequency band**, select either **2.4 GHz** or **5 GHz**.
5. For **Access point mode**, select the appropriate mode. Only modes appropriate for the selected band are displayed.



6. Click **Apply** to save the configuration and apply the change.



## Command line

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.

2. At the command line, type **config** to enter configuration mode:

```
> config
(config)>
```

3. Set channel for the radio:

- a. Set the band for the radio:

```
(config)> network wifi radio phy0 band value
(config)>
```

where *value* is either **2400mhz** or **5000mhz**.

- b. Set the mode for the Wi-Fi radio. For example:

- If the Wi-Fi radio has a band of **2400mhz**:

```
(config)> network wifi radio phy0 2400mhz mode value
(config)>
```

where *value* is one of **b**, **bg**, **bgn**, **g**, **gn**, or **n**.

- If the Wi-Fi radio has a band of **5000mhz**:

```
(config)> network wifi radio phy0 5000mhz mode value
(config)>
```

where *value* is one of **ac**, **acn**, or **n**.

4. Save the configuration and apply the change:

```
(config)> save
Configuration saved.
>
```

5. Type **exit** to exit the Admin CLI.

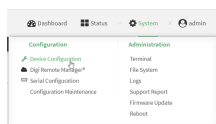
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Configure the Wi-Fi radio's transmit power

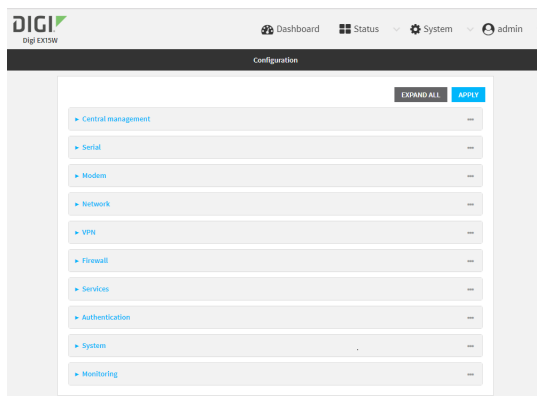
The default Wi-Fi transmit power that the Wi-Fi radio will use when in access point or client mode is 100 percent. You can configure the Wi-Fi radio to transmit at a lower power.

### WebUI

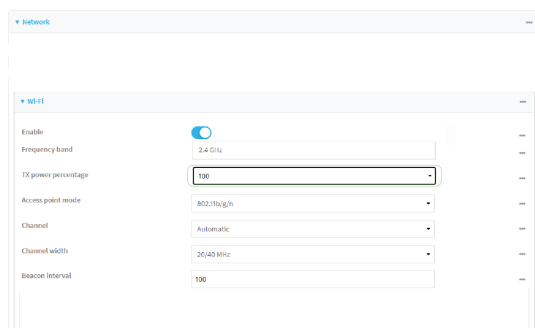
1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.



3. Click **Network > WiFi**.
4. For **Tx power percentage**, type or select the appropriate percentage for the Wi-Fi radio's transmit power.



5. Click **Apply** to save the configuration and apply the change.



## Command line

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the command line, type **config** to enter configuration mode:

```
> config
(config)>
```

3. Set the transmit power percentage for the radio:

```
(config)> network wifi radio phy0 tx_power value
(config)>
```

where *value* is any integer between 1 and 100 and represents the percentage of transmit power that the Wi-Fi module should use.

4. Save the configuration and apply the change:

```
(config)> save
Configuration saved.
>
```

5. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Configure a Wi-Fi access point with no security

This procedure configures a Wi-Fi access point that does not require a password for client connections, and uses no security or encryption.

By default, the EX15 device comes with one preconfigured access point, **Digi AP**. You cannot delete default access points, but you can modify them or you can create your own access points.

### Required configuration items

- Enable the Wi-Fi access point
- Select a Wi-Fi radio for the access point.
- The Service Set Identifier (SSID) for the access point.
- Configure security for the access point to unencrypted.
- LAN/bridge assignment. Once you configure a Wi-Fi access point, you must assign the Wi-Fi access point to a LAN interface or to a bridge. See [Configure a LAN](#) and [Configure a bridge](#) for more information.

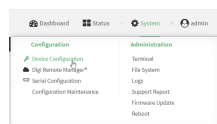
### Additional configuration items

- Determine whether to broadcast the access point's SSID.
- Determine whether to isolate clients connected to this access point, so that they cannot communicate with each other.
- The amount of time to wait before changing the group key.

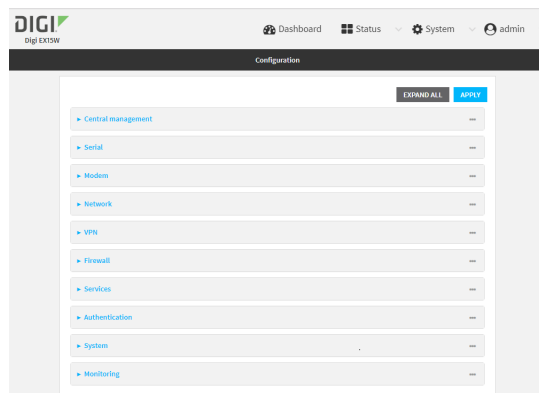
To configure a Wi-Fi access point with no security:

## WebUI

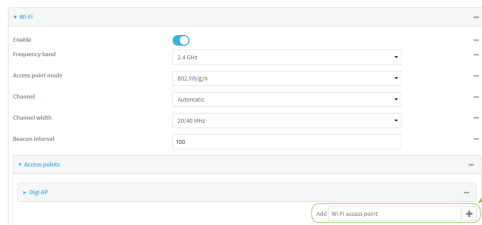
1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.

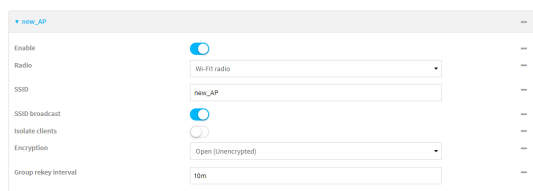


3. Click **Network > WiFi > Access points**.
4. Create a new access point or modify an existing access point:
  - To create a new access point, for **Add WiFi access point**, type a name for the access point and click **+**.



- To modify an existing access point, click to expand the access point.

The Wi-Fi access point configuration window is displayed.



5. **Enable** the access point.  
New access points are enabled by default. The default preconfigured access points are disabled by default.
6. For **SSID**, type the SSID. Up to 32 characters are allowed.
7. Enable **SSID broadcast** to configure the radio to broadcast the SSID.
8. (Optional) Enable **Isolate clients** to prevent clients that are connected to this access point from communicating with each other. See [Isolate Wi-Fi clients](#) for information about how to prevent clients connected to different access points from communicating with each other.
9. For **Encryption**, select **Open (Unencrypted)**.
10. (Optional) For **Group rekey interval**, type the amount of time to wait before changing the group key.



The group key is shared by all in clients of the access point, and after a client has disconnected, it will be able to use the group key to decrypt broadcast packets until the key is changed.

Allowed values are any number of days, hours, minutes, or seconds, and take the format **number{d|h|m|s}**.

For example, to set **Group rekey interval** to ten minutes, enter **10m** or **600s**.

Increasing the time between rekeys can improve connectivity issues in noisy environments. To disable group rekeys, set to **0**. This will allow any client that has previously connected see all broadcast traffic on the wireless network until the Wi-Fi radio is restarted. The default is 10 minutes.

11. Assign the Wi-Fi access point to a LAN interface or to a bridge. See [Configure a LAN](#) and [Configure a bridge](#) for more information.

The access point must be assigned to an active LAN, or a bridge that is assigned to an active LAN.

12. Click **Apply** to save the configuration and apply the change.



## Command line

### Configure a new Access point

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the command line, type **config** to enter configuration mode:

```
> config
(config)>
```

3. Create a new access point:

```
(config)> add network wifi ap new_AP
(config network wifi ap new_AP)>
```

New access points are enabled by default.

4. Set the SSID for the Wi-Fi access point. Up to 32 characters are allowed.

```
(config network wifi ap new_AP)> ssid my_SSID
(config network wifi ap new_AP)>
```

SSID broadcasting is enabled by default for new access points.

5. Set the security for the access point to **none** :

```
(config network wifi ap new_AP)> encryption type none
(config network wifi ap new_AP)>
```

- (Optional) Determine whether to prevent clients that are connected to this access point from communicating with each other:

---

```
(config)> network wifi ap digi_ap isolate_client true
(config)>
```

---

See [Isolate Wi-Fi clients](#) for information about how to prevent clients connected to different access points from communicating with each other.

- (Optional) Set the amount of time to wait before changing the group key.  
The group key is shared by all in clients of the access point, and after a client has disconnected, it will be able to use the group key to decrypt broadcast packets until the key is changed.

---

```
(config network wifi ap new_AP)> encryption group_rekey value
(config network wifi ap new_AP)>
```

---

where *value* is any number of days, hours, minutes, or seconds, and takes the format **number {d|h|m|s}**.

For example, to set **group rekey interval** to ten minutes, enter either **10m** or **600s**:

---

```
(config network wireless ap new_AP)> encryption group_rekey 600s
(config network wireless ap new_AP)>
```

---

Increasing the time between rekeys can improve connectivity issues in noisy environments. To disable group rekeys, set to **0**. This will allow any client that has previously connected see all broadcast traffic on the wireless network until the Wi-Fi radio is restarted. The default is 10 minutes.

- Assign the Wi-Fi access point to a LAN interface or to a bridge. See [Configure a LAN](#) and [Configure a bridge](#) for more information.  
The access point must be assigned to an active LAN, or a bridge that is assigned to an active LAN.
- Save the configuration and apply the change:

---

```
(config)> save
Configuration saved.
>
```

---

- Type **exit** to exit the Admin CLI.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

### Edit an existing Access point

- Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
- At the command line, type **config** to enter configuration mode:

---

```
> config
(config)>
```

---

3. Show available access points:

---

```
(config)> network wifi ap ?
```

```
Additional Configuration
```

```

```

```
digi_ap Digi AP
```

```
(config)>
```

---

4. Set the SSID for the appropriate access point:

---

```
(config)> network wifi ap digi_ap ssid my_SSID
```

```
(config)>
```

---

5. SSID broadcasting is enabled by default for the preconfigured access points. If SSID broadcasting is disabled:

---

```
(config)> network wifi ap digi_ap ssid_broadcast true
```

```
(config)>
```

---

6. Set the security for the access point to **none** :

---

```
(config)> network wifi ap digi_ap encryption type none
```

```
(config)>
```

---

7. (Optional) Determine whether to prevent clients that are connected to this access point from communicating with each other:

---

```
(config)> network wifi ap digi_ap isolate_client true
```

```
(config)>
```

---

See [Isolate Wi-Fi clients](#) for information about how to prevent clients connected to different access points from communicating with each other.

8. (Optional) Set the amount of time to wait before changing the group key.

The group key is shared by all in clients of the access point, and after a client has disconnected, it will be able to use the group key to decrypt broadcast packets until the key is changed.

---

```
(config)> network wifi ap digi_ap encryption group_rekey value
```

```
(config)>
```

---

where *value* is any number of days, hours, minutes, or seconds, and takes the format ***number {d|h|m|s}***.

For example, to set **group rekey interval** to ten minutes, enter either **10m** or **600s**:

---

```
(config)> network wireless ap digi_ap encryption group_rekey 600s
```

```
(config)>
```

---

Increasing the time between rekeys can improve connectivity issues in noisy environments. To disable group rekeys, set to **0**. This will allow any client that has previously connected see all

broadcast traffic on the wireless network until the Wi-Fi radio is restarted. The default is 10 minutes.

1. Assign the Wi-Fi access point to a LAN interface or to a bridge. See [Configure a LAN](#) and [Configure a bridge](#) for more information.

The access point must be assigned to an active LAN, or a bridge that is assigned to an active LAN.

2. Save the configuration and apply the change:

---

```
(config)> save
Configuration saved.
>
```

---

3. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Configure a Wi-Fi access point with personal security

The WPA and WPA2 personal security modes allow a Wi-Fi access point to authenticate clients by using a preshared key that the client enters when connecting to the access point.

By default, the EX15 device comes with one preconfigured access point, **Digi AP**. You cannot delete default access points, but you can modify them or you can create your own access points.

### Required configuration items

- Enable the Wi-Fi access point
- Select a Wi-Fi radio for the access point.
- The Service Set Identifier (SSID) for the access point.
- Configure security for the access point to WPA personal (PSK) or WPA2 personal (PSK).
- The password (preshared key) that clients will use to connect to the access point.
- LAN/bridge assignment. Once you configure a Wi-Fi access point, you must assign the Wi-Fi access point to a LAN interface or to a bridge. See [Configure a LAN](#) and [Configure a bridge](#) for more information.

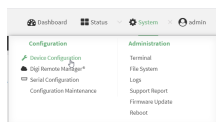
### Additional configuration items

- Determine whether to broadcast the access point's SSID.
- Determine whether to isolate clients connected to this access point, so that they cannot communicate with each other.
- The amount of time to wait before changing the group key.

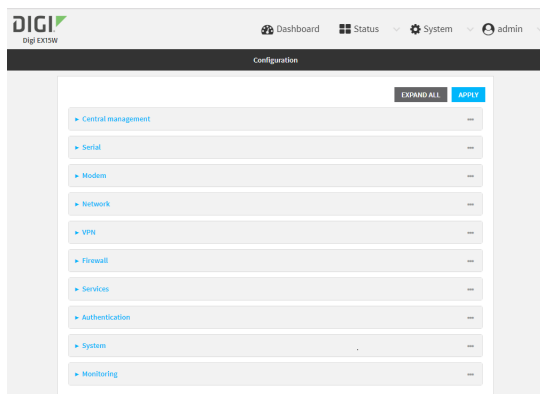
To configure a Wi-Fi access point with WPA personal (PSK) or WPA2 personal (PSK) security:



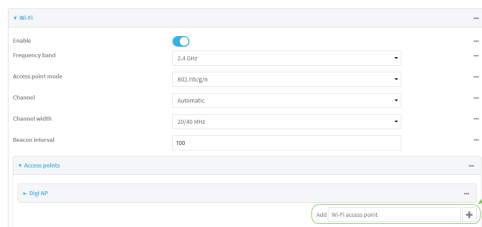
1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.

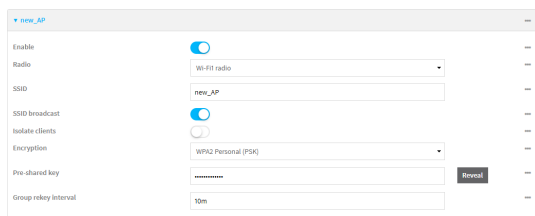


3. Click **Network > WiFi > Access points**.
4. Create a new access point or modify an existing access point:
  - To create a new access point, for **Add WiFi access point**, type a name for the access point and click **+**.



- To modify an existing access point, click to expand the access point.

The Wi-Fi access point configuration window is displayed.



5. **Enable** the access point.  
New access points are enabled by default. The default preconfigured access points are disabled by default.
6. For **SSID**, type the SSID. Up to 32 characters are allowed.

7. Enable **SSID broadcast** to configure the radio to broadcast the SSID.
8. (Optional) Enable **Isolate clients** to prevent clients that are connected to this access point from communicating with each other. See [Isolate Wi-Fi clients](#) for information about how to prevent clients connected to different access points from communicating with each other.
9. For **Encryption**, select **WPA Personal (PSK)** or **WPA2 Personal (PSK)**.
10. For **Pre-shared key**, enter the password that clients will use when connecting to the access point.
11. (Optional) For **Group rekey interval**, type the amount of time to wait before changing the group key.  
 The group key is shared by all in clients of the access point, and after a client has disconnected, it will be able to use the group key to decrypt broadcast packets until the key is changed.  
 Allowed values are any number of days, hours, minutes, or seconds, and take the format **number{d|h|m|s}**.  
 For example, to set **Group rekey interval** to ten minutes, enter **10m** or **600s**.  
 Increasing the time between rekeys can improve connectivity issues in noisy environments. To disable group rekeys, set to **0**. This will allow any client that has previously connected see all broadcast traffic on the wireless network until the Wi-Fi radio is restarted. The default is 10 minutes.
12. Assign the Wi-Fi access point to a LAN interface or to a bridge. See [Configure a LAN](#) and [Configure a bridge](#) for more information.  
 The access point must be assigned to an active LAN, or a bridge that is assigned to an active LAN.
13. Click **Apply** to save the configuration and apply the change.



## Command line

### Configure a new Access point

1. Log into the EX15 command line as a user with full Admin access rights.  
 Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the command line, type **config** to enter configuration mode:

```
> config
(config)>
```

3. Create a new access point:

```
(config)> add network wifi ap new_AP
(config network wifi ap new_AP)>
```

New access points are enabled by default.

- Set the SSID for the Wi-Fi access point. Up to 32 characters are allowed.

---

```
(config network wifi ap new_AP)> ssid my_SSID
(config network wifi ap new_AP)>
```

---

SSID broadcasting is enabled by default for new access points.

- Set the security for the access point to **psk** or **psk2** :

---

```
(config network wifi ap new_AP)> encryption type psk2
(config network wifi ap new_AP)>
```

---

- (Optional) Determine whether to prevent clients that are connected to this access point from communicating with each other:

---

```
(config)> network wifi ap digi_ap isolate_client true
(config)>
```

---

See [Isolate Wi-Fi clients](#) for information about how to prevent clients connected to different access points from communicating with each other.

- Set the password that clients will use when connecting to the access point:

---

```
(config network wifi ap new_AP)> encryption key_psk2 password
(config network wifi ap new_AP)>
```

---

- (Optional) Set the amount of time to wait before changing the group key.

The group key is shared by all in clients of the access point, and after a client has disconnected, it will be able to use the group key to decrypt broadcast packets until the key is changed.

---

```
(config network wifi ap new_AP)> encryption group_rekey value
(config network wifi ap new_AP)>
```

---

where *value* is any number of days, hours, minutes, or seconds, and takes the format **number {d|h|m|s}**.

For example, to set **group rekey interval** to ten minutes, enter either **10m** or **600s**:

---

```
(config network wireless ap new_AP)> encryption group_rekey 600s
(config network wireless ap new_AP)>
```

---

Increasing the time between rekeys can improve connectivity issues in noisy environments. To disable group rekeys, set to **0**. This will allow any client that has previously connected see all broadcast traffic on the wireless network until the Wi-Fi radio is restarted. The default is 10 minutes.

- Assign the Wi-Fi access point to a LAN interface or to a bridge. See [Configure a LAN](#) and [Configure a bridge](#) for more information.

The access point must be assigned to an active LAN, or a bridge that is assigned to an active LAN.

- Save the configuration and apply the change:

---

```
(config)> save
Configuration saved.
>
```

---

3. Type **exit** to exit the Admin CLI.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

### Edit an existing Access point

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the command line, type **config** to enter configuration mode:

---

```
> config
(config)>
```

---

3. Show available access points:

---

```
(config)> network wifi ap ?
```

```
Additional Configuration
```

```

```

```
digi_ap Digi AP
```

```
(config)>
```

---

4. Set the SSID for the appropriate access point:

---

```
(config)> network wifi ap digi_ap ssid my_SSID
(config)>
```

---

5. SSID broadcasting is enabled by default for the preconfigured access points. If SSID broadcasting is disabled:

---

```
(config)> network wifi ap digi_ap ssid_broadcast true
(config)>
```

---

6. Set the security for the access point to **psk** or **psk2** :

---

```
(config)> network wifi ap digi_ap encryption type psk2
(config)>
```

---

7. (Optional) Determine whether to prevent clients that are connected to this access point from communicating with each other:

---

```
(config)> network wifi ap digi_ap isolate_client true
(config)>
```

---

See [Isolate Wi-Fi clients](#) for information about how to prevent clients connected to different access points from communicating with each other.



8. Set the password that clients will use when connecting to the access point:

---

```
(config)> network wifi ap digi_ap encryption key_psk2 password
(config)>
```

---

9. (Optional) Set the amount of time to wait before changing the group key.

The group key is shared by all in clients of the access point, and after a client has disconnected, it will be able to use the group key to decrypt broadcast packets until the key is changed.

---

```
(config)> network wifi ap digi_ap encryption group_rekey value
(config)>
```

---

where *value* is any number of days, hours, minutes, or seconds, and takes the format **number {d|h|m|s}**.

For example, to set **group rekey interval** to ten minutes, enter either **10m** or **600s**:

---

```
(config)> network wireless ap digi_ap encryption group_rekey 600s
(config)>
```

---

Increasing the time between rekeys can improve connectivity issues in noisy environments. To disable group rekeys, set to **0**. This will allow any client that has previously connected see all broadcast traffic on the wireless network until the Wi-Fi radio is restarted. The default is 10 minutes.

1. Assign the Wi-Fi access point to a LAN interface or to a bridge. See [Configure a LAN](#) and [Configure a bridge](#) for more information.

The access point must be assigned to an active LAN, or a bridge that is assigned to an active LAN.

2. Save the configuration and apply the change:

---

```
(config)> save
Configuration saved.
>
```

---

3. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Configure a Wi-Fi access point with enterprise security

The WPA2 enterprise security mode allows a Wi-Fi access point to authenticate clients by using one or more RADIUS servers. When the Wi-Fi access point receives a connection request from a client, it authenticates the client with the RADIUS server before allowing the client to connect.

Using enterprise security modes allows each client to have different usernames and passwords configured in the RADIUS server, rather than using preshared key on the EX15 device.

By default, the EX15 device comes with one preconfigured access point, **Digi AP**. You cannot delete default access points, but you can modify them or you can create your own access points.

### Required configuration items

- Enable the Wi-Fi access point
- Select a Wi-Fi radio for the access point.
- The Service Set Identifier (SSID) for the access point.
- Configure security for the access point to WPA2 enterprise.
- The IP address for one or more RADIUS servers.
- The secret key for one or more RADIUS servers.
- LAN/bridge assignment. Once you configure a Wi-Fi access point, you must assign the Wi-Fi access point to a LAN interface or to a bridge. See [Configure a LAN](#) and [Configure a bridge](#) for more information.

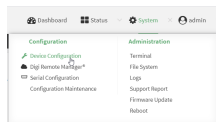
### Additional configuration items

- Determine whether to broadcast the access point's SSID.
- Determine whether to isolate clients connected to this access point, so that they cannot communicate with each other.
- The server port for one or more RADIUS server.
- The amount of time to wait before changing the group key.

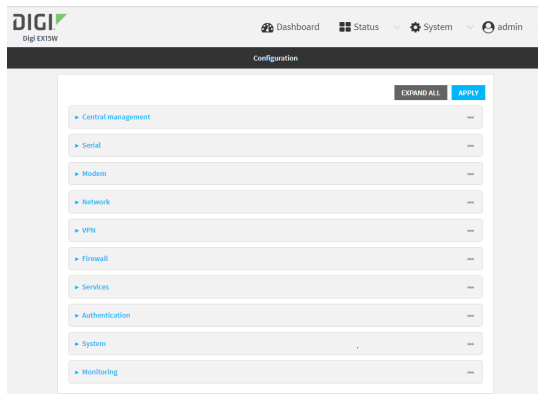
To configure a Wi-Fi access point with WPA2 enterprise security:

## WebUI

1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



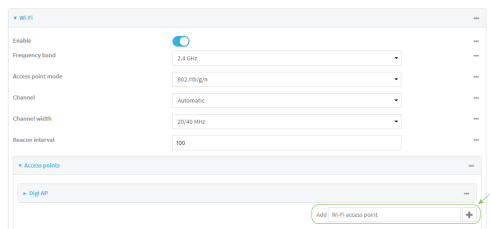
The **Configuration** window is displayed.



3. Click **Network** > **WiFi** > **Access points**.

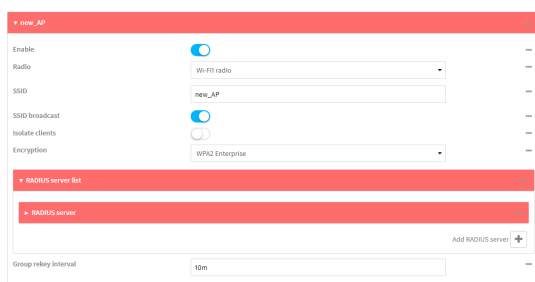
4. Create a new access point or modify an existing access point:

- To create a new access point, for **Add Wi-Fi access point:**, type a name for the access point and click **+**.



- To modify an existing access point, click to expand the access point.

The Wi-Fi access point configuration window is displayed.



5. **Enable** the access point.  
New access points are enabled by default. The default preconfigured access points are disabled by default.
6. For **SSID**, type the SSID. Up to 32 characters are allowed.
7. Enable **SSID broadcast** to configure the radio to broadcast the SSID.
8. (Optional) Enable **Isolate clients** to prevent clients that are connected to this access point from communicating with each other. See [Isolate Wi-Fi clients](#) for information about how to prevent clients connected to different access points from communicating with each other.
9. For **Encryption**, select **WPA2 Enterprise**.
10. Configure one or more RADIUS servers:
  - a. Click to expand **RADIUS server list**.
  - b. Click to expand **RADIUS server**.
  - c. For **RADIUS IP/hostname**, type the IP address or hostname of the RADIUS server.
  - d. (Optional) Change the **RADIUS port**. The default port is 1812.

- e. For **RADIUS secret key**, type the secret key as configured on the RADIUS server.

- f. To add additional RADIUS servers, click **+**

11. (Optional) For **Group rekey interval**, type the amount of time to wait before changing the group key.  
 The group key is shared by all in clients of the access point, and after a client has disconnected, it will be able to use the group key to decrypt broadcast packets until the key is changed.  
 Allowed values are any number of days, hours, minutes, or seconds, and take the format **number{d|h|m|s}**.  
 For example, to set **Group rekey interval** to ten minutes, enter **10m** or **600s**.  
 Increasing the time between rekeys can improve connectivity issues in noisy environments. To disable group rekeys, set to **0**. This will allow any client that has previously connected see all broadcast traffic on the wireless network until the Wi-Fi radio is restarted. The default is 10 minutes.
12. Assign the Wi-Fi access point to a LAN interface or to a bridge. See [Configure a LAN](#) and [Configure a bridge](#) for more information.  
 The access point must be assigned to an active LAN, or a bridge that is assigned to an active LAN.
13. Click **Apply** to save the configuration and apply the change.

## Command line

### Configure a new Access point

1. Log into the EX15 command line as a user with full Admin access rights.  
 Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.

2. At the command line, type **config** to enter configuration mode:

---

```
> config
(config)>
```

---

3. Create a new access point:

---

```
(config)> add network wifi ap new_AP
(config network wifi ap new_AP)>
```

---

New access points are enabled by default.

4. Set the SSID for the Wi-Fi access point. Up to 32 characters are allowed.

---

```
(config network wifi ap new_AP)> ssid my_SSID
(config network wifi ap new_AP)>
```

---

SSID broadcasting is enabled by default for new access points.

5. Set the security for the access point to **wpa2**:

---

```
(config network wifi ap new_AP)> encryption type wpa2
(config network wifi ap new_AP)>
```

---

6. (Optional) Determine whether to prevent clients that are connected to this access point from communicating with each other:

---

```
(config)> network wifi ap digi_ap isolate_client true
(config)>
```

---

See [Isolate Wi-Fi clients](#) for information about how to prevent clients connected to different access points from communicating with each other.

7. Configure one or more RADIUS servers:

- a. Set the IP address of the RADIUS server:

---

```
(config network wifi ap new_AP)> encryption radius_servers 0 host IP_
address
(config network wifi ap new_AP)>
```

---

- b. Set the secret key as configured on the RADIUS server:

---

```
(config network wifi ap new_AP)> encryption radius_servers 0 key secret_
key
(config network wifi ap new_AP)>
```

---

- c. (Optional) Set the RADIUS server's port. The default is 1812.

---

```
(config network wifi ap new_AP)> encryption radius_servers 0 port port
(config network wifi ap new_AP)>
```

---

- d. (Optional) Add and configure additional radius servers:

- i. Add a server:

---

```
(config network wifi ap new_AP)> add encryption radius_servers end
(config network wifi ap new_AP encryption radius_servers 1)>
```

---

- ii. Configure the new server as described above. For example, set the server IP address:

---

```
(config network wifi ap new_AP encryption radius_servers 1)> host
IP_address
(config network wifi ap new_AP encryption radius_servers 1)>
```

---

- iii. Repeat for additional radius servers.

8. (Optional) Set the amount of time to wait before changing the group key.

The group key is shared by all in clients of the access point, and after a client has disconnected, it will be able to use the group key to decrypt broadcast packets until the key is changed.

---

```
(config network wifi ap new_AP)> encryption group_rekey value
(config network wifi ap new_AP)>
```

---

where *value* is any number of days, hours, minutes, or seconds, and takes the format **number {d|h|m|s}**.

For example, to set **group rekey interval** to ten minutes, enter either **10m** or **600s**:

---

```
(config network wireless ap new_AP)> encryption group_rekey 600s
(config network wireless ap new_AP)>
```

---

Increasing the time between rekeys can improve connectivity issues in noisy environments. To disable group rekeys, set to **0**. This will allow any client that has previously connected see all broadcast traffic on the wireless network until the Wi-Fi radio is restarted. The default is 10 minutes.

1. Assign the Wi-Fi access point to a LAN interface or to a bridge. See [Configure a LAN](#) and [Configure a bridge](#) for more information.

The access point must be assigned to an active LAN, or a bridge that is assigned to an active LAN.

2. Save the configuration and apply the change:

---

```
(config)> save
Configuration saved.
>
```

---

3. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Edit an existing Access point

1. Log into the EX15 command line as a user with full Admin access rights.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.

2. At the command line, type **config** to enter configuration mode:

---

```
> config
(config)>
```

---

3. Show available access points:

---

```
(config)> network wifi ap ?
```

```
Additional Configuration
```

```

```

```
dig_i_ap Digi AP
```

```
(config)>
```

---

4. Set the SSID for the appropriate access point:

---

```
(config)> network wifi ap dig_i_ap ssid my_SSID
(config)>
```

---

5. SSID broadcasting is enabled by default for the preconfigured access points. If SSID broadcasting is disabled:

---

```
(config)> network wifi ap dig_i_ap ssid_broadcast true
(config)>
```

---

6. Set the security for the access point to **wpa2**:

---

```
(config)> network wifi ap dig_i_ap encryption type wpa2
(config)>
```

---

7. (Optional) Determine whether to prevent clients that are connected to this access point from communicating with each other:

---

```
(config)> network wifi ap dig_i_ap isolate_client true
(config)>
```

---

See [Isolate Wi-Fi clients](#) for information about how to prevent clients connected to different access points from communicating with each other.

8. Set the IP address or hostname of the RADIUS server:

---

```
(config)> network wifi ap dig_i_ap encryption host_wpa2 hostname
(config)>
```

---

9. Set the secret key as configured on the RADIUS server:

---

```
(config)> network wifi ap dig_i_ap encryption key_wpa2 secret_key
(config)>
```

---

10. (Optional) Set the RADIUS server's port. The default is 1812.

---

```
(config)> network wifi ap digi_ap encryption port_wpa2 port
(config)>
```

---

11. (Optional) Set the amount of time to wait before changing the group key.

The group key is shared by all in clients of the access point, and after a client has disconnected, it will be able to use the group key to decrypt broadcast packets until the key is changed.

---

```
(config)> network wifi ap digi_ap encryption group_rekey value
(config)>
```

---

where *value* is any number of days, hours, minutes, or seconds, and takes the format **number {d|h|m|s}**.

For example, to set **group rekey interval** to ten minutes, enter either **10m** or **600s**:

---

```
(config)> network wireless ap digi_ap encryption group_rekey 600s
(config)>
```

---

Increasing the time between rekeys can improve connectivity issues in noisy environments. To disable group rekeys, set to **0**. This will allow any client that has previously connected see all broadcast traffic on the wireless network until the Wi-Fi radio is restarted. The default is 10 minutes.

1. Assign the Wi-Fi access point to a LAN interface or to a bridge. See [Configure a LAN](#) and [Configure a bridge](#) for more information.

The access point must be assigned to an active LAN, or a bridge that is assigned to an active LAN.

2. Save the configuration and apply the change:

---

```
(config)> save
Configuration saved.
>
```

---

3. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.



## Isolate Wi-Fi clients

Client isolation prevents wireless clients connected to the EX15 device from communicating with other clients. There are two mechanisms for client isolation configuration:

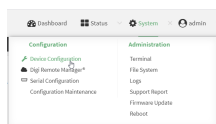
- [Isolate clients connected to the same access point](#)
- [Isolate clients connected to different access points](#)

This section provides instructions for both mechanisms.

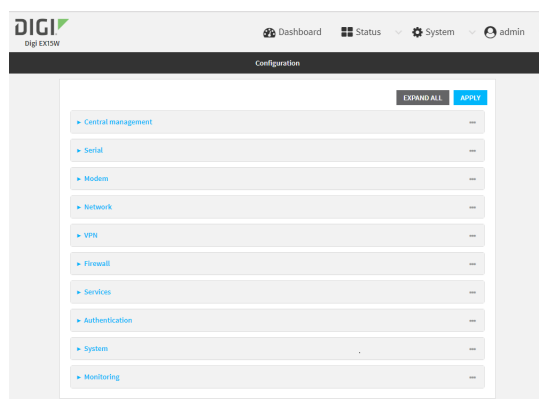
### Isolate clients connected to the same access point

#### WebUI

1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.



3. Click **Network > WiFi > Access points**.
4. Create a new access point or modify an existing access point. See [Configure a Wi-Fi access point with no security](#), [Configure a Wi-Fi access point with personal security](#), or [Configure a Wi-Fi access point with enterprise security](#).
5. Enable **Isolate clients**.
6. Click **Apply** to save the configuration and apply the change.



## Command line

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the command line, type **config** to enter configuration mode:
 

```
> config
(config)>
```
3. Create a new access point or modify an existing access point. See [Configure a Wi-Fi access point with no security](#), [Configure a Wi-Fi access point with personal security](#), or [Configure a Wi-Fi access point with enterprise security](#).
4. (Optional) Set the client isolation:
 

```
(config)> network wifi ap digi_ap isolate_client true
(config)>
```
5. Save the configuration and apply the change:
 

```
(config)> save
Configuration saved.
>
```
6. Type **exit** to exit the Admin CLI.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

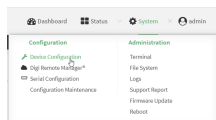
## Isolate clients connected to different access points

Isolating clients that are on different access points involves the following steps:

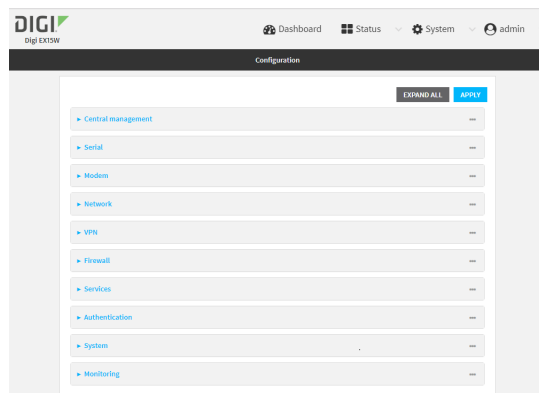
1. Create new access points.
2. Assign the access points to separate LAN interfaces.
3. Assign those LAN interfaces to separate firewall zones.
4. Create firewall filters to prevent traffic between the two firewall zones.

## WebUI

1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



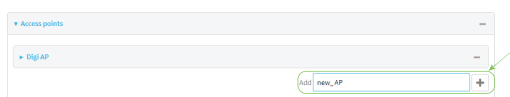
The **Configuration** window is displayed.



3. Create a new access point.

By default, the EX15 comes with one preconfigured access point, named **Digi AP**. In these instructions, we will use the existing **Digi AP** access point and create another new access point, named **new\_AP**.

- Click **Network > Wi-Fi > Access points**.
- For **Add Wi-Fi access point:**, type a name for the access point and click **+**.



- For **SSID**, type the SSID. Up to 32 characters are allowed.
  - Select the appropriate type of **Encryption** and complete the encryption-related fields as appropriate. See [Configure a Wi-Fi access point with no security](#), [Configure a Wi-Fi access point with personal security](#), or [Configure a Wi-Fi access point with enterprise security](#) for details.
4. Configure the firewall:
- Click **Firewall > Zones**.
  - In **Add Zone**, enter **LAN2\_isolation\_zone** for the name of the zone and click **+**.



**Note** We will be creating **LAN2** later in the procedure.

- Create a firewall filter to provide internet access for the **LAN2\_isolation\_zone**:
  - For **Add packet filter**, click **+**.
  - For **Label**, type **Allow LAN2\_isolation\_zone to External**.
  - For **Source zone**, select **LAN2\_isolation\_zone**.
  - For **Destination zone**, select **External**.

Allow LAN2\_isolation\_zone to External

|                  |                                       |
|------------------|---------------------------------------|
| Enable           | <input checked="" type="checkbox"/>   |
| Label            | Allow LAN2_isolation_zone to External |
| Action           | Accept                                |
| IP version       | Any                                   |
| Protocol         | Any                                   |
| Source zone      | LAN2_isolation_zone                   |
| Destination zone | External                              |

- d. Create a firewall filter to drop traffic from the **Internal** zone (used by the **LAN1** interface) to the **LAN2\_isolation\_zone**:
  - i. Click **Firewall > Packet filtering**.
  - ii. For **Add packet filter**, click **+**.
  - iii. For **Label**, type **Drop traffic from Internal to LAN2\_isolation\_zone**.
  - iv. For **Action**, select **Drop**.
  - v. For **Source zone**, select **Internal**.
  - vi. For **Destination zone**, select **LAN2\_isolation\_zone**.

Drop Internal to new\_zone

|                  |                                     |
|------------------|-------------------------------------|
| Enable           | <input checked="" type="checkbox"/> |
| Label            | Drop internal to new_zone           |
| Action           | Drop                                |
| IP version       | Any                                 |
| Protocol         | Any                                 |
| Source zone      | Internal                            |
| Destination zone | LAN2_isolation_zone                 |

- e. Rearrange the firewall filters.

Firewall filters are applied in the order that they are listed. As a result, in order to drop traffic from the **Internal** zone to the **LAN2\_isolation\_zone**, this filter must be listed prior to the **Allow all outgoing traffic filter**, which allows the **Internal** zone to have access to any zone.

To move the **Drop traffic from Internal to LAN2\_isolation\_zone** filter to the top of the list:

- i. Click the filter title.
- ii. Drag-and-drop the filter to the top of the list.

Drop traffic from Internal to LAN2\_isolation\_zone

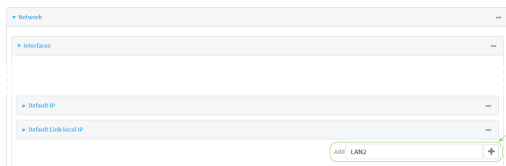
Allow all outgoing traffic

Allow LAN2\_isolation\_zone to External

5. Create a new LAN:

By default, the EX15 device comes with one preconfigured LAN, which includes the default access point. We will use that LAN for the default access point, and create a new LAN for the second access point.

- a. Click **Configuration > Network > Interfaces**.
- b. For **Add interface**, type a name for the LAN and click **+**.



- c. For **Zone**, select **LAN2\_isolation\_zone**.
  - d. For **Device**, select the new Wi-Fi access point.
  - e. Click to expand **IPv4**.
  - f. For **Address**, type an IP address and subnet for the LAN.
  - g. Click to expand **DHCP server**.
  - h. **Enable** the DHCP server.
6. Click **Apply** to save the configuration and apply the change.



## Command line

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the command line, type **config** to enter configuration mode:

```
> config
(config)>
```

3. Configure a new access point:
  - a. Create a new access point:

```
(config)> add network wifi ap new_AP
(config network wifi ap new_AP)>
```

New access points are enabled by default.

- b. Set the SSID for the Wi-Fi access point. Up to 32 characters are allowed.

```
(config network wifi ap new_AP)> ssid my_SSID
(config network wifi ap new_AP)>
```

- c. Set the security for the access point:

```
(config network wifi ap new_AP)> encryption type value
(config network wifi ap new_AP)>
```

where value is one of:

- **none**
  - **psk**
  - **psk2**
  - **wpa2:**
- d. Complete other encryption-related fields as appropriate based on the type of encryption. See [Configure a Wi-Fi access point with no security](#), [Configure a Wi-Fi access point with personal security](#), or [Configure a Wi-Fi access point with enterprise security](#) for details.
4. Configure the firewall:
- a. Return to the root config prompt by typing three periods (...):

---

```
(config network wifi ap new_AP)> ...
(config)>
```

---

- b. Add a new firewall zone named **LAN2\_isolation\_zone**. We will be creating **LAN2** later in the procedure.

---

```
(config)> add firewall zone LAN2_isolation_zone
(config firewall zone LAN2_isolation_zone)>
```

---

- c. Create a firewall filter to provide internet access for the **LAN2\_isolation\_zone**.

- i. Return to the root config prompt by typing three periods (...):

---

```
(config firewall zone LAN2_isolation_zone)> ...
(config)>
```

---

- ii. Add the new packet filter:

---

```
(config)> add firewall filter end
(config firewall filter 1)>
```

---

- iii. Set the label for the filter:

---

```
(config firewall filter 1)> label "Allow LAN2_isolation_zone to
External"
(config firewall filter 1)>
```

---

- iv. Set the source zone to **LAN2\_isolation\_zone**:

---

```
(config firewall filter 1)> src_zone LAN2_isolation_zone
(config firewall filter 1)>
```

---

- v. Set the destination zone to **external**:

---

```
(config firewall filter 1)> dst_zone external
(config firewall filter 1)>
```

---

- d. Create a firewall filter to drop traffic from the **Internal** zone (used by the **LAN1** interface) to the **LAN2\_isolation\_zone**:

Firewall filters are applied in the order that they are listed. As a result, in order to drop traffic from the **Internal** zone to the **LAN2\_isolation\_zone**, this filter must be added before the **Allow all outgoing traffic** filter, which allows the **Internal** zone to have access

to any zone. In this example, we will add the new to the first position in the list (index position **0**).

- i. Add the new packet filter:

---

```
(config firewall filter 1)> add .. 0
(config firewall filter 0)>
```

---

- ii. Set the label for the filter:

---

```
(config firewall filter 0)> label "Drop traffic from Internal to
LAN2_isolation_zone"
(config firewall filter 0)>
```

---

- iii. Set the source zone to **internal**:

---

```
(config firewall filter 0)> src_zone internal
(config firewall filter 0)>
```

---

- iv. Set the destination zone to **LAN2\_isolation\_zone**:

---

```
(config firewall filter 0)> dst_zone LAN2_isolation_zone
(config firewall filter 0)>
```

---

- v. Set the filter to drop traffic between the zones:

---

```
(config firewall filter 0)> action drop
(config firewall filter 0)>
```

---

## 5. Create a new LAN:

By default, the EX15 device comes with one preconfigured LAN, which includes the default access point. We will use that LAN for the default access point, and create a new LAN for the second access point.

- a. Return to the root config prompt by typing three periods (...):

---

```
(config firewall filter 0)> ...
(config)>
```

---

- b. Add the new LAN:

---

```
(config)> add network interface LAN2
(config network interface LAN2)>
```

---

- c. Set the device to the new Wi-Fi access point:

---

```
(config network interface LAN2)> device /network/wifi/ap/new_AP
(config network interface LAN2)>
```

---

- d. Set the zone to **LAN2\_isolation\_zone**:

---

```
(config network interface LAN2)> zone LAN2_isolation_zone
(config network interface LAN2)>
```

---

- e. Set the IP address and subnet mask of the LAN:

```
(config network interface LAN2)> ipv4 address address/mask
(config network interface LAN2)>
```

- f. Enable the DHCP server:

```
(config network interface LAN2)> ipv4 dhcp_server enable true
(config network interface LAN2)>
```

6. Save the configuration and apply the change:

```
(config network interface LAN2)> save
Configuration saved.
>
```

7. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Configure a Wi-Fi client and add client networks

### Required configuration items

- Create the Wi-Fi client.
- The EX15 device's Wi-Fi radio that the Wi-Fi client will use.
- The Wi-Fi network that the client will log into:
  - SSID of the Wi-Fi network's access point.
  - Type of security, and user name and/or password if applicable, used by the access point.
- WAN assignment. Once you configure a Wi-Fi client, you must assign the Wi-Fi client to a WAN. See [Wide Area Networks \(WANs\)](#) and [Wireless Wide Area Networks \(WWANs\)](#) for further information.

### Additional configuration items

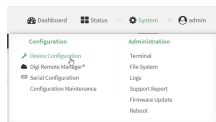
- Enable and configure background scanning, which allows the Wi-Fi client to move between access points that have the same SSID as their signal strength varies.
- Additional access points that client will attempt to use. If connection to one access point fails, the device will attempt to connect to the next access point in the list.

To configure a Wi-Fi client:

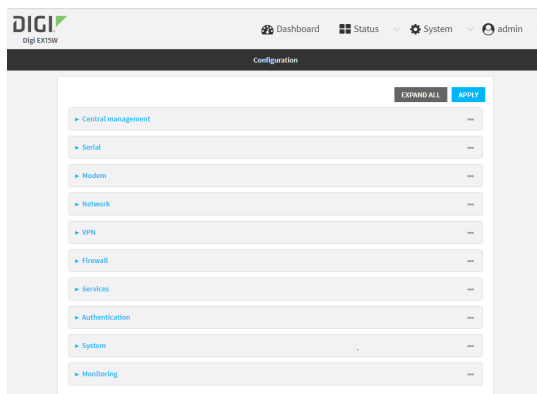




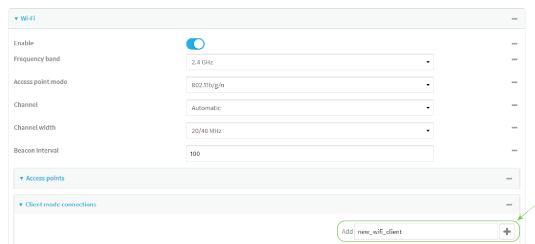
1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



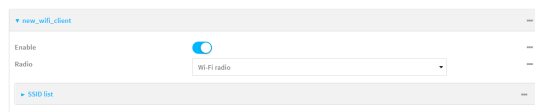
The **Configuration** window is displayed.



3. Click **Network > WiFi > Client mode connections**.
4. For **Add WiFi client**, type the name of the client and click **+**.



The Wi-Fi client configuration window is displayed.



New Wi-Fi clients are enabled by default. To disable, or to enable a client if it has been disabled, click **Enable**.

5. For **Radio**, select the appropriate Wi-Fi radio.
6. Configure the Wi-Fi network that the client will use:
  - a. Click to expand **SSID list**.
  - b. Enter the **SSID** of the access point that the client will use to connect to the Wi-Fi network.
  - c. Select the type of **Encryption** used by the access point.
    - If **WPA Personal (PSK)** or **WPA2 Personal (PSK)** is selected as the type of **Encryption**, for **Pre-shared key**, enter the password that the client will use to connect to the access point.

- If **WPA2 Enterprise** is selected as the type of **Encryption**, enter the **Username** and **Password** that the client will use to connect to the access point.

7. (Optional) Configure **Background scanning**.

Background scanning allows the device to scan for nearby access points and to move between access points that have the same SSID that is configured for the client connection, based on the signal strength of the access points.

- a. Click to expand **Background scanning**.

- b. Click **Enable background scanning** to enable.
- c. For **Scan threshold**, enter a value in dB that is used to determine the scanning frequency. The allowed value is an integer between **-113** and **0**.

The **Scan threshold** works with the **Short interval** and **Long interval** options to determine how often the device should scan for available access points:

- If the signal strength from the access point to which the client is currently connected is below the **Scan threshold**, it will use the **Short interval** to determine how often to scan for available access points.
  - If the signal strength from the access point to which the client is currently connected is stronger the **Scan threshold**, it will use the **Long interval** to determine how often to scan for available access points.
  - If **Short interval** and **Long interval** are set to the same value, **Scan threshold** is ignored. For example, the default configuration has both **Short interval** and **Long interval** set to **1** second, which means that the device will scan for access points once per second regardless of the **Scan threshold**.
- d. For **Short interval**, type the number of seconds to wait between scans for access points, when the signal strength from the access point to which the client is currently connected is below the **Scan threshold**.
- e. For **Long interval**, type the number of seconds to wait between scans for access points, when the signal strength from the access point to which the client is currently connected is stronger than the **Scan threshold**.
- f. Click to expand **Scan frequencies list**.

The EX15 device has three preconfigured channels that will be scanned for available access points:

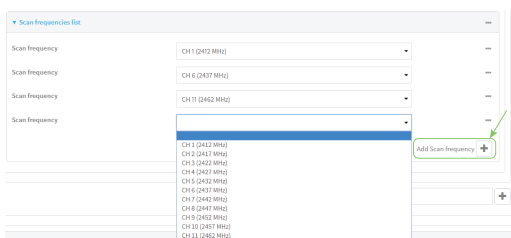
- Channel 1 (2412 MHz)
- Channel 6 (2437 MHz)
- Channel 11 (2462 MHz)

You can delete the preconfigured channels and add additional channels. At least one channel is required.

- g. To delete a preconfigured channel, click the menu icon (...) next to the channel and select **Delete**.



- h. To add a channel, click **Add Scan frequency** and select the appropriate channel.



8. Click **Apply** to save the configuration and apply the change.



## Command line

- Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
- At the command line, type **config** to enter configuration mode:

```
> config
(config)>
```

- Create a new Wi-Fi client:

```
(config)> add network wifi client new_client
(config network wifi client new_client)>
```

New access points are enabled by default.

- Set the Wi-Fi radio for the new access point:

```
(config network wifi client new_client)> radio wifi
(config network wifi client new_client)>
```

- Configure the Wi-Fi network that the client will use:

- Set the SSID of the access point that the client will use to connect to the Wi-Fi network:

```
(config network wifi client new_client)> ssid 0 ssid value
```

where *value* is the SSID of the access point.

- b. Set the security for the access point:

---

```
(config network wifi client new_client)> ssid 0 encryption type value
(config network wifi client new_client)>
```

---

where *value* is the type of encryption used by the access point. Allowed values are:

- **none**: no encryption.
- **psk**: WPA personal encryption.
- **psk2**: WPA2 personal encryption.
- **wpa2**: WPA2 enterprise encryption.

- c. If the type of encryption is set to:

- **psk** or **psk2**, set the password that the client will use to connect to the access point:

---

```
(config network wifi client new_client)> ssid 0 encryption key_
psk2 password
(config network wifi client new_client)>
```

---

- **wpa2**:

- i. Set the username that the client will use to connect to the access point:

---

```
(config network wifi client new_client)> ssid 0 encryption id_
wpa2 username
(config network wifi client new_client)>
```

---

- ii. Set the password that the client will use to connect to the access point:

---

```
(config network wifi client new_client)> ssid 0 encryption
password_wpa2 pwd
(config network wifi client new_client)>
```

---

6. (Optional) Configure background scanning.

Background scanning allows the device to scan for nearby access points and to move between access points that have the same SSID that is configured for the client connection, based on the signal strength of the access points.

- a. Enable background scanning:

---

```
(config network wifi client new_client)> background_scanning enable true
(config network wifi client new_client)>
```

---

- b. Set the scan threshold (**bgscan\_strength**), in dB, that is used to determine the scanning frequency.

---

```
(config network wifi client new_client)> bgscan_strength value
(config network wifi client new_client)>
```

---

where *value* is an integer between **-113** and **0**.

The scan threshold works with the short and long intervals (**bgscan\_short\_interval** and **bgscan\_long\_interval**) to determine how often the device should scan for available access points:

- If the signal strength from the access point to which the client is currently connected is below the value of **bgscan\_strength**, it will use **bgscan\_short\_interval** to determine how often to scan for available access points.
  - If the signal strength from the access point to which the client is currently connected is stronger than the value of **bgscan\_strength**, it will use **bgscan\_long\_interval** to determine how often to scan for available access points.
  - If **bgscan\_short\_interval** and **bgscan\_long\_interval** are set to the same value, **bgscan\_strength** is ignored. For example, the default configuration has both **bgscan\_short\_interval** and **bgscan\_long\_interval** set to **1** second, which means that the device will scan for access points once per second regardless of the value of **bgscan\_strength**.
- c. Set the number of seconds to wait between scans for access points, when the signal strength from the access point to which the client is currently connected is below the value of **bgscan\_strength**:

---

```
(config network wifi client new_client)> bgscan_short_interval value
(config network wifi client new_client)>
```

---

where value is any integer greater than 0. The default is **1**.

- d. Set the number of seconds to wait between scans for access points, when the signal strength from the access point to which the client is currently connected is greater than the value of **bgscan\_strength**:

---

```
(config network wifi client new_client)> bgscan_long_interval value
(config network wifi client new_client)>
```

---

where value is any integer greater than 0. The default is **1**.

- e. Configure the frequencies that will be scanned for available access points.

The EX15 device has three preconfigured frequencies:

- 2412 MHz
- 2437 MHz
- 2462 MHz

You can delete the preconfigured frequencies and add additional frequencies. At least one frequencies is required.

- f. To delete a preconfigured frequencies:
- i. Use the **show** command to determine the index number of the channel to be deleted:

---

```
(config network wifi client new_client)> show background_scanning
scan_freq
0 2412
1 2437
2 2462
(config network wifi client new_client)>
```

---

- ii. Use the appropriate index number to delete the channel. For example, to delete the 2412 frequency:

---

```
(config network wifi client new_client)> del 0
(config network wifi client new_client)>
```

---

g. To add a frequency:

- i. Use the **?** with an existing index number to determine the allowed values for frequencies:

---

```
(config network wifi client new_client)> background_scanning scan_
freq 1
```

---

Scan frequency: Enable this frequency in the background scan.

Format:

```
2412
2417
2422
2427
2432
2437
2442
2447
2452
2457
2462
```

Current value: 2437

---

- ii. Add the appropriate frequency. For example, to add the **2457** frequency to the end of the list:

---

```
(config network wifi client new_client)> add background_scanning
scan_freq end 2457
(config network wifi client new_client)>
```

---

7. Save the configuration and apply the change:

---

```
(config network wireless client new_client)> save
Configuration saved.
>
```

---

8. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Show Wi-Fi access point status and statistics

You can show summary status for all Wi-Fi access points, and detailed status and statistics for individual Wi-Fi access points.



1. Log into the EX15 WebUI as a user with Admin access.
2. On the main menu, click **Status**.
3. Under **Connections**, click **Wi-Fi > Access Points**.



## Command line

### Show summary of Wi-Fi access points

To show the status and statistics for Wi-Fi access points, use the `show wifi` command.

1. Log into the EX15 command line as a user with Admin access.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the Admin CLI prompt, type **show wifi ap**:

---

```
> show wifi ap
```

| AP      | Enabled | Status | SSID    | BSSID             |
|---------|---------|--------|---------|-------------------|
| -----   | -----   | -----  | -----   | -----             |
| my_AP   | true    | up     | my_SSID | 01:41:D1:14:36:37 |
| digi_ap | true    | up     | Digi2   | 00:40:D0:13:35:36 |

```
>
```

---

3. To view information about both active and inactive access points, include the **all** parameter:

---

```
> show wifi ap all
```

| AP       | Enabled | Status | SSID    | BSSID             |
|----------|---------|--------|---------|-------------------|
| -----    | -----   | -----  | -----   | -----             |
| my_AP    | true    | up     | my_SSID | 01:41:D1:14:36:37 |
| digi_ap  | true    | up     | Digi2   | 00:40:D0:13:35:36 |
| digi_ap2 | false   | down   |         |                   |

```
>
```

---

### Show detailed status and statistics of a specific Wi-Fi access point

To show a detailed status and statistics of a Wi-Fi access point, use the **show wifi ap name name** command.

1. Log into the EX15 command line as a user with Admin access.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the Admin CLI prompt, type **show wifi ap name name**:

---

```
> show wifi ap name my_AP
```

|          |         |
|----------|---------|
| Enabled  | : true  |
| Status   | : up    |
| SSID     | : my_AP |
| Security | : none  |

---

```

Channel :
Channel Width :
Radio : wifi
BSSID : 01:41:D1:14:36:37

Client Signal RX TX Uptime

cc:c0:78:34:d5:a2 -68 260997 279481 801
>

```

## Show Wi-Fi client status and statistics

You can show summary status for all Wi-Fi clients, and detailed status and statistics for individual Wi-Fi clients.

### WebUI

1. Log into the EX15 WebUI as a user with Admin access.
2. On the main menu, click **Status**.
3. Under **Connections**, click **Wi-Fi > Clients**.

### Command line

#### Show summary of Wi-Fi clients

To show the status and statistics for Wi-Fi client, use the [show wifi](#) command.

1. Log into the EX15 command line as a user with Admin access.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the Admin CLI prompt, type **show wifi client**:

```

> show wifi client

Client Enabled SSID Status Sig MAC

my_client true my_SSID up -43 91:fe:86:d1:0e:81
>

```

3. To view information about both active and inactive clients, include the **all** parameter:

```

> show wifi client all

Client Enabled SSID Status Sig MAC

my_client true my_SSID up -43 91:fe:86:d1:0e:81
client2 true SSID2 down
>

```



### Show detailed status and statistics of a specific Wi-Fi client

To show a detailed status and statistics of a Wi-Fi client, use the **show wifi client name *name*** command.

1. Log into the EX15 command line as a user with Admin access.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the Admin CLI prompt, type **show wifi client name *name***:

---

```
> show wifi client name my_client

Client : my_client
Enabled : true
SSID : my_SSID
Status : up
Signal : -43
MAC : 91:fe:86:d1:0e:81
Channel : 48
Radio : wifi1
TX Power : 23
Link Quality : 67/70
BSSID : 6D:B9:DD:BD:EE:C4

>
```

---

# Routing

---

This chapter contains the following topics:

|                                                 |     |
|-------------------------------------------------|-----|
| IP routing .....                                | 239 |
| Show the routing table .....                    | 266 |
| Dynamic DNS .....                               | 267 |
| Virtual Router Redundancy Protocol (VRRP) ..... | 273 |

## IP routing

The EX15 device uses IP routes to decide where to send a packet it receives for a remote network. The process for deciding on a route to send the packet is as follows:

1. The device examines the destination IP address in the IP packet, and looks through the IP routing table to find a match for it.
2. If it finds a route for the destination, it forwards the IP packet to the configured IP gateway or interface.
3. If it cannot find a route for the destination, it uses a default route.
4. If there are two or more routes to a destination, the device uses the route with the longest mask.
5. If there are two or more routes to a destination with the same mask, the device uses the route with the lowest metric.

This section contains the following topics:

|                                                                                          |     |
|------------------------------------------------------------------------------------------|-----|
| Configure a static route .....                                                           | 240 |
| Delete a static route .....                                                              | 243 |
| Policy-based routing .....                                                               | 245 |
| Configure a routing policy .....                                                         | 245 |
| Example: Dual WAN policy-based routing .....                                             | 254 |
| Example: Route traffic to a specific WAN interface based on the client MAC address ..... | 257 |
| Routing services .....                                                                   | 262 |
| Configure routing services .....                                                         | 263 |

## Configure a static route

A static route is a manually configured routing entry. Information about the route is manually entered rather than obtained from dynamic routing traffic.

### Required configuration items

- The destination address or network.
- The interface to use to reach the destination.

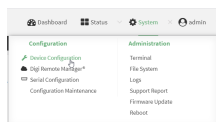
### Additional configuration items

- A label used to identify this route.
- The IPv4 address of the gateway used to reach the destination.
- The metric for the route. When multiple routes are available to reach the same destination, the route with the lowest metric is used.
- The Maximum Transmission Units (MTU) of network packets using this route.

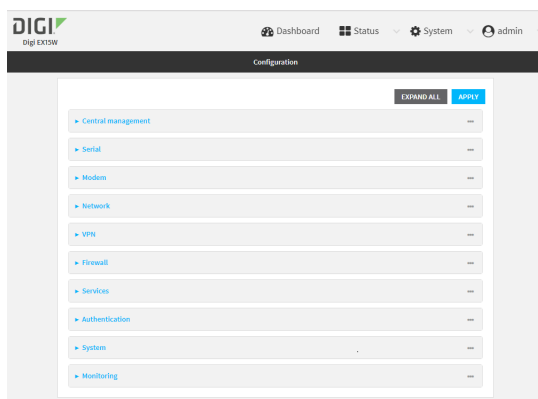
To configure a static route:

## WebUI

1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.



3. Click **Network > Routes > Static routes**.

- Click the **+** to add a new static route.



The new static route configuration page is displayed:

New static route configurations are enabled by default. To disable, click to toggle **Enable** to off.

- (Optional) For **Label**, type a label that will be used to identify this route.
- For **Destination**, type the IP address or network of the destination of this route.  
For example, to route traffic to the 192.168.47.0 network that uses a subnet mask of 255.255.255.0, type **192.168.47.0/24**. The **any** keyword can also be used to route packets to any destination with this static route.
- For **Interface**, select the interface on the EX15 device that will be used with this static route.
- (Optional) For **Gateway**, type the IPv4 address of the gateway used to reach the destination. Set to blank if the destination can be accessed without a gateway.
- (Optional) For **Metric**, type the metric for the route. When multiple routes are available to reach the same destination, the route with the lowest metric is used.
- (Optional) For **MTU**, type the Maximum Transmission Units (MTU) of network packets using this route.
- Click **Apply** to save the configuration and apply the change.



## Command line

- Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
- At the command line, type **config** to enter configuration mode:

```
> config
(config)>
```

3. Add a new static route:

---

```
(config)> add network route static end
(config network route static 0)>
```

---

New static route instances are enabled by default. To disable:

---

```
(config network route static 0)> enable false
(config network route static 0)>
```

---

4. (Optional) set a label that will be used to identify this route. For example:

---

```
(config network route static 0)> label "route to accounting network"
(config network route static 0)>
```

---

5. Set the IP address or network of the destination of this route. For example:

---

```
(config network route static 0)> destination ip_address[/netmask]
(config network route static 0)>
```

---

For example, to route traffic to the 192.168.47.0 network that uses a subnet mask of 255.255.255.0:

---

```
(config network route static 0)> dst 192.168.47.0/24
(config network route static 0)>
```

---

The **any** keyword can also be used to route packets to any destination with this static route.

6. Set the interface on the EX15 device that will be used with this static route:
  - a. Use the **?** to determine available interfaces:

---

```
(config network route static 0)>interface ?
```

---

Interface: The network interface to use to reach the destination.

Format:

```
/network/interface/defaultip
/network/interface/defaultlinklocal
/network/interface/lan
/network/interface/loopback
/network/interface/modem
/network/interface/wan
```

Current value:

---

```
(config network route static 0)> interface
```

---

- b. Set the interface. For example:

---

```
(config network route static 0)> interface /network/interface/wan
(config network route static 0)>
```

---

7. (Optional) Set the IPv4 address of the gateway used to reach the destination. Set to blank if the destination can be accessed without a gateway.

---

```
(config network route static 0)> gateway IPv4_address
(config network route static 0)>
```

---

8. (Optional) Set the metric for the route. When multiple routes are available to reach the same destination, the route with the lowest metric is used.

---

```
(config network route static 0)> metric value
(config network route static 0)>
```

---

where *value* is an interger between **0** and **65535**. The default is **0**.

9. (Optional) Set the Maximum Transmission Units (MTU) of network packets using this route:

---

```
(config network route static 0)> mtu integer
(config network route static 0)>
```

---

10. Save the configuration and apply the change:

---

```
(config)> save
Configuration saved.
>
```

---

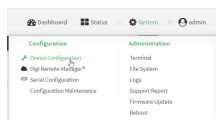
11. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

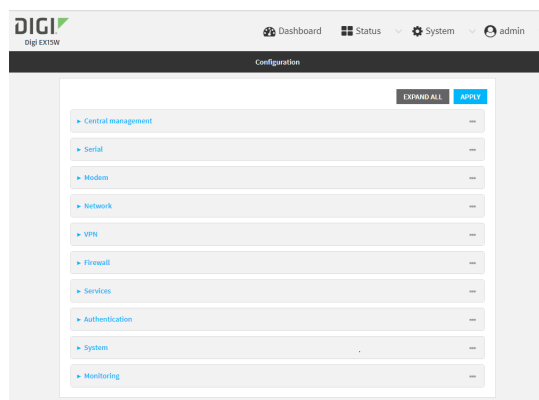
## Delete a static route

### WebUI

1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.



3. Click **Network > Routes > Static routes**.
4. Click the menu icon (...) for a static route and select **Delete**.



5. Click **Apply** to save the configuration and apply the change.



## Command line

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the command line, type **config** to enter configuration mode:

```
> config
(config)>
```

3. Determine the index number of the static route to be deleted:

```
(config)> show network route static
0
 dst 10.0.0.1
 enable true
 no gateway
 interface /network/interface/lan1
 label new_static_route
 metric 0
 mtu 0
1
 dst 192.168.5.1
 enable true
 gateway 192.168.5.1
 interface /network/interface/lan2
 label new_static_route_1
 metric 0
 mtu 0
(config)>
```

4. Use the index number to delete the static route:

```
(config)> del network route static 0
(config)>
```



5. Save the configuration and apply the change:

---

```
(config)> save
Configuration saved.
>
```

---

6. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Policy-based routing

Normally, a routing device determines how to route a network packet based on its destination address. However, you can use policy-based routing to forward the packet based on other criteria, such as the source of the packet. For example, you can configure the EX15 device so that high-priority traffic is routed through the cellular connection, while all other traffic is routed through an Ethernet (WAN) connection.

Policy-based routing for the EX15 device uses the following criteria to determine how to route traffic:

- Firewall zone (for example, internal/outbound traffic, external/inbound traffic, or IPsec tunnel traffic).
- Network interface (for example, the cellular connection, the WAN, or the LAN).
- IPv4 address.
- IPv6 address.
- MAC address.
- Domain.
- Protocol type (TCP, UDP, ICMP, or all).

The order of the policies is important. Routing policies are processed sequentially; as a result, if a packet matches an earlier policy, it will be routed using that policy's rules. It will not be processed by any subsequent rules.

## Configure a routing policy

### Required configuration items

- The packet matching parameters. It can any combination of the following:
  - Source interface.
  - Source address. This can be a firewall zone, an interface, a single IPv4/IPv6 address or network, or a MAC address.
  - Destination address. This can be a firewall zone, an interface, a single IPv4/IPv6 address or network, or a domain.
  - Protocol. This can be **any**, **tcp**, **udp** or **icmp**.
  - Source port. This is only used if the protocol is set to **tcp** or **udp**.
  - Destination port. This is only used if protocol is set to **tcp** or **udp**.
- The network interface used to reach the destination.

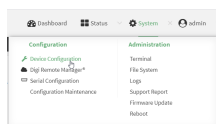
### Additional configuration items

- A label for the routing policy.
- Whether packets that match this policy should be dropped when the gateway interface is disconnected, rather than forwarded through other interfaces.

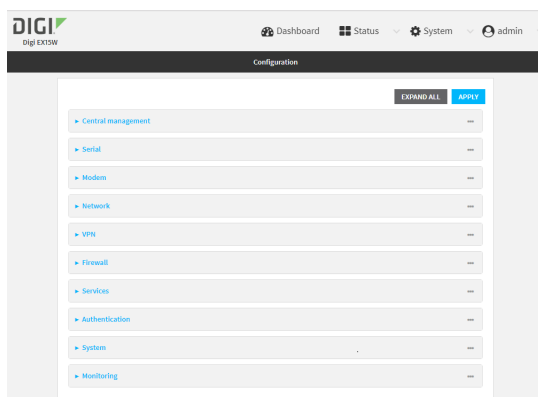
To configure a routing policy:

### WebUI

1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.



3. Click **Network > Routes > Policy-based routing**.
4. Click the **+** to add a new route policy.



The new route policy page is displayed:

New route policies are enabled by default. To disable, click to toggle **Enable** to off.

5. (Optional) For **Label**, type a label that will be used to identify this route policy.
6. For **Interface**, select the interface on the EX15 device that will be used with this route policy.
7. (Optional) Enable **Exclusive** to configure the policy to drop packets that match the policy when the gateway interface is disconnected, rather than forwarded through other interfaces.
8. For **IP version**, select **Any**, **IPv4**, or **IPv6**.

9. For **Protocol**, select **Any**, **TCP**, **UDP**, or **ICMP**.
  - If **TCP** or **UDP** is selected for **Protocol**, type the port numbers of the **Source port** and **Destination port**, or set to **any** to match for any port.
  - If **ICMP** is selected for **Protocol**, type the ICMP type and optional code, or set to **any** to match for any ICMP type.
10. For **DSCP**, type the 6-bit hexadecimal Differentiated Services Code Point (DSCP) field match criteria. This will match packets based on the DSCP field within the ToS field of the IP header.
11. Configure source address information:
  - a. Click to expand **Source address**.
  - b. For **Type**, select one of the following:
    - **Zone**: Matches the source IP address to the selected firewall zone. See [Firewall configuration](#) for more information about firewall zones.
    - **Interface**: Matches the source IP address to the selected interface's network address.
    - **IPv4 address**: Matches the source IP address to the specified IP address or network. Use the format `IPv4_address[/netmask]`, or use **any** to match any IPv4 address.
    - **IPv6 address**: Matches the source IP address to the specified IP address or network. Use the format `IPv6_address[/prefix_length]`, or use **any** to match any IPv6 address.
    - **MAC address**: Matches the source MAC address to the specified MAC address.
12. Configure the destination address information:
  - a. Click to expand **Destination address**.
  - b. For **Type**, select one of the following:
    - **Zone**: Matches the destination IP address to the selected firewall zone. See [Firewall configuration](#) for more information about firewall zones.
    - **Interface**: Matches the destination IP address to the selected interface's network address.
    - **IPv4 address**: Matches the destination IP address to the specified IP address or network. Use the format `IPv4_address[/netmask]`, or use **any** to match any IPv4 address.
    - **IPv6 address**: Matches the destination IP address to the specified IP address or network. Use the format `IPv6_address[/prefix_length]`, or use **any** to match any IPv6 address.
    - **Domain**: Matches the destination IP address to the specified domain names. To specify domains:
      - i. Click to expand **Domains**.
      - ii. Click the **+** to add a domain.
      - iii. For **Domain**, type the domain name.
      - iv. Repeat to add additional domains.
    - **Default route**: Matches packets destined for the default route, excluding routes for local networks.
13. Click **Apply** to save the configuration and apply the change.



## Command line

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the command line, type **config** to enter configuration mode:

---

```
> config
(config)>
```

---

3. Add a new routing policy:

---

```
(config)> add network route policy end
(config network route policy 0)>
```

---

New route policies are enabled by default. To disable:

---

```
(config network route policy 0)> enable false
(config network route policy 0)>
```

---

4. (Optional) Set the label that will be used to identify this route policy:

---

```
(config network route policy 0)> label "New route policy"
(config network route policy 0)>
```

---

5. Set the interface on the EX15 device that will be used with this route policy:
  - a. Use the **?** to determine available interfaces:

---

```
(config network route policy 0)>interface ?
```

---

Interface: The network interface used to reach the destination. Packets that satisfy the matching criteria will be routed through this interface. If the interface has a gateway then it will be used as the next hop.

Format:

```
/network/interface/defaultip
/network/interface/defaultlinklocal
/network/interface/lan
/network/interface/loopback
/network/interface/modem
/network/interface/wan
```

Current value:

---

```
(config network route policy 0)> interface
```

---

- b. Set the interface. For example:

---

```
(config network route policy 0)> interface /network/interface/wan
(config network route policy 0)>
```

---

6. (Optional) Enable **exclusive** to configure the policy to drop packets that match the policy when the gateway interface is disconnected, rather than forwarded through other interfaces:

---

```
(config network route policy 0)> exclusive true
(config network route policy 0)>
```

---

7. Select the IP version:

---

```
(config network route policy 0)> ip_version value
(config network route policy 0)>
```

---

where *value* is one of **any**, **ipv4**, or **ipv6**.

8. Set the protocol:

---

```
(config network route policy 0)> protocol value
(config network route policy 0)>
```

---

where *value* is one of:

- **any**: All protocols are matched.
- **tcp**: Source and destination ports are matched:

- a. Set the source port:

---

```
(config network route policy 0)> src_port value
(config network route policy 0)>
```

---

where *value* is the port number, or the keyword **any** to match any port as the source port.

- b. Set the destination port:

---

```
(config network route policy 0)> dst_port value
(config network route policy 0)>
```

---

where *value* is the port number, or the keyword **any** to match any port as the destination port.

- **udp**: Source and destination ports are matched:

- a. Set the source port:

---

```
(config network route policy 0)> src_port value
(config network route policy 0)>
```

---

where *value* is the port number, or the keyword **any** to match any port as the source port.

- b. Set the destination port:

---

```
(config network route policy 0)> dst_port value
(config network route policy 0)>
```

---

where *value* is the port number, or the keyword **any** to match any port as the destination port.

- **icmp**: The ICMP protocol is matched. Identify the ICMP type:

---

```
(config network route policy 0)> icmp_type value
(config network route policy 0)>
```

---

where *value* is the ICMP type and optional code, or set to **any** to match for any ICMP type.

9. Set the source address type:

---

```
(config network route policy 0)> src type value
(config network route policy 0)>
```

---

where *value* is one of:

- **zone**: Matches the source IP address to the selected firewall zone. Set the zone:

- a. Use the **?** to determine available zones:

---

```
(config network route policy 0)> src zone ?
```

---

Zone: Match the IP address to the specified firewall zone.

Format:

```
any
dynamic_routes
edge
external
internal
ipsec
loopback
setup
```

Default value: any

Current value: any

---

```
(config network route policy 0)> src zone
```

---

- b. Set the zone. For example:

---

```
(config network route policy 0)> src zone external
(config network route policy 0)>
```

---

See [Firewall configuration](#) for more information about firewall zones.

- **interface**: Matches the source IP address to the selected interface's network address. Set the interface:

- a. Use the **?** to determine available interfaces:

---

```
(config network route policy 0)>src interface ?
```

Interface: The network interface.

Format:

```
/network/interface/defaultip
/network/interface/defaultlinklocal
/network/interface/lan
/network/interface/loopback
/network/interface/modem
/network/interface/wan
```

Current value:

---

```
(config network route policy 0)> src interface
```

---

- b. Set the interface. For example:

---

```
(config network route policy 0)> src interface
/network/interface/wan
(config network route policy 0)>
```

---

- **address:** Matches the source IPv4 address to the specified IP address or network. Set the address that will be matched:

---

```
(config network route policy 0)> src address value
(config network route policy 0)>
```

---

where value uses the format **IPv4\_address[/netmask]**, or **any** to match any IPv4 address.

- **address6:** Matches the source IPv6 address to the specified IP address or network. Set the address that will be matched:

---

```
(config network route policy 0)> src address6 value
(config network route policy 0)>
```

---

where value uses the format **IPv6\_address[/prefix\_length]**, or **any** to match any IPv6 address.

- **mac:** Matches the source MAC address to the specified MAC address. Set the MAC address to be matched:

---

```
(config network route policy 0)> src mac MAC_address
(config network route policy 0)>
```

---

10. Set the destination address type:

---

```
(config network route policy 0)> dst type value
(config network route policy 0)>
```

---

where *value* is one of:

- **zone:** Matches the destination IP address to the selected firewall zone. Set the zone:

- a. Use the **?** to determine available zones:

---

```
(config network route policy 0)> dst zone ?
```

Zone: Match the IP address to the specified firewall zone.

Format:

```
any
dynamic_routes
edge
external
internal
ipsec
loopback
setup
```

Default value: any

Current value: any

---

```
(config network route policy 0)> dst zone
```

---

- b. Set the zone. For example:

---

```
(config network route policy 0)> dst zone external
(config network route policy 0)>
```

---

See [Firewall configuration](#) for more information about firewall zones.

- **interface:** Matches the destination IP address to the selected interface's network address. Set the interface:

- a. Use the **?** to determine available interfaces:

---

```
(config network route policy 0)>dst interface ?
```

Interface: The network interface.

Format:

```
/network/interface/defaultip
/network/interface/defaultlinklocal
/network/interface/lan
/network/interface/loopback
/network/interface/modem
/network/interface/wan
```

Current value:

---

```
(config network route policy 0)> dst interface
```

---

- b. Set the interface. For example:



---

```
(config network route policy 0)> dst interface
/network/interface/wan
(config network route policy 0)>
```

---

- **address:** Matches the destination IPv4 address to the specified IP address or network. Set the address that will be matched:

---

```
(config network route policy 0)> dst address value
(config network route policy 0)>
```

---

where value uses the format **IPv4\_address[/netmask]**, or **any** to match any IPv4 address.

- **address6:** Matches the destination IPv6 address to the specified IP address or network. Set the address that will be matched:

---

```
(config network route policy 0)> dst address6 value
(config network route policy 0)>
```

---

where value uses the format **IPv6\_address[/prefix\_length]**, or **any** to match any IPv6 address.

- **mac:** Matches the destination MAC address to the specified MAC address. Set the MAC address to be matched:

---

```
(config network route policy 0)> dst mac MAC_address
(config network route policy 0)>
```

---

11. Save the configuration and apply the change:

---

```
(config)> save
Configuration saved.
>
```

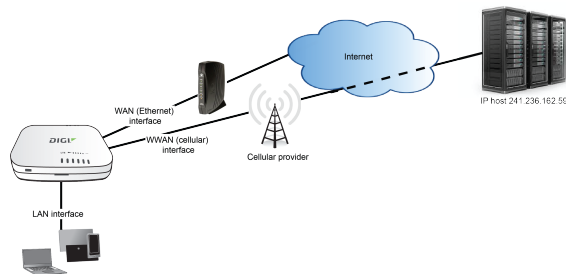
---

12. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

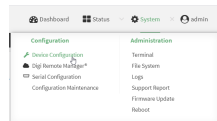
## Example: Dual WAN policy-based routing

This example routes traffic to a specific IP address to go through the cellular WWAN interface, while all other traffic uses the Ethernet WAN interface.

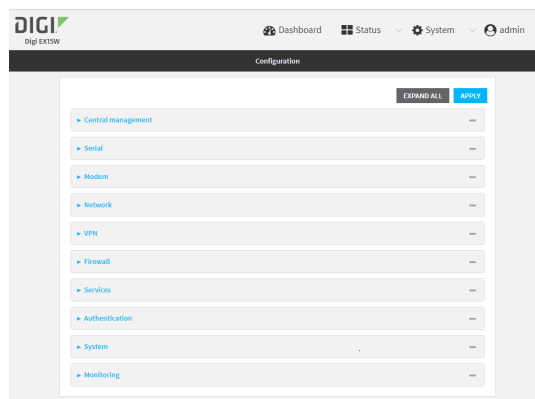


### WebUI

1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.



3. Click **Network > Routes > Policy-based routing**.
4. Click the **+** to add a new route policy.



5. For **Label**, enter **Route through cellular**.
6. For **Interface**, select .

7. Configure the source address:
  - a. Click to expand **Source address**.
  - b. For **Type**, select **Zone**.
  - c. For **Zone**, select **Internal**.
8. Configure the destination address:
  - a. Click to expand **Destination address**.
  - b. For **Type**, select **IPv4 address**.
  - c. For **IPv4 address**, type the IP address that will be the destination for outgoing traffic routed through the WWAN interface. In the above example, this is 241.236.162.59.

9. Click **Apply** to save the configuration and apply the change.

## Command line

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the command line, type **config** to enter configuration mode:

```
> config
(config)>
```

3. Create the route policy:
  - a. Add a new routing policy:

```
(config)> add network route policy end
(config network route policy 0)>
```

- b. Set the label that will be used to identify this route policy:

```
(config network route policy 0)> label "Route through cellular"
(config network route policy 0)>
```

- c. Set the interface:

```
(config network route policy 0)> interface /network/interface/
(config network route policy 0)>
```

- d. Configure the source address:

- i. Set the source type to **zone**:

```
(config network route policy 0)> src type zone
(config network route policy 0)>
```

- ii. Set the zone to **internal**:

```
(config network route policy 0)> src zone internal
(config network route policy 0)>
```

- e. Configure the destination address:

- i. Set the destination to use an IPv4 address:

```
(config network route policy 0)> dst type address
(config network route policy 0)>
```

- ii. Set the IP address that will be the destination for outgoing traffic routed through the WWAN interface. In the above example, this is 241.236.162.59.

```
(config network route policy 0)> dst address 241.236.162.59
(config network route policy 0)>
```

4. Save the configuration and apply the change:

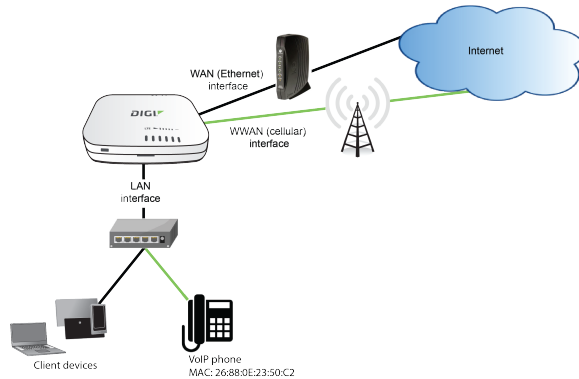
```
(config)> save
Configuration saved.
>
```

5. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

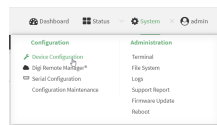
## Example: Route traffic to a specific WAN interface based on the client MAC address

This example routes all data from a certain client device through a cellular WAN based on the device's MAC address, while all other client devices are routed through the Ethernet WAN.

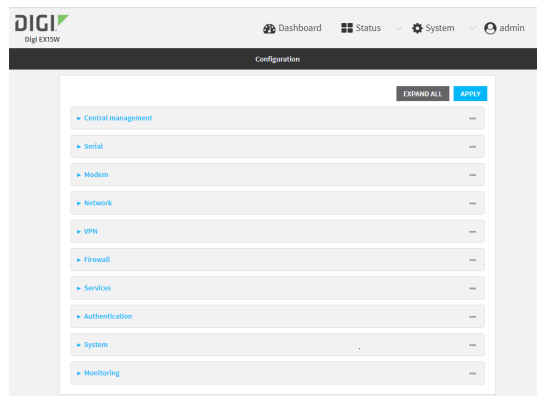


### WebUI

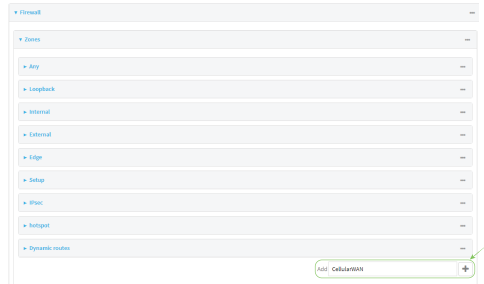
1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



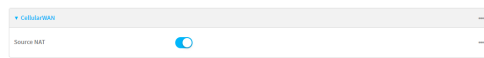
The **Configuration** window is displayed.



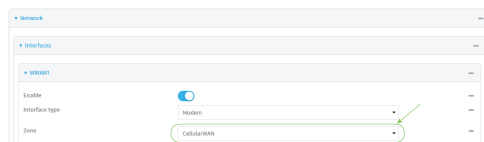
3. Create new firewall zones:
  - a. Create a firewall zone named CellularWAN with Source NAT enabled:
    - i. Click **Firewall > Zones**.
    - ii. For **Add Zone**, type **CellularWAN** and click **+**.



- iii. Enable Source **NAT**.



- b. Create second firewall zone named EthernetWAN with Source NAT enabled:
    - i. For **Add Zone**, type **EthernetWAN** and click **+**.
    - ii. Enable Source **NAT**.
4. Configure the WAN interfaces to use the new zones:
  - a. Configure the cellular WAN interface:
    - i. Click **Network > Interfaces > .**
    - ii. For **Zone**, select **CellularWAN**.



- b. Configure the Ethernet WAN interface:
      - i. Click **Network > Interfaces > .**
      - ii. For **Zone**, select **EthernetWAN**.
5. Configure the policy-based route for traffic from the client device that will be sent over the cellular WAN:
  - a. Click **Network > Routes > Policy-based routing**.
  - b. Click the **+** to add a new route policy.



- c. For **Label**, type **VoIP phone**.
- d. For **Interface**, select .
- e. Configure the source as the MAC address of the VoIP phone:
  - i. Click to expand **Source address**.
  - ii. For **Type**, select **MAC address**.
  - iii. For **MAC address**, type **26:88:0E:23:50:C2**.
- f. Configure the destination zone:
  - i. Click to expand **Destination address**.
  - ii. For **Type**, select **Zone**.
  - iii. For **Zone**, select **CellularWAN**.

The screenshot shows the 'VoIP phone' configuration page. It includes sections for 'Static routes' and 'Policy-based routing'. Under 'Policy-based routing', the 'VoIP phone' section is expanded, showing fields for 'Enable' (checked), 'Label' (VoIP phone), 'Interface' (Interface: Modem), 'Exclusive' (unchecked), 'IP version' (Any), and 'Protocol' (Any). Below this, the 'Source address' section is expanded, showing 'Type' (MAC address) and 'MAC address' (26:88:0E:23:50:C2). The 'Destination address' section is also expanded, showing 'Type' (Zone) and 'Zone' (CellularWAN).

6. Create a packet filtering rule that rejects all other LAN packets on the cellular WAN interface.
  - a. Click **Firewall > Packet filtering**.
  - b. Click the **+** to add a new packet filtering rule.

The screenshot shows the 'Firewall > Packet filtering' page. It has a sidebar with 'Zones', 'Port forwarding', and 'Packet filtering'. The 'Packet filtering' section is expanded, showing a list of rules. The first rule is 'Allow all outgoing traffic'. A green arrow points to the 'Add Packet Filter' button, which is represented by a plus sign (+).

- c. For **Label**, type **Reject LAN traffic to cellular WAN**.
- d. For **Action**, select **Drop**.
- e. For **Source zone**, select **Internal**.
- f. For **Destination zone**, select **CellularWAN**.

The screenshot shows the configuration page for the packet filtering rule 'Reject LAN traffic to cellular WAN'. It includes fields for 'Enable' (checked), 'Label' (Reject LAN traffic to cellular WAN), 'Action' (Drop), 'IP version' (Any), 'Protocol' (Any), 'Source zone' (Internal), and 'Destination zone' (CellularWAN).

7. Click **Apply** to save the configuration and apply the change.



## Command line

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.

2. At the command line, type **config** to enter configuration mode:

```
> config
(config)>
```

3. Create new firewall zones:

- a. Create a firewall zone named CellularWAN with Source NAT enabled:

- i. Create the firewall zone:

```
(config)> add firewall zone CellularWAN
(config firewall zone CellularWAN)>
```

- i. Enable Source NAT on the new zone:

```
(config firewall zone CellularWAN)> src_nat true
(config firewall zone CellularWAN)>
```

- b. Create second firewall zone named EthernetWAN with Source NAT enabled:

- i. Type **..** to move back one node in the configuration:

```
(config firewall zone CellularWAN)> ..
(config firewall zone)>
```

- ii. Create the firewall zone:

```
(config firewall zone)> add EthernetWAN
(config firewall zone EthernetWAN)>
```

- i. Enable Source NAT on the new zone:

```
(config firewall zone EthernetWAN)> src_nat true
(config firewall zone EthernetWAN)>
```

4. Configure the WAN interfaces to use the new zones:

- a. Set the zone for the cellular WAN interface:

- i. Type **...** to move to the root of the configuration:

```
(config firewall zone EthernetWAN)> ...
(config)>
```



- ii. Set the zone:

---

```
(config)> network interface zone CellularWAN
(config)>
```

---

- b. Set the zone for the Ethernet WAN interface:

---

```
(config)> network interface zone EthernetWAN
(config)>
```

---

- 5. Configure the policy-based route for traffic from the client device that will be sent over the cellular WAN:

- a. Add a new routing policy:

---

```
(config)> add network route policy end
(config network route policy 0)>
```

---

- b. Set the label that will be used to identify this route policy:

---

```
(config network route policy 0)> label "VoIP phone"
(config network route policy 0)>
```

---

- c. Set the interface:

---

```
(config network route policy 0)> interface /network/interface/
(config network route policy 0)>
```

---

- d. Configure the source as the MAC address of the VoIP phone:

- i. Set the source type to **mac**:

---

```
(config network route policy 0)> src type mac
(config network route policy 0)>
```

---

- ii. Set the MAC address to the MAC address of the VoIP phone:

---

```
(config network route policy 0)> src mac 26:88:0E:23:50:C2
(config network route policy 0)>
```

---

- e. Configure the destination zone:

- i. Set the source destination to **zone**:

---

```
(config network route policy 0)> dst type zone
(config network route policy 0)>
```

---

- ii. Set the zone to **CellularWAN**:

---

```
(config network route policy 0)> dst zone CellularWAN
(config network route policy 0)>
```

---

6. Create a packet filtering rule that rejects all other LAN packets on the cellular WAN interface:

- a. Create a new packet filtering rule:

- i. Type **...** to move to the root of the configuration:

```
(config network route policy 0)> ...
(config)>
```

- ii. Create the packet filtering rule:

```
(config)> add firewall filter end
(config firewall filter 2)>
```

- b. Set the label to **Reject LAN traffic to cellular WAN**:

```
(config firewall filter 2)> label "Reject LAN traffic to cellular WAN"
(config firewall filter 2)>
```

- c. Set the action to **drop**:

```
(config firewall filter 2)> action drop
(config firewall filter 2)>
```

- d. Set the source zone to **internal**:

```
(config firewall filter 2)> src_zone internal
(config firewall filter 2)>
```

- e. Set the destination zone to **CellularWAN**:

```
(config firewall filter 2)> dst_zone CellularWAN
(config firewall filter 2)>
```

7. Save the configuration and apply the change:

```
(config firewall filter 2)> save
Configuration saved.
>
```

8. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Routing services

Your EX15 includes support for dynamic routing services and protocols. The following routing services are supported:

| Service or protocol | Information                                                                                                                           |
|---------------------|---------------------------------------------------------------------------------------------------------------------------------------|
| RIP                 | The IPv4 Routing Information Protocol (RIP) service supports RIPv2 ( <a href="#">RFC2453</a> ) and RIPv1 ( <a href="#">RFC1058</a> ). |

| Service or protocol | Information                                                                                     |
|---------------------|-------------------------------------------------------------------------------------------------|
| RIPng               | The IPv6 Routing Information Protocol (RIP) service supports RIPng ( <a href="#">RFC2080</a> ). |
| OSPFv2              | The IPv4 Open Shortest Path First (OSPF) service supports OSPFv2 ( <a href="#">RFC2328</a> ).   |
| OSPFv3              | The IPv6 Open Shortest Path First (OSPF) service supports OSPFv3 ( <a href="#">RFC2740</a> ).   |
| BGP                 | The Border Gateway Protocol (BGP) service supports BGP-4 ( <a href="#">RFC1771</a> ).           |
| Babel               | The IPv4 and IPv6 Babel service.                                                                |
| IS-IS               | The IPv4 and IPv6 Intermediate System to Intermediate System (IS-IS) service.                   |

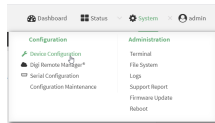
## Configure routing services

### Required configuration items

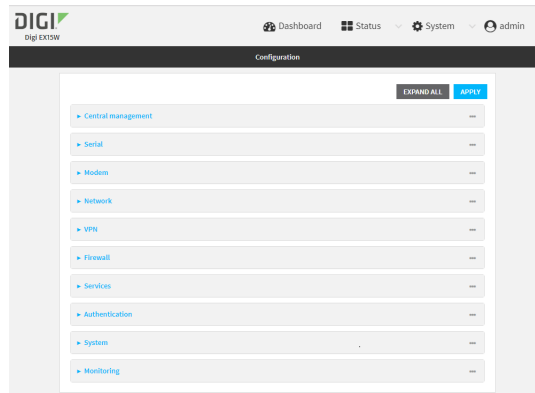
- Enable routing services.
- Enable and configure the types of routing services that will be used.

## WebUI

1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.



3. Click **Network > Routes > Routing services**.
4. Click **Enable**.



The default firewall zone setting, **Dynamic routes**, is specifically designed to work with routing services and should be left as the default.

5. Configure the routing services that will be used:
  - a. Click to expand a routing service.
  - b. **Enable** the routing service.
  - c. Complete the configuration of the routing service.
6. Click **Apply** to save the configuration and apply the change.



## Command line

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the command line, type **config** to enter configuration mode:

---

```
> config
(config)>
```

---

3. Enable routing services:

---

```
(config)> network route service enable true
(config)>
```

---

4. Configure routing services that will be used:
  - a. Use the **?** to display available routing services:

---

```
(config)> network route service ?
```

Routing services: Settings for dynamic routing services and protocols.

| Parameters | Current Value  |        |
|------------|----------------|--------|
| enable     | true           | Enable |
| zone       | dynamic_routes | Zone   |

Additional Configuration

---

|        |        |
|--------|--------|
| babel  | Babel  |
| bgp    | BGP    |
| isis   | IS-IS  |
| ospfv2 | OSPFv2 |
| ospfv3 | OSPFv3 |
| rip    | RIP    |
| ripng  | RIPng  |

```
(config)>
```

---

- b. Enable a routing service that will be used. For example, to enable the RIP service:

---

```
(config)> network route service rip enable true
(config)>
```

---

- c. Complete the configuration of the routing service. For example, use the **?** to view the available parameters for the RIP service:

---

```
(config)> network route service rip ?
```

| Parameters | Current Value |
|------------|---------------|
| -----      |               |

---

```

ecmp false Allow ECMP
enable true Enable

Additional Configuration

interface Interfaces
neighbour Neighbours
redis Route redistribution
timer Timers

(config)>
```

- 5. Save the configuration and apply the change:

```
(config)> save
Configuration saved.
>
```

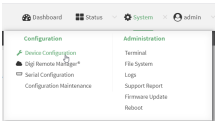
- 6. Type **exit** to exit the Admin CLI.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

Show the routing table

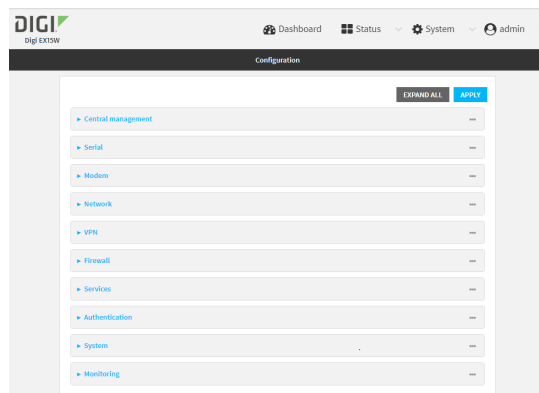
To display the routing table:

 WebUI

- 1. Log into the EX15 WebUI as a user with full Admin access rights.
- 2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.



3. Click **Status > Routes**.  
The **Network Routing** window is displayed.
4. Click **IPv4 Load Balance** to view IPv4 load balancing.
5. Click **IPv6 Load Balance** to view IPv6 load balancing.

### Command line

1. Log into the EX15 command line as a user with Admin access.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the Admin CLI prompt, type **show route**:  
You can limit the display to only IPv4 entries by using **show route ipv4**, or to IPv6 entries by using **show route ipv6**. You can also display more information by adding the **verbose** option to the **show route** and **show route ip\_type** commands.
3. Type **exit** to exit the Admin CLI.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Dynamic DNS

The Domain Name System (DNS) uses name servers to provide a mapping between computer-readable IP addresses and human-readable hostnames. This allows users to access websites and personal networks with easy-to-remember URLs. Unfortunately, IP addresses change frequently, invalidating these mappings when they do. Dynamic DNS has become the standard method of addressing this problem, allowing devices to update name servers with their new IP addresses.

By providing the EX15 device with the domain name and credentials obtained from a dynamic DNS provider, the router can automatically update the remote nameserver whenever your WAN or public IP address changes.

Your EX15 device supports a number of Dynamic DNS providers as well as the ability to provide a custom provider that is not included on the list of providers.

### Configure dynamic DNS

This section describes how to configure dynamic DNS on a EX15 device.

**Required configuration items**

- Add a new Dynamic DNS service.
- The interface that has its IP address registered with the Dynamic DNS provider.
- The name of a Dynamic DNS provider.
- The domain name that is linked to the interface's IP address.
- The username and password to authenticate with the Dynamic DNS provider.

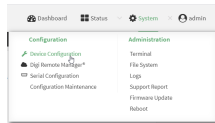
**Additional configuration items**

- If the Dynamic DNS service provider is set to **custom**, identify the URL that should be used to update the IP address with the Dynamic DNS provider.
- The amount of time to wait to check if the interface's IP address needs to be updated.
- The amount of time to wait to force an update of the interface's IP address.
- The amount of time to wait for an IP address update to succeed before retrying the update.
- The number of times to retry a failed IP address update.

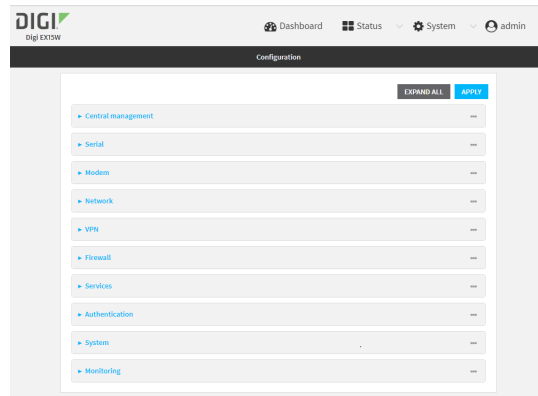


## WebUI

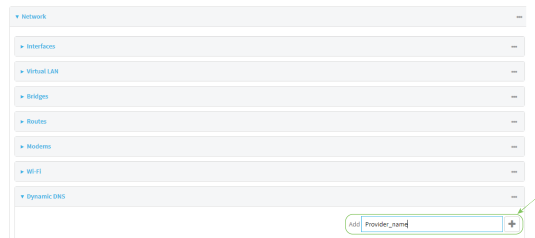
1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



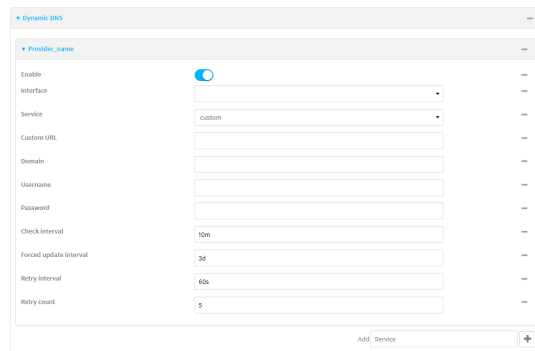
The **Configuration** window is displayed.



3. Click **Network > Dynamic DNS**.
4. Type a name for this Dynamic DNS instance in **Add Service** and click **+**.



The Dynamic DNS configuration page displays.



New Dynamic DNS configurations are enabled by default. To disable, click to toggle **Enable** to off.

5. For **Interface**, select the interface that has its IP address registered with the Dynamic DNS provider.
6. For **Service**, select the Dynamic DNS provider, or select **custom** to enter a custom URL for the Dynamic DNS provider.
7. If **custom** is selected for **Service**, type the **Custom URL** that should be used to update the IP address with the Dynamic DNS provider.
8. Type the **Domain** name that is linked to the interface's IP address.
9. Type the **Username** and **Password** used to authenticate with the Dynamic DNS provider.
10. (Optional) For **Check Interval**, type the amount of time to wait to check if the interface's IP address needs to be updated.  
 Allowed values are any number of weeks, days, hours, minutes, or seconds, and take the format **number{w|d|h|m|s}**.  
 For example, to set **Check interval** to ten minutes, enter **10m** or **600s**.
11. (Optional) For **Forced update interval**, type the amount of time to wait to force an update of the interface's IP address.  
 Allowed values are any number of weeks, days, hours, minutes, or seconds, and take the format **number{w|d|h|m|s}**.  
 For example, to set **Forced update interval** to ten minutes, enter **10m** or **600s**.  
 The setting for **Forced update interval** must be larger than the setting for **Check Interval**.
12. (Optional) For **Retry interval**, type the amount of time to wait for an IP address update to succeed before retrying the update.  
 Allowed values are any number of weeks, days, hours, minutes, or seconds, and take the format **number{w|d|h|m|s}**.  
 For example, to set **Retry interval** to ten minutes, enter **10m** or **600s**.
13. (Optional) For **Retry count**, type the number of times to retry a failed IP address update.
14. Click **Apply** to save the configuration and apply the change.



## Command line

1. Log into the EX15 command line as a user with full Admin access rights.  
 Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the command line, type **config** to enter configuration mode:
 

```
> config
(config)>
```
3. Add a new Dynamic DNS instance. For example, to add an instance named **new\_ddns\_instance**:

---

```
(config)> add network ddns new_ddns_instance
(config network ddns new_ddns_instance)>
```

---

New Dynamic DNS instances are enabled by default. To disable:

---

```
(config network ddns new_ddns_instance)> enable false
(config network ddns new_ddns_instance)>
```

---

4. Set the interface for the Dynamic DNS instance:

a. Use the **?** to determine available interfaces:

---

```
(config network ddns new_ddns_instance)>interface ?
```

---

Interface: The network interface from which to obtain the IP address to register with the dynamic DNS service.

Format:

```
defaultip
defaultlinklocal
lan
loopback
modem
wan
```

Current value:

---

```
(config network ddns new_ddns_instance)> interface
```

---

b. Set the interface. For example:

---

```
(config network ddns new_ddns_instance)> interface wan
(config network ddns new_ddns_instance)>
```

---

5. Set the Dynamic DNS provider service:

a. Use the **?** to determine available services:

---

```
(config network ddns new_ddns_instance)> service ?
```

---

Service: The provider of the dynamic DNS service.

Format:

```
custom
3322.org
changeip.com
ddns.com.br
dnsdynamic.org
...
```

Default value: custom

Current value: custom

---

```
(config network ddns new_ddns_instance)> service
```

---

- b. Set the service:

---

```
(config network ddns new_ddns_instance)> service service_name
(config network ddns new_ddns_instance)>
```

---

6. If **custom** is configured for **service**, set the custom URL that should be used to update the IP address with the Dynamic DNS provider:

---

```
(config network ddns new_ddns_instance)> custom url
(config network ddns new_ddns_instance)>
```

---

7. Set the domain name that is linked to the interface's IP address:

---

```
(config network ddns new_ddns_instance)> domain domain_name
(config network ddns new_ddns_instance)>
```

---

8. Set the username to authenticate with the Dynamic DNS provider:

---

```
(config network ddns new_ddns_instance)> username name
(config network ddns new_ddns_instance)>
```

---

9. Set the password to authenticate with the Dynamic DNS provider:

---

```
(config network ddns new_ddns_instance)> password pwd
(config network ddns new_ddns_instance)>
```

---

10. (Optional) Set the amount of time to wait to check if the interface's IP address needs to be updated:

---

```
(config network ddns new_ddns_instance)> check_interval value
(config network ddns new_ddns_instance)>
```

---

where *value* is any number of weeks, days, hours, minutes, or seconds, and takes the format **number{w|d|h|m|s}**.

For example, to set **check\_interval** to ten minutes, enter either **10m** or **600s**:

---

```
(config network ddns new_ddns_instance)> check_interval 600s
(config network ddns new_ddns_instance)>
```

---

The default is **10m**.

11. (Optional) Set the amount of time to wait to force an update of the interface's IP address:

---

```
(config network ddns new_ddns_instance)> force_interval value
(config network ddns new_ddns_instance)>
```

---

where *value* is any number of weeks, days, hours, minutes, or seconds, and takes the format **number{w|d|h|m|s}**.

For example, to set **force\_interval** to ten minutes, enter either **10m** or **600s**:

---

```
(config network ddns new_ddns_instance)> force_interval 600s
(config network ddns new_ddns_instance)>
```

---

The default is **3d**.

12. (Optional) Set the amount of time to wait for an IP address update to succeed before retrying the update:

---

```
(config network ddns new_ddns_instance)> retry_interval value
(config network ddns new_ddns_instance)>
```

---

where *value* is any number of weeks, days, hours, minutes, or seconds, and takes the format **number{w|d|h|m|s}**.

For example, to set **retry\_interval** to ten minutes, enter either **10m** or **600s**:

---

```
(config network ddns new_ddns_instance)> retry_interval 600s
(config network ddns new_ddns_instance)>
```

---

The default is **60s**.

13. (Optional) Set the number of times to retry a failed IP address update:

---

```
(config network ddns new_ddns_instance)> retry_count value
(config network ddns new_ddns_instance)>
```

---

where *value* is any interger. The default is **5**.

14. Save the configuration and apply the change:

---

```
(config)> save
Configuration saved.
>
```

---

15. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Virtual Router Redundancy Protocol (VRRP)

Virtual Router Redundancy Protocol (VRRP) is a standard for gateway device redundancy and failover that creates a "virtual router" with a floating IP address. Devices connected to the LAN then use this virtual router as their default gateway. Responsibility for the virtual router is assigned to one of the VRRP-enabled devices on a LAN (the "master router"), and this responsibility transparently fails over to backup VRRP devices if the master router fails. This prevents the default gateway from being a single point of failure, without requiring configuration of dynamic routing or router discovery protocols on every host.

Multiple EX15 devices can be configured as VRRP devices and assigned a priority. The router with the highest priority will be used as the master router. If the master router fails, then the IP address of the virtual router is mapped to the backup device with the next highest priority. Each VRRP router is configured with a unique LAN IP address, and the same shared VRRP address.

### VRRP+

VRRP+ is an extension to the VRRP standard that uses network probing to monitor connections through VRRP-enabled devices and can dynamically change the priority of the devices, including changing devices from master to backup, and from backup to master, even if the device has not failed. For example, if a host becomes unreachable on the far end of a network link, then the physical default gateway can be changed by adjusting the VRRP priority of the EX15 device connected to the failing link. This provides failover capabilities based on the status of connections behind the router, in

addition to the basic VRRP device failover. For EX15 devices, [SureLink](#) is used to probe network connections.

VRRP+ can be configured to probe a specified IP address by either sending an ICMP echo request (ping) or attempting to open a TCP socket to the IP address.

## Configure VRRP

This section describes how to configure VRRP on a EX15 device.

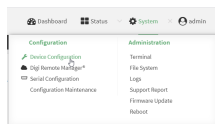
### Required configuration items

- Enable VRRP.
- The interface used by VRRP.
- The Router ID that identifies the virtual router instance. The Router ID must be the same on all VRRP devices that participate in the same VRRP device pool.
- The VRRP priority of this device.
- The shared virtual IP address for the VRRP virtual router. Devices connected to the LAN will use this virtual IP address as their default gateway.

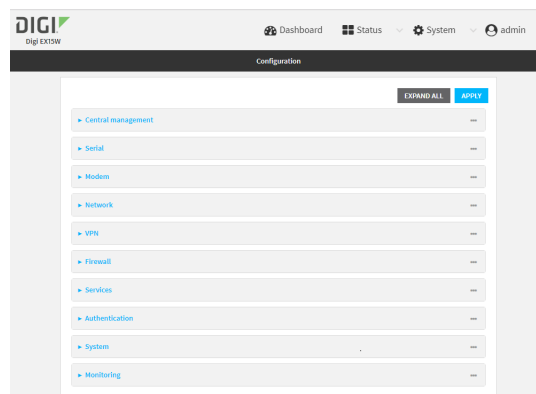
See [Configure VRRP+](#) for information about configuring VRRP+, an extension to VRRP that uses network probing to monitor connections through VRRP-enabled devices and dynamically change the VRRP priority of devices based on the status of their network connectivity.

## WebUI

1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.

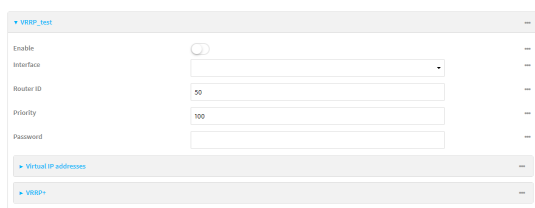


3. Click **Network > VRRP**.

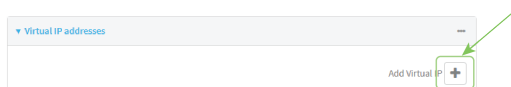
4. For **Add VRRP instance**, type a name for the VRRP instance and click **+**.



The new VRRP instance configuration is displayed.



5. Click **Enable**.
6. For **Interface**, select the interface on which this VRRP instance should run.
7. For **Router ID** field, type the ID of the virtual router instance. The Router ID must be the same on all VRRP devices that participate in the same VRRP device pool. Allowed values are from **1** and **255**, and it is configured to **50** by default.
8. For **Priority**, type the priority for this router in the group. The router with the highest priority will be used as the master router. If the master router fails, then the IP address of the virtual router is mapped to the backup device with the next highest priority. If this device's actual IP address is being used as the virtual IP address of the VRRP pool, then the priority of this device should be set to **255**. Allowed values are from **1** and **255**, and it is configured to **100** by default.
9. (Optional) For **Password**, type a password that will be used to authenticate this VRRP router with VRRP peers. If the password length exceeds 8 characters, it will be truncated to 8 characters.
10. Configure the virtual IP addresses associated with this VRRP instance:
  - a. Click to expand **Virtual IP addresses**.
  - b. Click **+** to add a virtual IP address.



- c. For **Virtual IP**, type the IPv4 or IPv6 address for a virtual IP of this VRRP instance.
  - d. (Optional) Repeat to add additional virtual IPs.
11. See [Configure VRRP+](#) for information about configuring VRRP+.
12. Click **Apply** to save the configuration and apply the change.



## Command line

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.

2. At the command line, type **config** to enter configuration mode:

```
> config
(config)>
```

3. Add a VRRP instance. For example:

```
(config)> add network vrrp VRRP_test
(config network vrrp VRRP_test)>
```

4. Enable the VRRP instance:

```
(config network vrrp VRRP_test)> enable true
(config network vrrp VRRP_test)>
```

5. Set the interface on which this VRRP instance should run:

- a. Use the **?** to determine available interfaces:

```
(config network vrrp VRRP_test)>interface ?
```

Interface: The network interface to communicate with VRRP peers on and listen for traffic to virtual IP addresses.

Format:

```
/network/interface/defaultip
/network/interface/defaultlinklocal
/network/interface/lan
/network/interface/loopback
/network/interface/modem
/network/interface/wan
```

Current value:

```
(config network vrrp VRRP_test)> interface
```

- b. Set the interface, for example:

```
(config network vrrp VRRP_test)> interface /network/interface/lan
(config network vrrp VRRP_test)>
```

- c. Repeat for additional interfaces.

6. Set the router ID. The Router ID must be the same on all VRRP devices that participate in the same VRRP device pool. Allowed values are from **1** and **255**, and it is configured to **50** by



default.

---

```
(config network vrrp VRRP_test)> router_id int
(config network vrrp VRRP_test)>
```

---

7. Set the priority for this router in the group. The router with the highest priority will be used as the master router. If the master router fails, then the IP address of the virtual router is mapped to the backup device with the next highest priority. If this device's actual IP address is being used as the virtual IP address of the VRRP pool, then the priority of this device should be set to **255**. Allowed values are from **1** and **255**, and it is configured to **100** by default.

---

```
(config network vrrp VRRP_test)> priority int
(config network vrrp VRRP_test)>
```

---

8. (Optional) Set a password that will be used to authenticate this VRRP router with VRRP peers. If the password length exceeds 8 characters, it will be truncated to 8 characters.

---

```
(config network vrrp VRRP_test)> password pwd
(config network vrrp VRRP_test)>
```

---

9. Add a virtual IP address associated with this VRRP instance. This can be an IPv4 or IPv6 address.

---

```
(config network vrrp VRRP_test)> add virtual_address end ip_address
(config network vrrp VRRP_test)>
```

---

Additional virtual IP addresses can be added by repeating this step with different values for *ip\_address*.

10. Save the configuration and apply the change:

---

```
(config network vrrp new_vrrp_instance)> save
Configuration saved.
>
```

---

11. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Configure VRRP+

VRRP+ is an extension to the VRRP standard that uses SureLink network probing to monitor connections through VRRP-enabled devices and adjust devices' VRRP priority based on the status of the SureLink tests.

This section describes how to configure VRRP+ on a EX15 device.

### Required configuration items

- Both master and backup devices:
  - A configured and enabled instance of VRRP. See [Configure VRRP](#) for information.
  - Enable VRRP+.

- WAN interfaces to be monitored by using VRRP+.

**Note** SureLink is enabled by default on all WAN interfaces, and should not be disabled on the WAN interfaces that are being monitored by VRRP+.

If multiple WAN interfaces are being monitored on the same device, the VRRP priority will be adjusted only if all WAN interfaces fail SureLink tests.

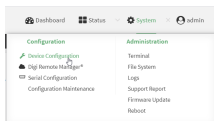
- The amount that the VRRP priority will be modified when SureLink determines that the VRRP interface is not functioning correctly.
- Configure the VRRP interface's DHCP server to use a custom gateway that corresponds to one of the VRRP virtual IP addresses.
- Backup devices only:
  - Enable and configure SureLink on the VRRP interface.
  - Set the IP gateway to the IP address of the VRRP interface on the master device.

### Additional configuration items

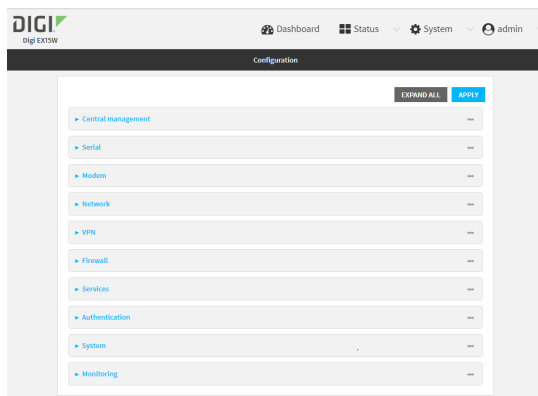
- For backup VRRP devices, enable the ability to monitor the VRRP master, so that a backup device can increase its priority when the master device fails SureLink tests.

## WebUI

1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.



3. Click **Network > VRRP**.
4. Create a new VRRP instance, or click to expand an existing VRRP instance.  
See [Configure VRRP](#) for information about creating a new VRRP instance.

5. Click to expand **VRRP+**.

6. Click **Enable**.
7. Add interfaces to monitor:
  - a. Click to expand **Monitor interfaces**.
  - b. Click **+** to add an interface for monitoring.

- c. For **Interface**, select the local interface to monitor. Generally, this will be a cellular or WAN interface.
  - d. (Optional) Click **+** again to add additional interfaces.
8. (Optional) For backup devices, click to enable **Monitor VRRP+ master**.  
This parameter allows a backup VRRP device to monitor the master device, and increase its priority when the master device is failing SureLink tests. This can allow a device functioning as a backup device to promote itself to master.
9. For **Priority modifier**, type or select the amount that the device's priority should be decreased due to SureLink connectivity failure, and increased when SureLink succeeds again.  
Along with the priority settings for devices in this VRRP pool, the amount entered here should be large enough to automatically demote a master device when SureLink connectivity fails. For example, if the VRRP master device has a priority of **100** and the backup device has a priority of **80**, then the **Priority modifier** should be set to an amount greater than **20** so that if SureLink fails on the master, it will lower its priority to below **80**, and the backup device will assume the master role.
10. Configure the VRRP interface. The VRRP interface is defined in the **Interface** parameter of the VRRP configuration, and generally should be a LAN interface:

The screenshot shows the VRRP configuration page. The 'VRRP' section is expanded, and 'Interface LAN1' is selected. The 'Virtual IP address' section shows '10.0.0.1'. The 'Monitor interfaces' section is also visible.

To configure the VRRP interface:

- Click to expand **Network > Interfaces**.
- Click to expand the appropriate VRRP interface (for example, **LAN1**).
- For backup devices, for **Default Gateway**, type the IP address of the VRRP interface on the master device.

The screenshot shows the IP configuration page. The 'IP' section is expanded, and 'Static IP address' is selected. The 'Address' field is set to '102.168.3.2/24'. The 'default gateway' field is set to '102.168.3.1'. A callout points to the 'default gateway' field with the text 'IP address of the VRRP interface on the master device'.

- Configure the VRRP interface's DHCP server to use a custom gateway that corresponds to one of the VRRP virtual IP addresses:
  - Click to expand **DHCP Server > Advanced settings**.
  - For **Gateway**, select **Custom**.
  - For **Custom gateway**, enter the IP address of one of the virtual IPs used by this VRRP instance.

The screenshot shows the DHCP server configuration page. The 'DHCP server' section is expanded, and 'Enable' is checked. The 'Advanced settings' section is expanded, showing 'Gateway' set to 'Custom' and 'Custom gateway' set to '102.168.3.1'.

- For backup devices, enable and configure SureLink on the VRRP interface. Generally, this should be a LAN interface; VRRP+ will then monitor the LAN using SureLink to determine if the interface has network connectivity and promote a backup to master if SureLink fails.
  - Click to expand **IPv4 > SureLink**.
  - Click **Enable**.
  - For **Interval**, type the amount of time to wait between connectivity tests. To guarantee seamless internet access for VRRP+ purposes, SureLink tests should occur

more often than the default of 15 minutes.

Allowed values are any number of weeks, days, hours, minutes, or seconds, and take the format **number{w|d|h|m|s}**. For example, to set **Interval** to five seconds, enter **5s**.

- iv. Click to expand **Test targets > Test target**.
- v. Configure the test target. For example, to configure SureLink to verify internet connectivity on the LAN by pinging my.devicecloud.com:
  - i. For **Test Type**, select **Ping test**.
  - ii. For **Ping host**, type **my.devicecloud.com**.

11. Click **Apply** to save the configuration and apply the change.

## Command line

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the command line, type **config** to enter configuration mode:

```
> config
(config)>
```

3. Create a new VRRP instance, or edit an existing one. See [Configure VRRP](#) for information about creating a new VRRP instance.
4. Enable VRRP+:

```
(config)> network vrrp VRRP_test vrrp_plus enable true
(config)>
```

5. Add interfaces to monitor. Generally, this will be a cellular or WAN interface.
  - a. Use the **?** to determine available interfaces:

```
(config)>network vrrp test interface ?
```

```
Interface: The network interface.
```

---

Format:

```
/network/interface/defaultip
/network/interface/defaultlinklocal
/network/interface/lan
/network/interface/loopback
/network/interface/modem
/network/interface/wan
```

Current value:

---

```
(config)> network vrrp test interface
```

---

- b. Set the interface, for example:

---

```
(config)> add network vrrp VRRP_test vrrp_plus monitor_interface end
/network/interface/modem
(config)>
```

---

- c. (Optional) Repeat for additional interfaces.

6. Set the amount that the device's priority should be decreased or increased due to SureLink connectivity failure or success:

---

```
(config)> network vrrp VRRP_test vrrp_plus weight value
(config)>
```

---

where *value* is an integer between **1** and **254**. The default is **10**.

Along with the priority settings for devices in this VRRP pool, the amount entered here should be large enough to automatically demote a master device when SureLink connectivity fails. For example, if the VRRP master device has a priority of **100** and the backup device has a priority of **80**, then **weight** should be set to an amount greater than **20** so that if SureLink fails on the master, it will lower its priority to below **80**, and the backup device will assume the master role.

7. (Optional) For backup devices, enable the ability for the device to monitor the master device. This allows a backup VRRP device to monitor the master device, and increase its priority when the master device is failing SureLink tests. This can allow a device functioning as a backup device to promote itself to master.

---

```
(config)> network vrrp VRRP_test vrrp_plus monitor_master true
(config)>
```

---

8. Configure the VRRP interface:

- a. Configure the VRRP interface's DHCP server to use a custom gateway that corresponds to one of the VRRP virtual IP addresses:
- i. Set the DHCP server gateway type to custom:

---

```
(config)> network interface lan ipv4 dhcp_server advanced gateway
custom
(config)>
```

---

- ii. Determine the VRRP virtual IP addresses:

---

```
(config)> show network vrrp VRRP_test virtual_address
0 192.168.3.3
1 10.10.10.1

(config)>
```

---

- iii. Set the custom gateway to one of the VRRP virtual IP addresses. For example:

---

```
(config)> network interface lan ipv4 dhcp_server advanced gateway_
custom 192.168.3.3
(config)>
```

---

- b. For backup devices, set the default gateway to the IP address of the VRRP interface on the master device. For example:

---

```
(config)> network interface lan ipv4 gateway 192.168.3.1
(config)>
```

---

- c. For backup devices, enable and configure SureLink on the VRRP interface.

- i. Determine the VRRP interface. Generally, this should be a LAN interface; VRRP+ will then monitor the LAN using SureLink to determine if the interface has network connectivity and promote a backup to master if SureLink fails.

---

```
(config)> show network vrrp VRRP_test interface
/network/interface/lan
(config)>
```

---

- ii. Enable SureLink on the interface:

---

```
(config)> network interface lan ipv4 surelink enable true
(config)>
```

---

- iii. Set the amount of time to wait between connectivity tests:

---

```
(config)> network interface lan ipv4 surelink interval value
(config)>
```

---

where *value* is any number of weeks, days, hours, minutes, or seconds, and takes the format **number{w|d|h|m|s}**.

For example, to set **interval** to ten minutes, enter **5s**:

---

```
(config)> network interface lan ipv4 surelink interval 5s
(config)>
```

---

- iv. Create a SureLink test target:

---

```
(config)> add network interface lan ipv4 surelink target end
(config network interface lan ipv4 surelink target 0)>
```

---

## v. Configure the type of test for the test target:

---

```
(config network interface lan ipv4 surelink target 0)> test value
(config network interface lan ipv4 surelink target 0)>
```

---

where *value* is one of:

- **ping:** Tests connectivity by sending an ICMP echo request to a specified hostname or IP address.

- Specify the hostname or IP address:

---

```
(config network interface lan ipv4 surelink target 0)>
ping_host host
(config network interface lan ipv4 surelink target 0)>
```

---

- (Optional) Set the size, in bytes, of the ping packet:

---

```
(config network interface lan ipv4 surelink target 0)>
ping_size [num]
(config network interface lan ipv4 surelink target 0)>
```

---

- **dns:** Tests connectivity by sending a DNS query to the specified DNS server.

- Specify the DNS server. Allowed value is the IP address of the DNS server.

---

```
(config network interface lan ipv4 surelinktarget 0)> dns_
server ip_address
(config network interface lan ipv4 surelinktarget 0)>
```

---

- **dns\_configured:** Tests connectivity by sending a DNS query to the DNS servers configured for this interface.

- **http:** Tests connectivity by sending an HTTP or HTTPS GET request to the specified URL.

- Specify the url:

---

```
(config network interface lan ipv4 surelink target 0)>
http_url value
(config network interface lan ipv4 surelink target 0)>
```

---

where *value* uses the format **http[s]://hostname/[path]**

- **interface\_up:** The interface is considered to be down based on the interfaces down time, and the amount of time an initial connection to the interface takes before this test is considered to have failed.

- (Optional) Set the amount of time that the interface can be down before this test is considered to have failed:

---

```
(config network interface lan ipv4 surelink target 0)>
interface_down_time value
(config network interface lan ipv4 surelink target 0)>
```

---

where *value* is any number of weeks, days, hours, minutes, or seconds, and takes the format **number{w|d|h|m|s}**.



For example, to set **interface\_down\_time** to ten minutes, enter either **10m** or **600s**:

---

```
(config network interface lan ipv4 surelink target 0)>
interface_down_time 600s
(config network interface lan ipv4 surelink target 0)>
```

---

The default is 60 seconds.

- (Optional) Set the amount of time to wait for an initial connection to the interface before this test is considered to have failed:

---

```
(config network interface lan ipv4 surelink target 0)>
interface_timeout value
(config network interface lan ipv4 surelink target 0)>
```

---

where *value* is any number of weeks, days, hours, minutes, or seconds, and takes the format **number{w|d|h|m|s}**.

For example, to set **interface\_timeout** to ten minutes, enter either **10m** or **600s**:

---

```
(config network interface lan ipv4 surelink target 0)>
interface_timeout 600s
(config network interface lan ipv4 surelink target 0)>
```

---

The default is 60 seconds.

9. Save the configuration and apply the change:

---

```
(config)> save
Configuration saved.
>
```

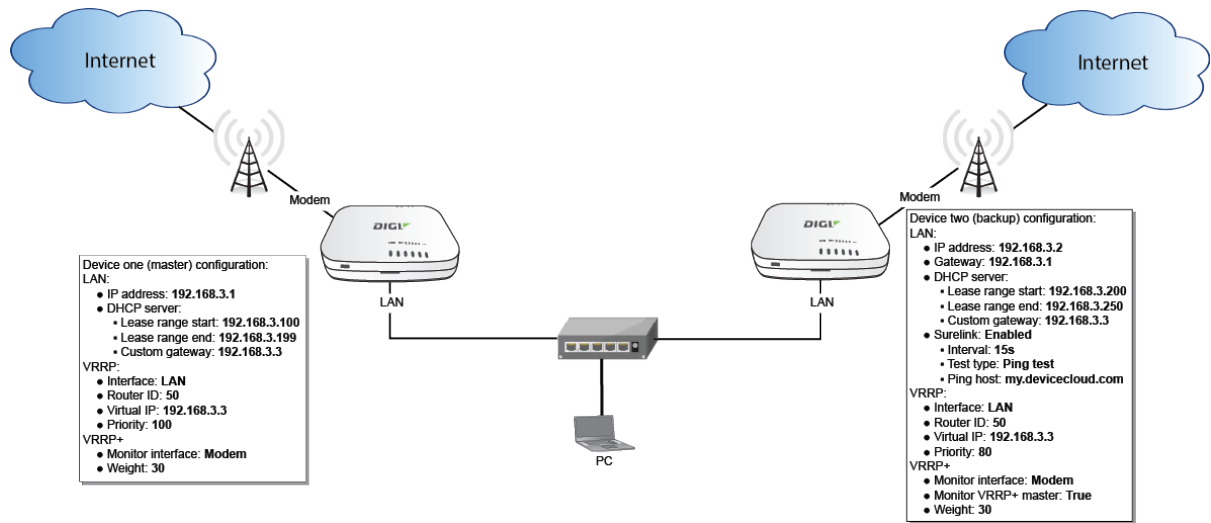
---

10. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Example: VRRP/VRRP+ configuration

This example configuration creates a VRRP pool containing two EX15 devices:

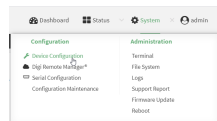


## Configure device one (master device)

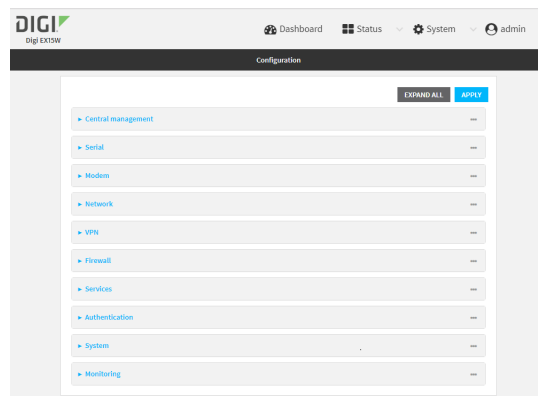
### WebUI

#### Task 1: Configure VRRP on device one

1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.

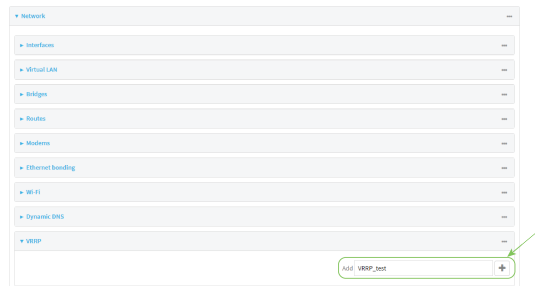


The **Configuration** window is displayed.

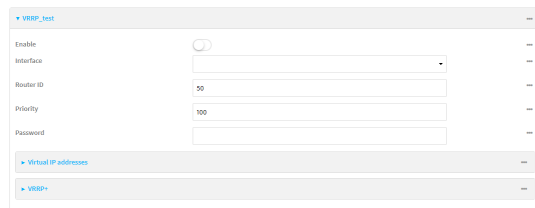


3. Click **Network > VRRP**.

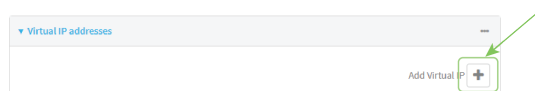
- For **Add VRRP instance**, type a name for the VRRP instance and click **+**.



The new VRRP instance configuration is displayed.



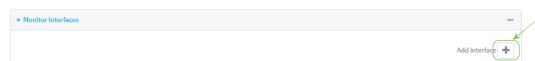
- Click **Enable**.
- For **Interface**, select **Interface: LAN**.
- For **Router ID**, leave at the default setting of **50**.
- For **Priority**, leave at the default setting of **100**.
- Click to expand **Virtual IP addresses**.
- Click **+** to add a virtual IP address.



- For **Virtual IP**, type **192.168.3.3**.

## Task 2: Configure VRRP+ on device one

- Click to expand **VRRP+**.
- Click **Enable**.
- Click to expand **Monitor interfaces**.
- Click **+** to add an interface for monitoring.



- Select **Interface: Modem**.
- For **Priority modifier**, type **30**.

**Task 3: Configure the IP address for the VRRP interface, LAN, on device one**

1. Click **Network > Interfaces > LAN > IPv4**
2. For **Address**, type **192.168.3.1/24**.

The screenshot shows the configuration page for the IPv4 interface. The 'Address' field is highlighted with a green box and a green arrow pointing to it, indicating the value '192.168.3.1/24'.

**Task 4: Configure the DHCP server for LAN on device one**

1. Click to expand **Network > Interfaces > LAN > IPv4 > DHCP Server**
2. For **Lease range start**, leave at the default of **100**.
3. For **Lease range end**, type **199**.
4. Click to expand **Advanced settings**.
5. For **Gateway**, select **Custom**.
6. For **Custom gateway**, enter **192.168.3.3**.

The screenshot shows the DHCP server configuration page. The 'Lease range end' field is set to '199'. Under 'Advanced settings', the 'Gateway' is set to 'Custom' and the 'Custom gateway' is set to '192.168.3.3'.

7. Click **Apply** to save the configuration and apply the change.

The screenshot shows the configuration page with the 'Apply' button highlighted by a green arrow, indicating the final step to save the configuration.

**Command line****Task 1: Configure VRRP on device one**

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the command line, type **config** to enter configuration mode:

```
> config
(config)>
```

3. Create the VRRP instance:

---

```
(config)> add network vrrp VRRP_test
(config network vrrp VRRP_test)>
```

---

4. Enable the VRRP instance:

---

```
(config network vrrp VRRP_test)> enable true
(config network vrrp VRRP_test)>
```

---

5. Set the VRRP interface to LAN:

---

```
(config network vrrp VRRP_test)> interface /network/interface/lan
(config network vrrp VRRP_test)>
```

---

6. Add the virtual IP address associated with this VRRP instance.

---

```
(config network vrrp VRRP_test)> add virtual_address end 192.168.3.3
(config network vrrp VRRP_test)>
```

---

### **Task 2: Configure VRRP+ on device one**

1. Enable VRRP+:

---

```
(config network vrrp VRRP_test)> vrrp_plus enable true
(config network vrrp VRRP_test)>
```

---

2. Add the interface to monitor:

---

```
(config network vrrp VRRP_test)> add vrrp_plus monitor_interface end
/network/interface/modem
(config network vrrp VRRP_test)>
```

---

3. Set the amount that the device's priority should be decreased or increased due to SureLink connectivity failure or success to **30**:

---

```
(config network vrrp VRRP_test)> network vrrp VRRP_test vrrp_plus weight
30
(config network vrrp VRRP_test)>
```

---

### **Task 3: Configure the IP address for the VRRP interface, LAN, on device one**

1. Type ... to return to the root of the config prompt:

---

```
(config network vrrp VRRP_test)> ...
(config)>
```

---

2. Set the IP address for LAN:

---

```
(config)> network interface lan ipv4 address 192.168.3.1/24
(config)>
```

---

**Task 4: Configure the DHCP server for LAN on device one**

1. Set the start and end addresses of the DHCP pool to use to assign DHCP addresses to clients:
  - a. Set the start address to **100**:

```
(config)> network interface lan ipv4 dhcp_server lease_start 100
(config)>
```

- b. Set the end address to **199**:

```
(config)> network interface lan ipv4 dhcp_server lease_end 199
(config)>
```

2. Set the DHCP server gateway type to custom:

```
(config)> network interface lan ipv4 dhcp_server advanced gateway custom
(config)>
```

3. Set the custom gateway to **192.168.3.3**:

```
(config)> network interface lan ipv4 dhcp_server advanced gateway_custom
192.168.3.3
(config)>
```

4. Save the configuration and apply the change:

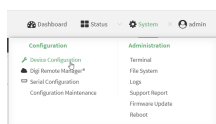
```
(config)> save
Configuration saved.
>
```

5. Type **exit** to exit the Admin CLI.

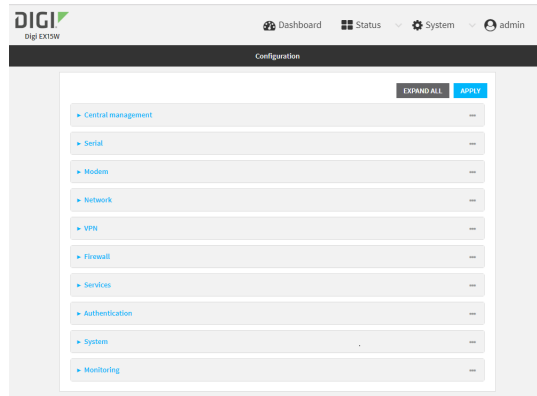
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

**Configure device two (backup device)****Task 1: Configure VRRP on device two**

1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



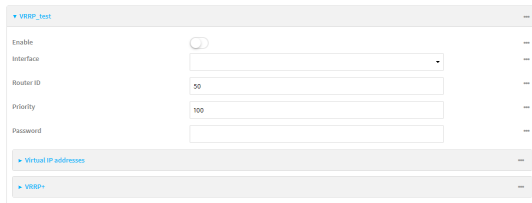
The **Configuration** window is displayed.



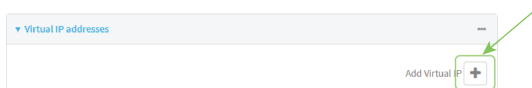
3. Click **Network > VRRP**.
4. For **Add VRRP instance**, type a name for the VRRP instance and click **+**.



The new VRRP instance configuration is displayed.



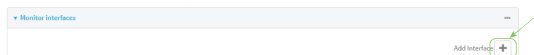
5. Click **Enable**.
6. For **Interface**, select **Interface: LAN**.
7. For **Router ID**, leave at the default setting of **50**.
8. For **Priority**, type **80**.
9. Click to expand **Virtual IP addresses**.
10. Click **+** to add a virtual IP address.



11. For **Virtual IP**, type **192.168.3.3**.

**Task 2: Configure VRRP+ on device two**

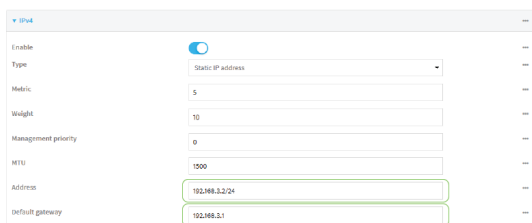
1. Click to expand **VRRP+**.
2. Click **Enable**.
3. Click to expand **Monitor interfaces**.
4. Click **+** to add an interface for monitoring.



5. Select **Interface: Modem**.
6. Click to enable **Monitor VRRP+ master**.
7. For **Priority modifier**, type **30**.

**Task 3: Configure the IP address for the VRRP interface, LAN, on device two**

1. Click **Network > Interfaces > LAN > IPv4**
2. For **Address**, type **192.168.3.2/24**.
3. For **Default gateway**, type the IP address of the VRRP interface on the master device, configured above in [Task 3, step 2 \(192.168.3.1\)](#).

**Task 4: Configure SureLink for LAN on device two**

1. Click **Network > Interfaces > LAN > IPv4 > SureLink**.
2. Click **Enable**.
3. For **Interval**, type **15s**.
4. Click to expand **Test targets > Test target**.
5. For **Test Type**, select **Ping test**.



- For **Ping host**, type **my.devicecloud.com**.

The screenshot shows the 'SureLink' configuration interface. The 'Enable' toggle is turned on. Below it, there are fields for 'Restart interface', 'Reboot device', 'Interval' (set to 15s), 'Success condition' (set to 'One test to get passes'), 'Attempts' (set to 3), and 'Response timeout' (set to 15s). Under the 'Test targets' section, a new target is added with 'Test type' set to 'Ping test', 'Ping host' set to 'my.devicecloud.com', and 'Ping payload size' set to '20'.

### Task 5: Configure the DHCP server for LAN on device two

- Click to expand **Network > Interfaces > LAN > IPv4 > DHCP Server**
- For **Lease range start**, type **200**.
- For **Lease range end**, type **250**.
- Click **Advanced settings**.
- For **Gateway**, select **Custom**.
- For **Custom gateway**, enter **192.168.3.3**.

The screenshot shows the 'DHCP server' configuration interface. The 'Enable' toggle is turned on. Below it, there are fields for 'Lease time' (set to 12h), 'Lease range start' (set to 200), and 'Lease range end' (set to 250). Under the 'Advanced settings' section, 'Gateway' is set to 'Custom' and 'Custom gateway' is set to 192.168.3.3.

- Click **Apply** to save the configuration and apply the change.

The screenshot shows the bottom of the configuration page. The 'Apply' button is highlighted with a green arrow. The page also shows a 'Configuration' tab and a 'Cancel' button.

## Command line

### Task 1: Configure VRRP on device two

- Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
- At the command line, type **config** to enter configuration mode:

```
> config
(config)>
```

3. Create the VRRP instance:

```
(config)> add network vrrp VRRP_test
(config network vrrp VRRP_test)>
```

4. Enable the VRRP instance:

```
(config network vrrp VRRP_test)> enable true
(config network vrrp VRRP_test)>
```

5. Set the VRRP interface to LAN:

```
(config network vrrp VRRP_test)> interface /network/interface/lan
(config network vrrp VRRP_test)>
```

6. Add the virtual IP address associated with this VRRP instance.

```
(config network vrrp VRRP_test)> add virtual_address end 192.168.3.3
(config network vrrp VRRP_test)>
```

### **Task 2: Configure VRRP+ on device two**

1. Enable VRRP+:

```
(config network vrrp VRRP_test)> vrrp_plus enable true
(config network vrrp VRRP_test)>
```

2. Add the interface to monitor:

```
(config network vrrp VRRP_test)> add vrrp_plus monitor_interface end
/network/interface/modem
(config network vrrp VRRP_test)>
```

3. Enable the ability to monitor the master device:

```
(config network vrrp VRRP_test)> vrrp_plus monitor_master true
(config network vrrp VRRP_test)>
```

4. Set the amount that the device's priority should be decreased or increased due to SureLink connectivity failure or success to **30**:

```
(config network vrrp VRRP_test)> network vrrp VRRP_test vrrp_plus weight
30
(config network vrrp VRRP_test)>
```

### **Task 3: Configure the IP address for the VRRP interface, LAN, on device two**

1. Type ... to return to the root of the config prompt:

```
(config network vrrp VRRP_test)> ...
(config)>
```

2. Set the IP address for LAN:

---

```
(config)> network interface lan ipv4 address 192.168.3.2
(config)>
```

---

3. Set the default gateway to the IP address of the VRRP interface on the master device, configured above in [Task 3, step 2 \(192.168.3.1\)](#).

---

```
(config)> network interface lan ipv4 gateway 192.168.3.1
(config)>
```

---

#### **Task 4: Configure SureLink for LAN on device two**

1. Enable SureLink on the LAN interface:

---

```
(config)> network interface lan ipv4 surelink enable true
(config)>
```

---

2. Create a SureLink test target:

---

```
(config)> add network interface lan ipv4 surelink target end
(config network interface lan ipv4 surelink target 0)>
```

---

3. Set the type of test to ping:

---

```
(config network interface lan ipv4 surelink target 0)> test ping
(config network interface lan ipv4 surelink target 0)>
```

---

4. Set **my.devicecloud.com** as the hostname to ping:

---

```
(config network interface lan ipv4 surelink target 0)> ping_host
my.devicecloud.com
(config network interface lan ipv4 surelink target 0)>
```

---

#### **Task 5: Configure the DHCP server for LAN on device two**

1. Type ... to return to the root of the configuration prompt:

---

```
(config network interface lan ipv4 surelink target 0)> ...
(config)>
```

---

2. Set the start and end addresses of the DHCP pool to use to assign DHCP addresses to clients:

- a. Set the start address to **200**:

---

```
(config)> network interface lan ipv4 dhcp_server lease_start 200
(config)>
```

---

- b. Set the end address to **250**:

---

```
(config)> network interface lan ipv4 dhcp_server lease_end 250
(config)>
```

---

- Set the DHCP server gateway type to custom:

```
(config)> network interface lan ipv4 dhcp_server advanced gateway custom
(config)>
```

- Set the custom gateway to **192.168.3.3**:

```
(config)> network interface lan ipv4 dhcp_server advanced gateway_custom
192.168.3.3
(config)>
```

- Save the configuration and apply the change:

```
(config)> save
Configuration saved.
>
```

- Type **exit** to exit the Admin CLI.

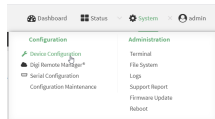
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Show VRRP status and statistics

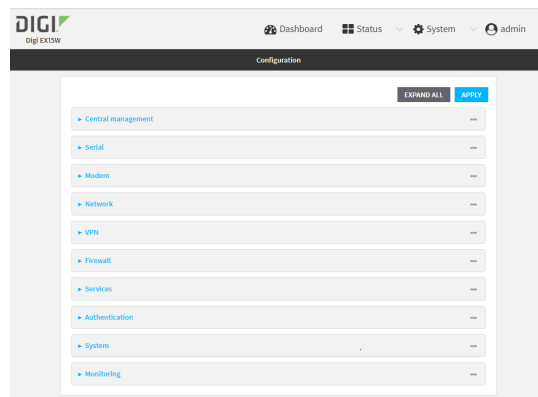
This section describes how to display VRRP status and statistics for a EX15 device. VRRP status is available from the Web UI only.

### WebUI

- Log into the EX15 WebUI as a user with full Admin access rights.
- On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.



- Click **Status > VRRP**.

The **Virtual Router Redundancy Protocol** window is displayed.

## Command line

- Log into the EX15 command line as a user with Admin access.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
- At the Admin CLI prompt, type **show vrrp**:

```
> show vrrp
```

| VRRP      | Status | Proto | State  | Virtual IP    |
|-----------|--------|-------|--------|---------------|
| VRRP_test | Up     | IPv4  | Backup | 10.10.10.1    |
| VRRP_test | Up     | IPv4  | Backup | 100.100.100.1 |

```
>
```

- To display additional information about a specific VRRP instance, at the Admin CLI prompt, type **show vrrp name name**:

```
> show vrrp name VRRP_test
```

```
VRRP_test VRRP Status

Enabled : True
Status : Up
Interface : lan

IPv4

Virtual IP address(es) : 10.10.10.1, 100.100.100.1
Current State : Master
Current Priority : 100
Last Transition : Tue Jan 1 00:00:39 2019
Became Master : 1
Released Master : 0
Adverts Sent : 71
Adverts Received : 4
Priority Zero Sent : 0
Priority zero Received : 0
```

---

>

---

# Virtual Private Networks (VPN)

---

Virtual Private Networks (VPNs) are used to securely connect two private networks together so that devices can connect from one network to the other using secure channels.

This chapter contains the following topics:

|                                           |     |
|-------------------------------------------|-----|
| IPsec .....                               | 300 |
| OpenVPN .....                             | 336 |
| Generic Routing Encapsulation (GRE) ..... | 367 |
| NEMO .....                                | 388 |

## IPsec

IPsec is a suite of protocols for creating a secure communication link—an IPsec tunnel—between a host and a remote IP network or between two IP networks across a public network such as the Internet.

### IPsec data protection

IPsec protects the data being sent across a public network by providing the following:

---

**Data origin authentication**

Authentication of data to validate the origin of data when it is received.

**Data integrity**

Authentication of data to ensure it has not been modified during transmission.

**Data confidentiality**

Encryption of data sent across the IPsec tunnel to ensure that an unauthorized device cannot read the data.

**Anti-Replay**

Authentication of data to ensure an unauthorized device has not injected it into the IPsec tunnel.

---

### IPsec modes

IPsec can run in two different modes: **Tunnel** and **Transport**.

---

**Tunnel**

The entire IP packet is encrypted and/or authenticated and then encapsulated as the payload in a new IP packet.

**Transport**

Only the payload of the IP packet is encrypted and/or authenticated. The IP header is left untouched. This mode has limitations when using an authentication header, because the IP addresses in the IP header cannot be translated (for example, with Network Address Translation (NAT), as it would invalidate the authentication hash value.

---

### Internet Key Exchange (IKE) settings

IKE is a key management protocol that allows IPsec to negotiate the security associations (SAs) that are used to create the secure IPsec tunnel. Both IKEv1 and IKEv2 are supported.

SA negotiations are performed in two phases, known as **phase 1** and **phase 2**.

#### **Phase 1**

In phase 1, IKE creates a secure authenticated communication channel between the device and the peer (the remote device which is at the other end of the IPsec tunnel) using the configured pre-shared key and the Diffie-Hellman key exchange. This creates the IKE SAs that are used to encrypt further IKE communications.

For IKEv1, there are two modes for the phase 1 negotiation: **Main mode** and **Aggressive mode**. IKEv2 does not use these modes.

---

**Main mode**

Main mode is the default mode. It is slower than aggressive mode, but more secure, in that all sensitive information sent between the device and its peer is encrypted.

**Aggressive mode**

Aggressive mode is faster than main mode, but is not as secure as main mode, because the device and its peer exchange their IDs and hash information in clear text instead of being encrypted.

---



---

Aggressive mode is usually used when one or both of the devices have a dynamic external IP address.

---

## **Phase 2**

In phase 2, IKE negotiates the SAs for IPsec. This creates two unidirectional SAs, one for each direction. Once the phase 2 negotiation is complete, the IPsec tunnel should be fully functional.

## **IPsec and IKE renegotiation**

To reduce the chances of an IPsec tunnel being compromised, the IPsec SAs and IKE SA are renegotiated at a regular interval. This results in different encryption keys being used in the IPsec tunnel.

## **Authentication**

### **Client authentication**

XAUTH (extended authentication) pre-shared key authentication mode provides additional security by using client authentication credentials in addition to the standard pre-shared key. The EX15 device can be configured to authenticate with the remote peer as an XAUTH client.

### **RSA Signatures**

With RSA signatures authentication, the EX15 device uses a private RSA key to authenticate with a remote peer that is using a corresponding public key.

### **Certificate-based Authentication**

X.509 certificate-based authentication makes use of private keys on both the server and client which are secured and never shared. Both the server and client have a certificate which is generated with their respective private key and signed by a Certificate Authority (CA).

The EX15 implementation of IPsec can be configured to use X.509 certificate-based authentication using the private keys and certificates, along with a root CA certificate from the signing authority and, if available, a Certificate Revocation List (CRL).

## **Configure an IPsec tunnel**

Configuring an IPsec tunnel with a remote device involves configuring the following items:

### **Required configuration items**

#### **■ IPsec tunnel configuration items:**

- The mode: either tunnel or transport.
- Enable the IPsec tunnel.  
The IPsec tunnel is enabled by default.
- The firewall zone of the IPsec tunnel.
- The routing metric for routes associated with this IPsec tunnel.
- The authentication type and pre-shared key or other applicable keys and certificates.
- The local endpoint type and ID values, and the remote endpoint host and ID values.

### ■ IKE configuration items

- The IKE version, either IKEv1 or IKEv2.
- Whether to initiate a key exchange or wait for an incoming request.
- The IKE mode, either main aggressive.
- The IKE authentication protocol to use for the IPsec tunnel negotiation during phase 1 and phase 2.
- The IKE encryption protocol to use for the IPsec tunnel negotiation during phase 1 and phase 2.
- The IKE Diffie-Hellman group to use for the IPsec tunnel negotiation during phase 1 and phase 2.
- Enable dead peer detection and configure the delay and timeout.
- Destination networks that require source NAT.
- Active recovery configuration. See [Configure SureLink active recovery for IPsec](#) for information about IPsec active recovery.

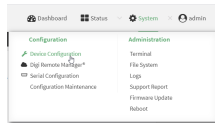
### Additional configuration items

The following additional configuration settings are not typically configured to get an IPsec tunnel working, but can be configured as needed:

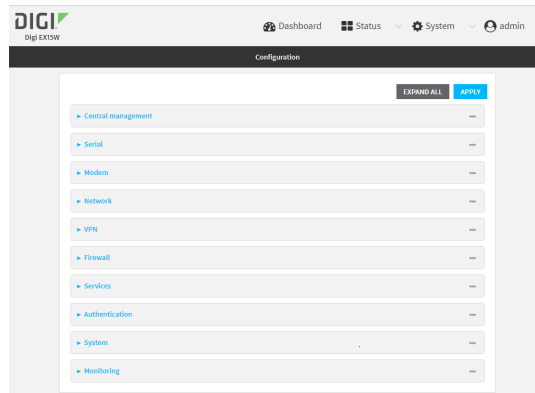
- Determine whether the device should use UDP encapsulation even when it does not detect that NAT is being used.
- If using IPsec failover, identify the primary tunnel during configuration of the backup tunnel.
- The Network Address Translation (NAT) keep alive time.
- The protocol, either Encapsulating Security Payload (ESP) or Authentication Header (AH).
- The management priority for the IPsec tunnel interface. The active interface with the highest management priority will have its address reported as the preferred contact address for central management and direct device access.
- Enable XAUTH client authentication, and the username and password to be used to authenticate with the remote peer.
- Enable Mode-configuration (MODECFG) to receive configuration information, such as the private IP address, from the remote peer.
- Disable the padding of IKE packets. This should normally not be done except for compatibility purposes.
- Destination networks that require source NAT.
- Depending on your network and firewall configuration, you may need to add a packet filtering rule to allow incoming IPsec traffic.
- **Tunnel and key renegotiating**
  - The lifetime of the IPsec tunnel before it is renegotiated.
  - The amount of time before the IKE phase 1 lifetime expires.
  - The amount of time before the IKE phase 2 lifetime expires
  - The lifetime margin, a randomizing amount of time before the IPsec tunnel is renegotiated.

## WebUI

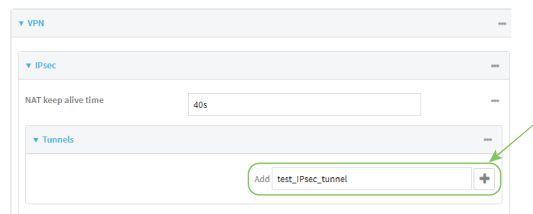
1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.



3. Click **VPN > IPsec**.
4. (Optional) Change the **NAT keep alive time**.  
Allowed values are any number of weeks, days, hours, minutes, or seconds, and take the format **number{w|d|h|m|s}**.  
For example, to set **NAT keep alive time** to ten minutes, enter **10m** or **600s**.  
The default is 40 seconds.
5. Click to expand **Tunnels**.
6. For **Add IPsec tunnel**, type a name for the tunnel and click **+**.



The new IPsec tunnel configuration is displayed.

7. The IPsec tunnel is enabled by default. To disable, click **Enable**.
8. (Optional) **Preferred tunnel** provides an optional mechanism for IPsec failover behavior. See [Configure IPsec failover](#) for more information.
9. (Optional) Enable **Force UDP encapsulation** to force the tunnel to use UDP encapsulation even when it does not detect that NAT is being used.
10. For **Zone**, select the firewall zone for the IPsec tunnel. Generally this should be left at the default of **IPsec**.

**Note** Depending on your network configuration, you may need to add a packet filtering rule to allow incoming traffic. For example, for the **IPsec** zone:

- a. Click to expand **Firewall > Packet filtering**.
- b. For **Add packet filter**, click **+**.
- c. For **Label**, type **Allow incoming IPsec traffic**.
- d. For **Source zone**, select **IPsec**.

Leave all other fields at their default settings.

11. For **Metric**, enter or select the priority of routes associated with this IPsec tunnel. When more than one active route matches a destination, the route with the lowest metric is used. The metric can also be used in tandem with SureLink to configure IPsec failover behavior. See [Configure IPsec failover](#) for more information.

12. Select the Mode, either:
  - **Tunnel**: The entire IP packet is encrypted and/or authenticated and then encapsulated as the payload in a new IP packet.
  - **Transport**: Only the payload of the IP packet is encrypted and/or authenticated. The IP header is unencrypted.
13. Select the **Protocol**, either:
  - **ESP** (Encapsulating Security Payload): Provides encryption as well as authentication and integrity.
  - **AH** (Authentication Header): Provides authentication and integrity only.
14. Click to expand **Authentication**.

The screenshot shows a configuration window for 'Authentication'. At the top, there's a tab labeled 'Authentication'. Below it, the 'Authentication type' is set to 'Pre-shared key'. A dropdown menu is open, showing the same option selected, along with 'RSA signature', 'SCEP certificates', and 'X.509 certificate'. Below the dropdown is a text input field for the 'Pre-shared key' and a 'Reveal' button to toggle visibility.

- a. For **Authentication type**, select one of the following:
  - **Pre-shared key**: Uses a pre-shared key (PSK) to authenticate with the remote peer.
    - i. Type the **Pre-shared key**.
  - **Asymmetric pre-shared keys**: Uses asymmetric pre-shared keys to authenticate with the remote peer.
    - i. For **Local key**, type the local pre-shared key. This must be the same as the remote key on the remote host.
    - ii. For **Remote key**, type the remote pre-shared key. This must be the same as the local key on the remote host.
  - **SA signature**: Uses a private RSA key to authenticate with the remote peer.
    - i. For **Private key**, paste the device's private RSA key in PEM format.
    - ii. Type the **Private key passphrase** that is used to decrypt the private key. Leave blank if the private key is not encrypted.
    - iii. For **Peer public key**, paste the peer's public RSA key in PEM format.
  - **X.509 certificate**: Uses private key and X.509 certificates to authenticate with the remote peer.
    - i. For **Private key**, paste the device's private RSA key in PEM format.
    - ii. Type the **Private key passphrase** that is used to decrypt the private key. Leave blank if the private key is not encrypted.
    - iii. For **Certificate**, paste the local X.509 certificate in PEM format.
    - iv. For Peer verification, select either:
      - **Peer certificate**: For **Peer certificate**, paste the peer's X.509 certificate in PEM format.
      - **Certificate Authority**: For **Certificate Authority chain**, paste the Certificate Authority (CA) certificates. These must include all peer certificates in the chain up to the root CA certificate, in PEM format.
15. (Optional) For **Management Priority**, set the priority for this IPsec tunnel.

16. (Optional) To configure the device to connect to its remote peer as an XAUTH client:
  - a. Click to expand **XAUTH client**.

The screenshot shows a configuration panel for the 'XAUTH client'. At the top, there is a header 'XAUTH client' with a dropdown arrow. Below this, there is a section with three items: 'Enable' with a toggle switch, 'Username' with a text input field, and 'Password' with a text input field. Each item has a small minus sign icon to its right.

- b. Click **Enable**.
  - c. Type the **Username** and **Password** that the device will use to authenticate as an XAUTH client with the peer.
17. (Optional) Click **Enable MODECFG client** to receive configuration information, such as the private IP address, from the remote peer.
18. Click to expand **Local endpoint**.
  - a. For **Type**, select either:
    - **Default route**: Uses the same network interface as the default route.
    - **Interface**: Select the **Interface** to be used as the local endpoint.
  - b. Click to expand **ID**.
    - i. Select the ID type:
      - **Auto**: The ID will be automatically determined from the value of the tunnels endpoints.
      - **Raw**: Enter an ID and have it passed unmodified to the underlying IPsec stack. For **Raw ID value**, type the ID that will be passed.
      - **Any**: Any ID will be accepted.
      - **IPv4**: The ID will be interpreted as an IP address and sent as an ID\_IPV4\_ADDR IKE identity. For **IPv4 ID value**, type an IPv4 formatted ID. This can be a fully-qualified domain name or an IPv4 address.
      - **IPv6**: The ID will be interpreted as an IP address and sent as an ID\_IPV6\_ADDR IKE identity. For **IPv6 ID value**, type an IPv6 formatted ID. This can be a fully-qualified domain name or an IPv6 address.
      - **RFC822/Email**: The ID will be interpreted as an RFC822 (email address). For **RFC822 ID value**, type the ID in internet email address format.
      - **FQDN**: The ID will be interpreted as FQDN (Fully Qualified Domain Name) and sent as an ID\_FQDN IKE identity. For **FQDN ID value**, type the ID as an FQDN.
      - **KeyID**: The ID will be interpreted as a Key ID and sent as an ID\_KEY\_ID IKE identity. For **KEYID ID value**, type the key ID.
19. Click to expand **Remote endpoint**.
  - a. For **Hostname**, select either a hostname or IP address. If your device is not configured to initiate the IPsec connection (see **IKE > Initiate connection**), you can also use the

keyword **any**, which means that the hostname is dynamic or unknown.

b. Click to expand **ID**.

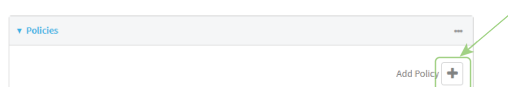
i. Select the ID type:

- **Auto**: The ID will be automatically determined from the value of the tunnels endpoints.
- **Raw**: Enter an ID and have it passed unmodified to the underlying IPsec stack.  
For **Raw ID value**, type the ID that will be passed.
- **Any**: Any ID will be accepted.
- **IPv4**: The ID will be interpreted as an IPv4 address and sent as an ID\_IPV4\_ADDR IKE identity.  
For **IPv4 ID value**, type an IPv4 formatted ID. This can be a fully-qualified domain name or an IPv4 address.
- **IPv6**: The ID will be interpreted as an IPv6 address and sent as an ID\_IPV6\_ADDR IKE identity.  
For **IPv6 ID value**, type an IPv6 formatted ID. This can be a fully-qualified domain name or an IPv6 address.
- **RFC822/Email**: The ID will be interpreted as an RFC822 (email address).  
For **RFC822 ID value**, type the ID in internet email address format.
- **FQDN**: The ID will be interpreted as FQDN (Fully Qualified Domain Name) and sent as an ID\_FQDN IKE identity.  
For **FQDN ID value**, type the ID as an FQDN.
- **KeyID**: The ID will be interpreted as a Key ID and sent as an ID\_KEY\_ID IKE identity.  
For **KEYID ID value**, type the key ID.

20. Click to expand **Policies**.

Policies define the network traffic that will be encapsulated by this tunnel.

a. Click **+** to create a new policy.



The new policy configuration is displayed.

b. Click to expand **Local network**.

- c. For **Type**, select one of the following:
    - **Address:** The address of a local network interface.  
For **Address**, select the appropriate interface.
    - **Network:** The subnet of a local network interface.  
For **Address**, select the appropriate interface.
    - **Custom network:** A user-defined network.  
For **Custom network**, enter the IPv4 address and optional netmask. The keyword **any** can also be used.
    - **Request a network:** Requests a network from the remote peer.
  - d. For **Remote network**, enter the IP address and optional netmask of the remote network.  
The keyword **any** can also be used. .
21. Click to expand **IKE**.

The screenshot shows the configuration page for IKE. The 'IKE' section is expanded, revealing several settings:

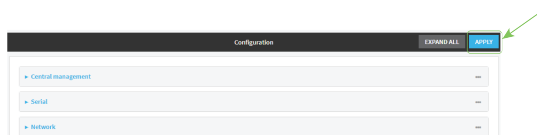
- IKE version:** A dropdown menu set to 'IKEv1'.
- Initiate connection:** A toggle switch that is turned on (blue).
- Mode:** A dropdown menu set to 'Main mode'.
- Enable padding:** A toggle switch that is turned on (blue).
- Phase 1 lifetime:** A text input field containing '3h'.
- Phase 2 lifetime:** A text input field containing '1h'.
- Lifetime margin:** A text input field containing '9m'.

Below these settings are two expandable sections: 'Phase 1 Proposals' and 'Phase 2 Proposals', each with a right-pointing arrow and a collapse icon.

- a. For **IKE version**, select either IKEv1 or IKEv2. This setting must match the peer's IKE version.
- b. **Initiate connection** instructs the device to initiate the key exchange, rather than waiting for an incoming request. This must be disabled if **Remote endpoint** > **Hostname** is set to **any**.
- c. For **Mode**, select either **Main mode** or **Aggressive mode**.
- d. For **Enable padding**, click to disable the padding of IKE packets. This should normally not be disabled except for compatibility purposes.
- e. For **Phase 1 lifetime**, enter the amount of time that the IKE security association expires after a successful negotiation and must be re-authenticated.  
Allowed values are any number of weeks, days, hours, minutes, or seconds, and take the format **number{w|d|h|m|s}**.  
For example, to set **Phase 1 lifetime** to ten minutes, enter **10m** or **600s**.
- f. For **Phase 2 lifetime**, enter the amount of time that the IKE security association expires after a successful negotiation and must be rekeyed.  
Allowed values are any number of weeks, days, hours, minutes, or seconds, and take the format **number{w|d|h|m|s}**.  
For example, to set **Phase 2 lifetime** to ten minutes, enter **10m** or **600s**.



- g. For **Lifetime margin**, enter a randomizing amount of time before the IPsec tunnel is renegotiated.  
Allowed values are any number of weeks, days, hours, minutes, or seconds, and take the format **number{w|d|h|m|s}**.  
For example, to set **Lifetime margin** to ten minutes, enter **10m** or **600s**.
- h. Click to expand **Phase 1 Proposals**.
  - i. Click **+** to create a new phase 1 proposal.
  - ii. For **Cipher**, select the type of encryption.
  - iii. For **Hash**, select the type of hash to use to verify communication integrity.
  - iv. For **Diffie-Hellman group**, select the type of Diffie-Hellman group to use for key exchange.
  - v. You can add additional Phase 1 proposals by clicking **+** next to **Add Phase 1 Proposal**.
- i. Click to expand **Phase 2 Proposals**.
  - i. Click **+** to create a new phase 2 proposal.
  - ii. For **Cipher**, select the type of encryption.
  - iii. For **Hash**, select the type of hash to use to verify communication integrity.
  - iv. For **Diffie-Hellman group**, select the type of Diffie-Hellman group to use for key exchange.
  - v. You can add additional Phase 2 proposals by clicking **+** next to **Add Phase 2 Proposal**.
22. (Optional) Click to expand **Dead peer detection**. Dead peer detection is enabled by default. Dead peer detection uses periodic IKE transmissions to the remote endpoint to detect whether tunnel communications have failed, allowing the tunnel to be automatically restarted when failure occurs.
  - a. To enable or disable dead peer detection, click **Enable**.
  - b. For **Delay**, type the number of seconds between transmissions of dead peer packets. Dead peer packets are only sent when the tunnel is idle.
  - c. For **Timeout**, type the number of seconds to wait for a response from a dead peer packet before assuming the tunnel has failed.
23. (Optional) Click to expand **NAT** to create a list of destination networks that require source NAT.
  - a. Click **+** next to **Add NAT destination**.
  - b. For **Destination network**, type the IPv4 address and optional netmask of a destination network that requires source NAT. You can also use **any**, meaning that any destination network connected to the tunnel will use source NAT.
24. See [Configure SureLink active recovery for IPsec](#) for information about IPsec **Active recovery**.
25. Click **Apply** to save the configuration and apply the change.



## Command line

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the command line, type **config** to enter configuration mode:

---

```
> config
(config)>
```

---

3. Add an IPsec tunnel. For example, to add an IPsec tunnel named **ipsec\_example**:

---

```
(config)> add vpn ipsec tunnel ipsec_example
(config vpn ipsec tunnel ipsec_example)>
```

---

The IPsec tunnel is enabled by default. To disable:

---

```
(config vpn ipsec tunnel ipsec_example)> enable false
(config vpn ipsec tunnel ipsec_example)>
```

---

4. (Optional) Set the tunnel to use UDP encapsulation even when it does not detect that NAT is being used:

---

```
(config vpn ipsec tunnel ipsec_example)> force_udp_encap true
(config vpn ipsec tunnel ipsec_example)>
```

---

5. Set the firewall zone for the IPsec tunnel. Generally this should be left at the default of **ipsec**.

---

```
(config vpn ipsec tunnel ipsec_example)> zone zone
(config vpn ipsec tunnel ipsec_example)>
```

---

To view a list of available zones:

---

```
(config vpn ipsec tunnel ipsec_example)> zone ?
```

---

Zone: The firewall zone assigned to this IPsec tunnel. This can be used by packet filtering rules and access control lists to restrict network traffic on this tunnel.

Format:

```
any
dynamic_routes
edge
external
internal
ipsec
loopback
setup
```

Default value: ipsec

Current value: ipsec

---

```
(config vpn ipsec tunnel ipsec_example)>
```

---

**Note** Depending on your network configuration, you may need to add a packet filtering rule to allow incoming traffic. For example, for the **IPsec** zone:

- a. Type ... to move to the root of the configuration:

```
(config vpn ipsec tunnel ipsec_example)> ...
(config)>
```

- b. Add a packet filter:

```
(config)> add firewall filter end
(config firewall filter 2)>
```

- c. Set the label to **Allow incoming IPsec traffic**:

```
(config config firewall filter 2)> label "Allow incoming IPsec traffic"
(config firewall filter 2)>
```

- d. Set the source zone to **ipsec**:

```
(config config firewall filter 2)> src_zone ipsec
(config firewall filter 2)>
```

6. Set the metric for the IPsec tunnel. When more than one active route matches a destination, the route with the lowest metric is used. The metric can also be used in tandem with SureLink to configure IPsec failover behavior. See [Configure IPsec failover](#) for more information.

```
(config vpn ipsec tunnel ipsec_example)> metric value
(config vpn ipsec tunnel ipsec_example)>
```

where *value* is any integer between **0** and **65535**.

7. Set the mode:

```
(config vpn ipsec tunnel ipsec_example)> mode mode
(config vpn ipsec tunnel ipsec_example)>
```

where *mode* is either:

- **tunnel**: The entire IP packet is encrypted and/or authenticated and then encapsulated as the payload in a new IP packet.
- **transport**: Only the payload of the IP packet is encrypted and/or authenticated. The IP header is unencrypted.

The default is **tunnel**.

8. Set the protocol:

```
(config vpn ipsec tunnel ipsec_example)> type protocol
(config vpn ipsec tunnel ipsec_example)>
```

where *protocol* is either:

- **esp** (Encapsulating Security Payload): Provides encryption as well as authentication and integrity.
- **ah** (Authentication Header): Provides authentication and integrity only.

The default is **esp**.

9. (Optional) Set the management priority for this IPsec tunnel:

---

```
(config vpn ipsec tunnel ipsec_example)> mgmt value
(config vpn ipsec tunnel ipsec_example)>
```

---

where *value* is any interger between **0** and **1000**.

10. Set the authentication type:

---

```
(config vpn ipsec tunnel ipsec_example)> auth type value
(config vpn ipsec tunnel ipsec_example)>
```

---

where *value* is one of:

- **secret:** Uses a pre-shared key (PSK) to authenticate with the remote peer.

- a. Set the pre-shared key:

---

```
(config vpn ipsec tunnel ipsec_example)> auth secret key
(config vpn ipsec tunnel ipsec_example)>
```

---

- **asymmetric-secrets:** Uses asymmetric pre-shared keys to authenticate with the remote peer.

- a. Set the local pre-shared key. This must be the same as the remote key on the remote host.:

---

```
(config vpn ipsec tunnel ipsec_example)> auth local_secret key
(config vpn ipsec tunnel ipsec_example)>
```

---

- b. Set the remote pre-shared key. This must be the same as the local key on the remote host.:

---

```
(config vpn ipsec tunnel ipsec_example)> auth remote_secret key
(config vpn ipsec tunnel ipsec_example)>
```

---

- **rsasig:** Uses a private RSA key to authenticate with the remote peer.

- a. For the **private\_key** parameter, paste the device's private RSA key in PEM format:

---

```
(config vpn ipsec tunnel ipsec_example)> auth private_key key
(config vpn ipsec tunnel ipsec_example)>
```

---

- b. Set the private key passphrase that is used to decrypt the private key. Leave blank if the private key is not encrypted.

---

```
(config vpn ipsec tunnel ipsec_example)> auth private_key_
passphrase passphrase
(config vpn ipsec tunnel ipsec_example)>
```

---

- c. For the **peer\_public\_key** parameter, paste the peer's public RSA key in PEM format:

---

```
(config vpn ipsec tunnel ipsec_example)> auth peer_public_key key
(config vpn ipsec tunnel ipsec_example)>
```

---

- **x509**: Uses private key and X.509 certificates to authenticate with the remote peer.
  - a. For the **private\_key** parameter, paste the device's private RSA key in PEM format:

---

```
(config vpn ipsec tunnel ipsec_example)> auth private_key key
(config vpn ipsec tunnel ipsec_example)>
```

---

- b. Set the private key passphrase that is used to decrypt the private key. Leave blank if the private key is not encrypted.

---

```
(config vpn ipsec tunnel ipsec_example)> auth private_key_
passphrase passphrase
(config vpn ipsec tunnel ipsec_example)>
```

---

- c. For the **cert** parameter, paste the local X.509 certificate in PEM format:

---

```
(config vpn ipsec tunnel ipsec_example)> auth cert certificate
(config vpn ipsec tunnel ipsec_example)>
```

---

- d. Set the method for verifying the peer's X.509 certificate:

---

```
(config vpn ipsec tunnel ipsec_example)> auth peer_verify value
(config vpn ipsec tunnel ipsec_example)>
```

---

where *value* is either:

- **cert**: Uses the peer's X.509 certificate in PEM format for verification.
  - For the **peer\_cert** parameter, paste the peer's X.509 certificate in PEM format:

---

```
(config vpn ipsec tunnel ipsec_example)> auth peer_cert
certificate
(config vpn ipsec tunnel ipsec_example)>
```

---

- **ca**: Uses the Certificate Authority chain for verification.
  - For the **ca\_cert** parameter, paste the Certificate Authority (CA) certificates. These must include all peer certificates in the chain up to the root CA certificate, in PEM format.

---

```
(config vpn ipsec tunnel ipsec_example)> auth ca_cert cert_
chain
(config vpn ipsec tunnel ipsec_example)>
```

---

#### 11. (Optional) Configure the device to connect to its remote peer as an XAUTH client:

- a. Enable XAUTH client functionality:

---

```
(config vpn ipsec tunnel ipsec_example)> xauth_client enable true
(config vpn ipsec tunnel ipsec_example)>
```

---

- b. Set the XAUTH client username:

---

```
(config vpn ipsec tunnel ipsec_example)> xauth_client username name
(config vpn ipsec tunnel ipsec_example)>
```

---

- c. Set the XAUTH client password:

---

```
(config vpn ipsec tunnel ipsec_example)> xauth_client password pwd
(config vpn ipsec tunnel ipsec_example)>
```

---

12. (Optional) Enable MODECFG client functionality:

MODECFG client functionality configures the device to receive configuration information, such as the private IP address, from the remote peer.

- a. Enable MODECFG client functionality:

---

```
(config vpn ipsec tunnel ipsec_example)> modecfg_client enable true
(config vpn ipsec tunnel ipsec_example)>
```

---

13. Configure the local endpoint:

- a. Set the method for determining the local network interface:

---

```
(config vpn ipsec tunnel ipsec_example)> local type value
(config vpn ipsec tunnel ipsec_example)>
```

---

where *value* is either:

- **defaultroute:** Uses the same network interface as the default route.
- **interface:** Select the **Interface** to be used as the local endpoint.

- b. Set the ID type:

---

```
(config vpn ipsec tunnel ipsec_example)> local id type value
(config vpn ipsec tunnel ipsec_example)>
```

---

where *value* is one of:

- **auto:** The ID will be automatically determined from the value of the tunnels endpoints.
- **raw:** Enter an ID and have it passed unmodified to the underlying IPsec stack.  
Set the unmodified ID that will be passed:

---

```
(config vpn ipsec tunnel ipsec_example)> local id raw_id id
(config vpn ipsec tunnel ipsec_example)>
```

---

- **any:** Any ID will be accepted.
- **ipv4:** The ID will be interpreted as an IPv4 address and sent as an ID\_IPV4\_ADDR IKE identity.  
Set an IPv4 formatted ID. This can be a fully-qualified domain name or an IPv4 address.

---

```
(config vpn ipsec tunnel ipsec_example)> local id ipv4_id id
(config vpn ipsec tunnel ipsec_example)>
```

---

- **ipv6:** The ID will be interpreted as an IPv6 address and sent as an ID\_IPV6\_ADDR IKE identity.  
Set an IPv6 formatted ID. This can be a fully-qualified domain name or an IPv6 address.

---

```
(config vpn ipsec tunnel ipsec_example)> local id ipv6_id id
(config vpn ipsec tunnel ipsec_example)>
```

---

- **rfc822**: The ID will be interpreted as an RFC822 (email address).

Set the ID in internet email address format:

---

```
(config vpn ipsec tunnel ipsec_example)> local id rfc822_id id
(config vpn ipsec tunnel ipsec_example)>
```

---

- **fqdn**: The ID will be interpreted as FQDN (Fully Qualified Domain Name) and sent as an ID\_FQDN IKE identity.

Set the ID as an FQDN:

---

```
(config vpn ipsec tunnel ipsec_example)> local id rfc822_id id
(config vpn ipsec tunnel ipsec_example)>
```

---

- **keyid**: The ID will be interpreted as a Key ID and sent as an ID\_KEY\_ID IKE identity.

Set the key ID:

---

```
(config vpn ipsec tunnel ipsec_example)> local id keyid_id id
(config vpn ipsec tunnel ipsec_example)>
```

---

#### 14. Configure the remote endpoint:

- Set the hostname or IP address of the remote endpoint:

---

```
(config vpn ipsec tunnel ipsec_example)> remote hostname value
(config vpn ipsec tunnel ipsec_example)>
```

---

If your device is not configured to initiate the IPsec connection (see [ike initiate](#)), you can also use the keyword **any**, which means that the hostname is dynamic or unknown.

- Set the ID type:

---

```
(config vpn ipsec tunnel ipsec_example)> remote id type value
(config vpn ipsec tunnel ipsec_example)>
```

---

where *value* is one of:

- **auto**: The ID will be automatically determined from the value of the tunnels endpoints.

- **raw**: Enter an ID and have it passed unmodified to the underlying IPsec stack.

Set the unmodified ID that will be passed:

---

```
(config vpn ipsec tunnel ipsec_example)> remote id raw_id id
(config vpn ipsec tunnel ipsec_example)>
```

---

- **any**: Any ID will be accepted.

- **ipv4**: The ID will be interpreted as an IPv4 address and sent as an ID\_IPV4\_ADDR IKE identity.

Set an IPv4 formatted ID. This can be a fully-qualified domain name or an IPv4 address.

---

```
(config vpn ipsec tunnel ipsec_example)> remote id ipv4_id id
(config vpn ipsec tunnel ipsec_example)>
```

---

- **ipv6:** The ID will be interpreted as an IPv6 address and sent as an ID\_IPV6\_ADDR IKE identity.

Set an IPv6 formatted ID. This can be a fully-qualified domain name or an IPv6 address.

---

```
(config vpn ipsec tunnel ipsec_example)> remote id ipv6_id id
(config vpn ipsec tunnel ipsec_example)>
```

---

- **rfc822:** The ID will be interpreted as an RFC822 (email address).

Set the ID in internet email address format:

---

```
(config vpn ipsec tunnel ipsec_example)> remote id rfc822_id id
(config vpn ipsec tunnel ipsec_example)>
```

---

- **fqdn:** The ID will be interpreted as FQDN (Fully Qualified Domain Name) and sent as an ID\_FQDN IKE identity.

Set the ID as an FQDN:

---

```
(config vpn ipsec tunnel ipsec_example)> remote id rfc822_id id
(config vpn ipsec tunnel ipsec_example)>
```

---

- **keyid:** The ID will be interpreted as a Key ID and sent as an ID\_KEY\_ID IKE identity.

Set the key ID:

---

```
(config vpn ipsec tunnel ipsec_example)> remote id keyid_id id
(config vpn ipsec tunnel ipsec_example)>
```

---

#### 15. Configure IKE settings:

- Set the IKE version:

---

```
(config vpn ipsec tunnel ipsec_example)> ike version value
(config vpn ipsec tunnel ipsec_example)>
```

---

where *value* is either **ikev1** or **ikev2**. This setting must match the peer's IKE version.

- Determine whether the device should initiate the key exchange, rather than waiting for an incoming request. By default, the device will initiate the key exchange. This must be disabled if **remote hostname** is set to **any**. To disable:

---

```
(config vpn ipsec tunnel ipsec_example)> ike initiate false
(config vpn ipsec tunnel ipsec_example)>
```

---

- Set the IKE phase 1 mode:

---

```
(config vpn ipsec tunnel ipsec_example)> ike mode value
(config vpn ipsec tunnel ipsec_example)>
```

---

where *value* is either **aggressive** or **main**.



- d. Padding of IKE packets is enabled by default and should normally not be disabled except for compatibility purposes. To disable:

---

```
(config vpn ipsec tunnel ipsec_example)> ike pad false
(config vpn ipsec tunnel ipsec_example)>
```

---

- e. Set the amount of time that the IKE security association expires after a successful negotiation and must be re-authenticated:

---

```
(config vpn ipsec tunnel ipsec_example)> ike phase1_lifetime value
(config vpn ipsec tunnel ipsec_example)>
```

---

where *value* is any number of weeks, days, hours, minutes, or seconds, and takes the format **number{w|d|h|m|s}**.

For example, to set **phase1\_lifetime** to ten minutes, enter either **10m** or **600s**:

---

```
(config vpn ipsec tunnel ipsec_example)> ike phase1_lifetime 600s
(config vpn ipsec tunnel ipsec_example)>
```

---

The default is three hours.

- f. Set the amount of time that the IKE security association expires after a successful negotiation and must be rekeyed.

---

```
(config vpn ipsec tunnel ipsec_example)> ike phase2_lifetime value
(config vpn ipsec tunnel ipsec_example)>
```

---

where *value* is any number of weeks, days, hours, minutes, or seconds, and takes the format **number{w|d|h|m|s}**.

For example, to set **phase2\_lifetime** to ten minutes, enter either **10m** or **600s**:

---

```
(config vpn ipsec tunnel ipsec_example)> ike phase2_lifetime 600s
(config vpn ipsec tunnel ipsec_example)>
```

---

The default is one hour.

- g. Set a randomizing amount of time before the IPsec tunnel is renegotiated:

---

```
(config vpn ipsec tunnel ipsec_example)> ike lifetime_margin value
(config vpn ipsec tunnel ipsec_example)>
```

---

where *value* is any number of weeks, days, hours, minutes, or seconds, and takes the format **number{w|d|h|m|s}**.

For example, to set **lifetime\_margin** to ten minutes, enter either **10m** or **600s**:

---

```
(config vpn ipsec tunnel ipsec_example)> ike lifetime_margin 600s
(config vpn ipsec tunnel ipsec_example)>
```

---

The default is nine minutes.

- h. Configure the types of encryption, hash, and Diffie-Hellman group to use during phase 1:

- i. Add a phase 1 proposal:

```
(config vpn ipsec tunnel ipsec_example)> add ike phase1_proposal end
(config vpn ipsec tunnel ipsec_example ike phase1_proposal 0)>
```

- ii. Set the type of encryption to use during phase 1:

```
(config vpn ipsec tunnel ipsec_example ike phase1_proposal 0)>
cipher value
(config vpn ipsec tunnel ipsec_example ike phase1_proposal 0)>
```

where *value* is one of **3des**, **aes128**, **aes192**, **aes256**, or **null**. The default is **3des**.

- iii. Set the type of hash to use during phase 1 to verify communication integrity:

```
(config vpn ipsec tunnel ipsec_example ike phase1_proposal 0)> hash
value
(config vpn ipsec tunnel ipsec_example ike phase1_proposal 0)>
```

where *value* is one of **md5**, **sha1**, **sha256**, **sha384**, or **sha512**. The default is **sha1**.

- iv. Set the type of Diffie-Hellman group to use for key exchange during phase 1:

```
(config vpn ipsec tunnel ipsec_example ike phase1_proposal 0)> dh_
group value
(config vpn ipsec tunnel ipsec_example ike phase1_proposal 0)>
```

where *value* is one of **ecp384**, **modp768**, **modp1024**, **modp1536**, **modp2048**, **modp3072**, **modp4096**, **modp6144**, or **modp8192**. The default is **modp1024**.

- v. (Optional) Add additional phase 1 proposals:

- i. Move back one level in the schema:

```
(config vpn ipsec tunnel ipsec_example ike phase1_proposal 0)>
..
(config vpn ipsec tunnel ipsec_example ike phase1_proposal)>
```

- ii. Add an additional proposal:

```
(config vpn ipsec tunnel ipsec_example ike phase1_proposal)> add
end
(config vpn ipsec tunnel ipsec_example ike phase1_proposal 1)>
```

Repeat the above steps to set the type of encryption, hash, and Diffie-Hellman group for the additional proposal.

- iii. Repeat to add more phase 1 proposals.

- i. Configure the types of encryption, hash, and Diffie-Hellman group to use during phase 2:

- i. Move back two levels in the schema:

```
(config vpn ipsec tunnel ipsec_example ike phase1_proposal 0)>
(config vpn ipsec tunnel ipsec_example ike)>
```

- ii. Add a phase 2 proposal:

---

```
(config vpn ipsec tunnel ipsec_example ike)> add ike phase2_proposal
end
(config vpn ipsec tunnel ipsec_example ike phase2_proposal 0)>
```

---

- iii. Set the type of encryption to use during phase 2:

---

```
(config vpn ipsec tunnel ipsec_example ike phase2_proposal 0)>
cipher value
(config vpn ipsec tunnel ipsec_example ike phase2_proposal 0)>
```

---

where *value* is one of **3des**, **aes128**, **aes192**, **aes256**, or **null**. The default is **3des**.

- iv. Set the type of hash to use during phase 2 to verify communication integrity:

---

```
(config vpn ipsec tunnel ipsec_example ike phase2_proposal 0)> hash
value
(config vpn ipsec tunnel ipsec_example ike phase2_proposal 0)>
```

---

where *value* is one of **md5**, **sha1**, **sha256**, **sha384**, or **sha512**. The default is **sha1**.

- v. Set the type of Diffie-Hellman group to use for key exchange during phase 2:

---

```
(config vpn ipsec tunnel ipsec_example ike phase2_proposal 0)> dh-
group value
(config vpn ipsec tunnel ipsec_example ike phase2_proposal 0)>
```

---

where *value* is one of **ecp384**, **modp768**, **modp1024**, **modp1536**, **modp2048**, **modp3072**, **modp4096**, **modp6144**, or **modp8192**. The default is **modp1024**.

- vi. (Optional) Add additional phase 2 proposals:

- i. Move back one level in the schema:

---

```
(config vpn ipsec tunnel ipsec_example ike phase2_proposal 0)>
..
(config vpn ipsec tunnel ipsec_example ike phase2_proposal)>
```

---

- ii. Add an additional proposal:

---

```
(config vpn ipsec tunnel ipsec_example ike phase2_proposal)> add
end
(config vpn ipsec tunnel ipsec_example ike phase2_proposal 1)>
```

---

Repeat the above steps to set the type of encryption, hash, and Diffie-Hellman group for the additional proposal.

- iii. Repeat to add more phase 2 proposals.

- 16. (Optional) Configure dead peer detection:

Dead peer detection is enabled by default. Dead peer detection uses periodic IKE transmissions to the remote endpoint to detect whether tunnel communications have failed, allowing the tunnel to be automatically restarted when failure occurs.

- a. Change to the root of the configuration schema:

---

```
(config vpn ipsec tunnel ipsec_example ike phase2_proposal 0)> ...
(config)>
```

---

- b. To disable dead peer detection:

---

```
(config)> vpn ipsec tunnel ipsec_example dpd enable false
(config)>
```

---

- c. Set the number of seconds between transmissions of dead peer packets. Dead peer packets are only sent when the tunnel is idle. The default is **60**.

---

```
(config)> vpn ipsec tunnel ipsec_example dpd delay value
(config)>
```

---

- d. Set the number of seconds to wait for a response from a dead peer packet before assuming the tunnel has failed. The default is **90**.

---

```
(config)> vpn ipsec tunnel ipsec_example dpd timeout value
(config)>
```

---

17. (Optional) Create a list of destination networks that require source NAT:

- a. Add a destination network:

---

```
(config)> add vpn ipsec tunnel ipsec_example nat end
(config vpn ipsec tunnel ipsec_example nat 0)>
```

---

- b. Set the IPv4 address and optional netmask of a destination network that requires source NAT. You can also use **any**, meaning that any destination network connected to the tunnel will use source NAT.

---

```
(config vpn ipsec tunnel ipsec_example nat 0)> dst value
(config vpn ipsec tunnel ipsec_example nat 0)>
```

---

18. Configure policies that define the network traffic that will be encapsulated by this tunnel:

- a. Change to the root of the configuration schema:

---

```
(config vpn ipsec tunnel ipsec_example nat 0)> ...
(config)>
```

---

- b. Add a policy:

---

```
(config)> add vpn ipsec tunnel ipsec_example policy end
(config vpn ipsec tunnel ipsec_example policy 0)>
```

---

- c. Set the type of local network policy:

---

```
(config vpn ipsec tunnel ipsec_example policy 0)> local type value
(config vpn ipsec tunnel ipsec_example policy 0)>
```

---

where *value* is one of:

- **address:** The address of a local network interface.

Set the address:

- i. Use the **?** to determine available interfaces:

---

```
(config vpn ipsec tunnel ipsec_example policy 0)>local address
?
```

Address: The local network interface to use the address of.  
This field must be set when 'Type' is set to 'Address'.

Format:

```
defaultip
defaultlinklocal
lan
loopback
modem
wan
```

Current value:

```
(config vpn ipsec tunnel ipsec_example policy 0)> local
address
```

---

- ii. Set the interface. For example:

---

```
(config vpn ipsec tunnel ipsec_example policy 0)> local
address wan
(config vpn ipsec tunnel ipsec_example policy 0)>
```

---

- **network:** The subnet of a local network interface.

Set the network:

- i. Use the **?** to determine available interfaces:

---

```
(config vpn ipsec tunnel ipsec_example policy 0)>local network
?
```

Interface: The network interface.

Format:

```
defaultip
defaultlinklocal
lan
loopback
modem
wan
```

Current value:

```
(config vpn ipsec tunnel ipsec_example policy 0)> local
network
```

---

- ii. Set the interface. For example:

---

```
(config vpn ipsec tunnel ipsec_example policy 0)> local
network wan
(config vpn ipsec tunnel ipsec_example policy 0)>
```

---

- **custom:** A user-defined network.

Set the custom network:

---

```
(config vpn ipsec tunnel ipsec_example policy 0)> local custom
value
(config vpn ipsec tunnel ipsec_example policy 0)>
```

---

where *value* is the IPv4 address and optional netmask. The keyword **any** can also be used.

- **request:** Requests a network from the remote peer.

- d. Set the IP address and optional netmask of the remote network. The keyword **any** can also be used.

---

```
(config vpn ipsec tunnel ipsec_example policy 0)> remote network value
(config vpn ipsec tunnel ipsec_example policy 0)>
```

---

19. (Optional) Change the NAT keep alive time:

- a. Change to the root of the configuration schema:

---

```
(config vpn ipsec tunnel ipsec_example policy 0)> ...
(config)>
```

---

- b.
  - (config)> vpn ipsec advanced keep\_alive *value*
  - (config)>

where *value* is any number of weeks, days, hours, minutes, or seconds, and takes the format **number{w|d|h|m|s}**.

For example, to set **keep\_alive** to ten minutes, enter either **10m** or **600s**:

---

```
(config)> vpn ipsec advanced keep_alive 600s
(config)>
```

---

The default is 40 seconds.

20. Save the configuration and apply the change:

---

```
(config)> save
Configuration saved.
>
```

---

21. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Configure IPsec failover

There are two methods to configure the EX15 device to fail over from a primary IPsec tunnel to a backup tunnel:

- **SureLink** active recovery—You can use SureLink along with the IPsec tunnel's metric to configure two or more tunnels so that when the primary tunnel is determined to be inactive by SureLink, a secondary tunnel can begin serving traffic that the primary tunnel was serving.
- **Preferred tunnel**—When multiple IPsec tunnels are configured, one tunnel can be configured as a backup to another tunnel by defining a preferred tunnel for the backup device.

### Required configuration items

- Two or more configured IPsec tunnels: The primary tunnel, and one or more backup tunnels.
- Either:
  - SureLink configured on the primary tunnel with **Restart Interface** enabled, and the metric for all tunnels set appropriately to determine which IPsec tunnel has priority. With this failover configuration, both tunnels are active simultaneously, and there is minimal downtime due to failover.
  - Identify the preferred tunnel during configuration of the backup tunnel. In this scenario, the backup tunnel is not active until the preferred tunnel fails.

### IPsec failover using SureLink

With this configuration, when two IPsec tunnels are configured with the same local and remote endpoints but different metrics, traffic addressed to the remote endpoint will be routed through the IPsec tunnel with the lower metric.

If **SureLink > Restart Interface** is enabled for the tunnel with the lower metric, and SureLink determines that the tunnel is not functioning properly (for example, pings to a host at the other end of the tunnel are failing), then:

1. SureLink will shut down the tunnel and renegotiate its IPsec connection.
2. While the tunnel with the lower metric is down, traffic addressed to the remote endpoint will be routed through the tunnel with the higher metric.

For example:

- Tunnel\_1:
  - **Metric:** 10
  - **Local endpoint > Interface:** LAN
  - **Remote endpoint > Hostname:** 192.168.10.1
  - **SureLink** configuration:
    - **Restart Interface** enabled
    - **Test target:**
      - **Test type:** Ping test
      - **Ping host:** 192.168.10.2
- Tunnel\_2:

- **Metric:** 20
- **Local endpoint > Interface:** LAN
- **Remote endpoint > Hostname:** 192.168.10.1

In this configuration:

1. Tunnel\_1 will normally be used for traffic destined for the 192.168.10.1 endpoint.
2. If pings to 192.168.10.2 fail, SureLink will shut down the tunnel and renegotiate its IPsec connection.
3. While Tunnel\_1 is down, Tunnel\_2 will be used for traffic destined for the 192.168.10.1 endpoint.

## WebUI

1. Configure the primary IPsec tunnel. See [Configure an IPsec tunnel](#) for instructions.
  - During configuration of the IPsec tunnel, set the metric to a low value (for example, **10**).

The screenshot shows the 'IPsec Primary Tunnel' configuration page. The 'Enable' toggle is turned on. The 'Preferred tunnel' dropdown is set to 'IPsec'. The 'Force UDP encapsulation' toggle is turned off. The 'Zone' dropdown is set to 'IPsec'. The 'Metric' field is a text input with the value '10' entered. The 'Mode' dropdown is set to 'Tunnel mode'. The 'Protocol' dropdown is set to 'ESP'.

- Configure SureLink for the primary IPsec tunnel and enable **Restart interface**. See [Configure SureLink active recovery for IPsec](#) for instructions.

The screenshot shows the 'SureLink' configuration page. The 'Enable' toggle is turned on. The 'Restart interface' toggle is turned on. The 'Reboot device' toggle is turned off. The 'Interval' field is set to '15m'. The 'Success condition' dropdown is set to 'One test target passes'. The 'Attempts' field is set to '3'. The 'Response timeout' field is set to '15s'. There is a 'Test targets' link at the bottom.

2. Create a backup IPsec tunnel. Configure this tunnel to use the same local and remote endpoints as the primary tunnel. See [Configure an IPsec tunnel](#) for instructions.
  - During configuration of the IPsec tunnel, set the metric to a value that is higher than the metric of the primary tunnel (for example, **20**).

The screenshot shows the 'IPsec Backup Tunnel' configuration page. The 'Enable' toggle is turned on. The 'Preferred tunnel' dropdown is set to 'IPsec'. The 'Force UDP encapsulation' toggle is turned off. The 'Zone' dropdown is set to 'IPsec'. The 'Metric' field is a text input with the value '20' entered. The 'Mode' dropdown is set to 'Tunnel mode'. The 'Protocol' dropdown is set to 'ESP'.

## Command line



1. Configure the primary IPsec tunnel. See [Configure an IPsec tunnel](#) for instructions.
  - During configuration of the IPsec tunnel, set the metric to a low value (for example, **10**):

```
(config vpn ipsec tunnel IPsecFailoverPrimaryTunnel)> metric 10
(config vpn ipsec tunnel IPsecFailoverPrimaryTunnel)>
```

- Configure SureLink for the primary IPsec tunnel and enable **Restart interface**. See [Configure SureLink active recovery for IPsec](#) for instructions.

```
(config vpn ipsec tunnel IPsecFailoverPrimaryTunnel)> surelink restart
true
(config vpn ipsec tunnel IPsecFailoverPrimaryTunnel)>
```

2. Create a backup IPsec tunnel. Configure this tunnel to use the same local and remote endpoints as the primary tunnel. See [Configure an IPsec tunnel](#) for instructions.
  - During configuration of the IPsec tunnel, set the metric to a value that is higher than the metric of the primary tunnel (for example, **20**):

```
(config vpn ipsec tunnel IPsecFailoverBackupTunnel)> metric 20
(config vpn ipsec tunnel IPsecFailoverBackupTunnel)>
```

## IPsec failover using Preferred tunnel

### WebUI

1. Configure the primary IPsec tunnel. See [Configure an IPsec tunnel](#) for instructions.
2. Create a backup IPsec tunnel. See [Configure an IPsec tunnel](#) for instructions.
3. During configuration of the backup IPsec tunnel, identify the primary IPsec tunnel in the **Preferred tunnel** parameter:

The screenshot shows the configuration page for the 'IPsecFailoverBackupTunnel'. The 'Preferred tunnel' dropdown menu is highlighted with a red box and contains the text 'IPsecFailoverPrimaryTunnel'. Other visible fields include 'Enable' (checked), 'Force UDP encapsulation' (unchecked), 'Zone' (set to 'IPsec'), 'Metric' (set to '0'), 'Mode' (set to 'Tunnel mode'), and 'Protocol' (set to 'ESP').

### Command line

1. Configure the primary IPsec tunnel. See [Configure an IPsec tunnel](#) for instructions.
2. Create a backup IPsec tunnel. See [Configure an IPsec tunnel](#) for instructions.
3. During configuration of the backup IPsec tunnel, identify the primary IPsec tunnel:
  - a. Use the **?** to view a list of available tunnels:

```
(config vpn ipsec tunnel backup_ipsec_tunnel)> ipsec_failover ?
```

```
Preferred tunnel: This tunnel will not start until the preferred tunnel
has failed. It will continue
to operate until the preferred tunnel returns to full operation status.
```

```

Format:
 primary_ipsec_tunnel
 backup_ipsec_tunnel
Optional: yes
Current value:

(config vpn ipsec tunnel backup_ipsec_tunnel)> ipsec_failover

```

- b. Set the primary IPsec tunnel:

```

(config vpn ipsec tunnel backup_ipsec_tunnel)> ipsec_failover primary_ipsec_tunnel
(config vpn ipsec tunnel backup_ipsec_tunnel)>

```

## Configure SureLink active recovery for IPsec

You can configure the EX15 device to regularly probe IPsec client connections to determine if the connection has failed and take remedial action.

You can also configure the IPsec tunnel to fail over to a backup tunnel. See [Configure IPsec failover](#) for further information.

### Required configuration items

- A valid IPsec configuration. See [Configure an IPsec tunnel](#) for configuration instructions.
- Enable IPsec active recovery.
- The behavior of the EX15 device upon IPsec failure: either
  - Restart the IPsec interface
  - Reboot the device.

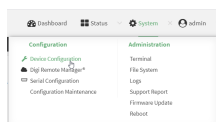
### Additional configuration items

- The interval between connectivity tests.
- Whether the interface should be considered to have failed if one of the test targets fails, or all of the test targets fail.
- The number of probe attempts before the IPsec connection is considered to have failed.
- The amount of time that the device should wait for a response to a probe attempt before considering it to have failed.

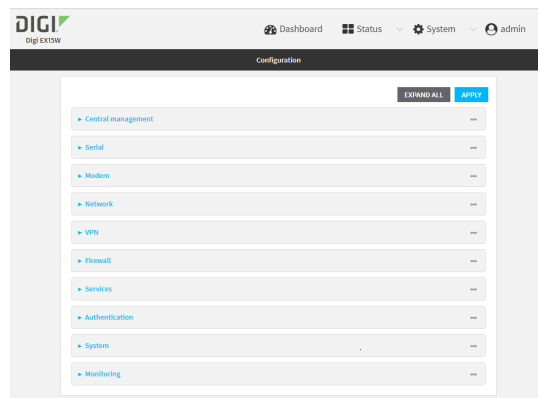
To configure the EX15 device to regularly probe the IPsec connection:

## WebUI

1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.



3. Click **VPN > IPsec**.
4. Create a new IPsec tunnel or select an existing one:
  - To create a new IPsec tunnel, see [Configure an IPsec tunnel](#).
  - To edit an existing IPsec tunnel, click to expand the appropriate tunnel.
5. After creating or selecting the IPsec tunnel, click **Active recovery**.

6. **Enable** active recovery.
7. For **Restart interface**, enable to configure the device to restart the interface when its connection is considered to have failed. This is useful for interfaces that may regain connectivity after restarting, such as a cellular modem.
8. For **Reboot device**, enable to instruct the device to reboot when the WAN connection is considered to have failed.
9. Change the **Interval** between connectivity tests.  
Allowed values are any number of weeks, days, hours, minutes, or seconds, and take the format **number{w|d|h|m|s}**.

For example, to set **Interval** to ten minutes, enter **10m** or **600s**.

The default is 15 minutes.

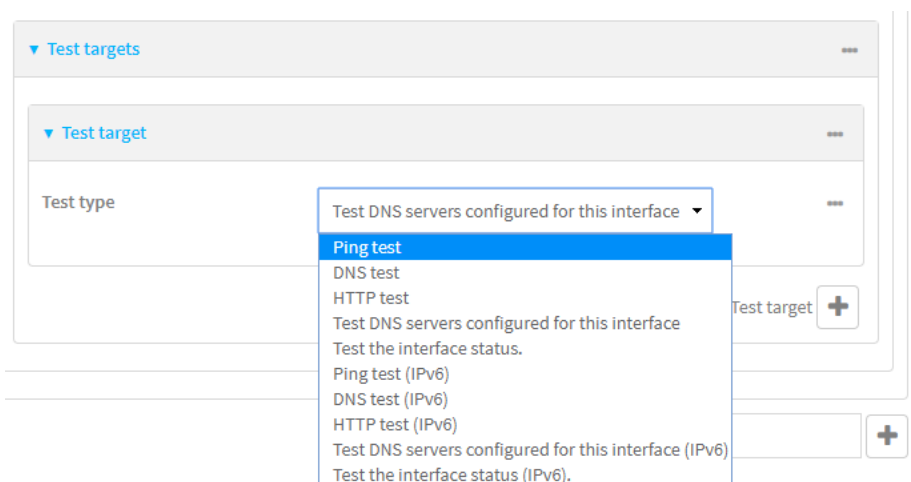
10. For **Success condition**, determine whether the interface should fail over based on the failure of one of the test targets, or all of the test targets.
11. For **Attempts**, type the number of probe attempts before the WAN is considered to have failed.
12. For **Response timeout**, type the amount of time that the device should wait for a response to a probe attempt before considering it to have failed.

Allowed values are any number of weeks, days, hours, minutes, or seconds, and take the format **number{w|d|h|m|s}**.

For example, to set **Response timeout** to ten minutes, enter **10m** or **600s**.

The default is 15 seconds.

13. Add a test target:
  - a. Click to expand **Test targets**.



- b. For **Add Test target**, click **+**.
  - c. Select the **Test type**:
    - **Ping test** or **Ping test (IPv6)**: Tests connectivity by sending an ICMP echo request to the hostname or IP address specified in **Ping host**. You can also optionally change the number of bytes in the **Ping payload size**.
    - **DNS test** or **DNS test (IPv6)**: Tests connectivity by sending a DNS query to the specified **DNS server**.
    - **HTTP test** or **HTTP test (IPv6)**: Tests connectivity by sending an HTTP or HTTPS GET request to the URL specified in **Web servers**. The URL should take the format of **http[s]://hostname/[path]**.
    - **Test DNS servers configured for this interface** or **Test DNS servers configured for this interface (IPv6)**: Tests connectivity by sending a DNS query to the DNS servers configured for this interface.
    - **Test the interface status** or **Test the interface status IPv6**: The interface is considered to be down based on:

- **Down time:** The amount of time that the interface can be down before this test is considered to have failed.

Allowed values are any number of weeks, days, hours, minutes, or seconds, and take the format **number{w|d|h|m|s}**.

For example, to set **Down time** to ten minutes, enter **10m** or **600s**.

The default is 60 seconds.

- **Initial connection time:** The amount of time to wait for an initial connection to the interface before this test is considered to have failed.

Allowed values are any number of weeks, days, hours, minutes, or seconds, and take the format **number{w|d|h|m|s}**.

For example, to set **Initial connection time** to ten minutes, enter **10m** or **600s**.

The default is 60 seconds.

14. Click **Apply** to save the configuration and apply the change.



## Command line

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the command line, type **config** to enter configuration mode:

```
> config
(config)>
```

3. Create a new IPsec tunnel, or edit an existing one:
  - To create a new IPsec tunnel, see [Configure an IPsec tunnel](#).
  - To edit an existing IPsec tunnel, change to the IPsec tunnel's node in the configuration schema. For example, for an IPsec tunnel named **ipsec\_example**, change to the **ipsec\_example** node in the configuration schema:

```
(config)> vpn ipsec tunnel ipsec_example
(config vpn ipsec tunnel ipsec_example)>
```

4. Enable active recovery:

```
(config vpn ipsec tunnel ipsec_example)> connection_monitor enable true
(config vpn ipsec tunnel ipsec_example)>
```

5. To configure the device to restart the interface when its connection is considered to have failed:

---

```
(config vpn ipsec tunnel ipsec_example)> connection_monitor restart true
(config vpn ipsec tunnel ipsec_example)>
```

---

This is useful for interfaces that may regain connectivity after restarting, such as a cellular modem.

6. To configure the device to reboot when the interface is considered to have failed:

---

```
(config vpn ipsec tunnel ipsec_example)> connection_monitor reboot enable
(config vpn ipsec tunnel ipsec_example)>
```

---

7. Set the **Interval** between connectivity tests:

---

```
(config vpn ipsec tunnel ipsec_example)> connection_monitor interval value
(config vpn ipsec tunnel ipsec_example)>
```

---

where *value* is any number of weeks, days, hours, minutes, or seconds, and takes the format **number{w|d|h|m|s}**.

For example, to set **interval** to ten minutes, enter either **10m** or **600s**:

---

```
(config vpn ipsec tunnel ipsec_example)> connection_monitor interval 600s
(config vpn ipsec tunnel ipsec_example)>
```

---

The default is 15 minutes.

8. Determine whether the interface should fail over based on the failure of one of the test targets, or all of the test targets:

---

```
(config vpn ipsec tunnel ipsec_example)> connection_monitor success_
condition value
(config vpn ipsec tunnel ipsec_example)>
```

---

Where *value* is either **one** or **all**.

9. Set the number of probe attempts before the WAN is considered to have failed:

---

```
(config vpn ipsec tunnel ipsec_example)> connection_monitor attempts num
(config vpn ipsec tunnel ipsec_example)>
```

---

The default is **3**.

10. Set the amount of time that the device should wait for a response to a probe attempt before considering it to have failed:

---

```
(config vpn ipsec tunnel ipsec_example)> connection_monitor timeout value
(config vpn ipsec tunnel ipsec_example)>
```

---

where *value* is any number of weeks, days, hours, minutes, or seconds, and takes the format **number{w|d|h|m|s}**.

For example, to set **timeout** to ten minutes, enter either **10m** or **600s**:

---

```
(config vpn ipsec tunnel ipsec_example)> connection_monitor interval 600s
(config vpn ipsec tunnel ipsec_example)>
```

---

The default is 15 seconds.

## 11. Configure test targets:

## a. Add a test target:

---

```
(config vpn ipsec tunnel ipsec_example)> add connection_monitor target
end
(config vpn ipsec tunnel ipsec_example connection_monitor target 0)>
```

---

## b. Set the test type:

---

```
(config vpn ipsec tunnel ipsec_example connection_monitor target 0)>
test value
(config vpn ipsec tunnel ipsec_example connection_monitor target 0)>
```

---

where *value* is one of:

- **ping** (IPv4) or **ping6** (IPv6): Tests connectivity by sending an ICMP echo request to a specified hostname or IP address.

- Specify the hostname or IP address by using **ping\_host** or **ping\_host6**:

---

```
(config vpn ipsec tunnel ipsec_example connection_monitor
target 0)> ping_host host
(config vpn ipsec tunnel ipsec_example connection_monitor
target 0)>
```

---

- (Optional) Set the size, in bytes, of the ping packet by using **ping\_size** or **ping\_size6**:

---

```
(config vpn ipsec tunnel ipsec_example connection_monitor
target 0)> ping_size [num]
(config vpn ipsec tunnel ipsec_example connection_monitor
target 0)>
```

---

- **dns** (IPv4) or **dns6** (IPv6): Tests connectivity by sending a DNS query to the specified DNS server.

- Specify the DNS server. Allowed value is the IP address of the DNS server.

---

```
(config vpn ipsec tunnel ipsec_example connection_monitor
target 0)> dns_server ip_address
(config vpn ipsec tunnel ipsec_example connection_monitor
target 0)>
```

---

- **dns\_configured** (IPv4) or **dns\_configured6** (IPv6): Tests connectivity by sending a DNS query to the DNS servers configured for this interface.

- **http** (IPv4) or **http6** (IPv6): Tests connectivity by sending an HTTP or HTTPS GET request to the specified URL.

- Specify the url. Allowed value uses the format **http[s]://hostname/[path]**.

---

```
(config vpn ipsec tunnel ipsec_example connection_monitor
target 0)> http_url url
(config vpn ipsec tunnel ipsec_example connection_monitor
target 0)>
```

---

- **interface\_up** (IPv4) or **interface\_up6** (IPv6): : The interface is considered to be down based on the interfaces down time, and the amount of time an initial connection to the interface takes before this test is considered to have failed.
  - (Optional) Set the amount of time that the interface can be down before this test is considered to have failed:

---

```
(config vpn ipsec tunnel ipsec_example connection_monitor
target 0)> interface_down_time value
(config vpn ipsec tunnel ipsec_example connection_monitor
target 0)>
```

---

where *value* is any number of weeks, days, hours, minutes, or seconds, and takes the format **number{w|d|h|m|s}**.

For example, to set **interface\_down\_time** to ten minutes, enter either **10m** or **600s**:

---

```
(config vpn ipsec tunnel ipsec_example connection_monitor
target 0)> interface_down_time 600s
(config vpn ipsec tunnel ipsec_example connection_monitor
target 0)>
```

---

The default is 60 seconds.

- (Optional) Set the amount of time to wait for an initial connection to the interface before this test is considered to have failed:

---

```
(config vpn ipsec tunnel ipsec_example connection_monitor
target 0)> interface_timeout value
(config vpn ipsec tunnel ipsec_example connection_monitor
target 0)>
```

---

where *value* is any number of weeks, days, hours, minutes, or seconds, and takes the format **number{w|d|h|m|s}**.

For example, to set **interface\_timeout** to ten minutes, enter either **10m** or **600s**:

---

```
(config vpn ipsec tunnel ipsec_example connection_monitor
target 0)> interface_timeout 600s
(config vpn ipsec tunnel ipsec_example connection_monitor
target 0)>
```

---

The default is 60 seconds.

12. Save the configuration and apply the change:

---

```
(config vpn ipsec tunnel ipsec_example connection_monitor target 0)> save
Configuration saved.
>
```

---

13. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.



## Show IPsec status and statistics

### WebUI

1. Log into the EX15 WebUI as a user with Admin access.
2. On the menu, select **Status > IPsec**.  
The **IPsec** page appears.
3. To view configuration details about an IPsec tunnel, click the  (configuration) icon in the upper right of the tunnel's status pane.

### Command line

1. Log into the EX15 command line as a user with Admin access.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. To display details about all configured IPsec tunnels, type the following at the prompt:

---

```
> show ipsec all
```

| Name   | Enable | Status  | Hostname    |
|--------|--------|---------|-------------|
| -----  | -----  | -----   | -----       |
| ipsec1 | true   | up      | 192.168.2.1 |
| vpn1   | false  | pending | 192.168.3.1 |

```
>
```

---

3. To display details about a specific tunnel:

---

```
> show ipsec tunnel ipsec1
```

```
Tunnel : ipsec1
Enable : true
Status : pending
Hostname : 192.168.2.1
Zone : ipsec
Mode : tunnel
Type : esp
```

```
>
```

---

4. Type **exit** to exit the Admin CLI.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Debug an IPsec configuration

If you experience issues with an IPsec tunnel not being successfully negotiated with the remote end of the tunnel, you can enable IPsec debug messages to be written to the system log. See [View system and event logs](#) for more information about viewing the system log.

There are two methods to enable IPsec debug messages:

- From the Admin CLI—Sets the debug level to **1** (basic debugging information only).
- From the interactive shell—Allows for more detailed debug information.

### Use the Admin CLI to set the IPsec debug level to 1

To set the debug level to **1** by using the Admin CLI:

#### Command line

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the command line, type **config** to enter configuration mode:
 

```
> config
(config)>
```
3. Set the **action ipsec debug** command to **true**:
 

```
config> action ipsec debug true
config>
```
4. Save the configuration and apply the change:
 

```
(config)> save
Configuration saved.
>
```
5. Type **exit** to exit the Admin CLI.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

This sets the IPsec debug level to **1**.

### Use the interactive shell to set the IPsec debug level

By using the interactive shell to set the debug level, you can enable the EX15 device to write additional debug messages to the system log. The command accepts the following values to set the debug level:

- **-1** — (Default) No debug information is written. This is the equivalent of turning off debug messages for IPsec.
- **0** — Basic auditing logs, (for example, SA up/SA down).
- **1** — Generic control flow with errors. Select this for basic debugging information.
- **2** — More detailed debugging control flow.
- **3** — Includes RAW data dumps in hexadecimal format.
- **4** — Also includes sensitive material in dumps (for example, encryption keys).

To access the shell menu option, you must have shell access enabled. See [Authentication groups](#) for information about configuring authentication groups that include shell access.

#### Command line

1. Log into the EX15 command line as a user with shell access.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **shell** to access the device shell.

2. At the shell prompt, execute the following command:

---

```
ipsec stroke loglevel ike debug_level
#
```

---

where *debug\_level* is one of the following:

- **-1** — (Default) No debug information is written. This is the equivalent of turning off debug messages for IPsec.
- **0** — Basic auditing logs, (for example, SA up/SA down).
- **1** — Generic control flow with errors. Select this for basic debugging information.
- **2** — More detailed debugging control flow.
- **3** — Includes RAW data dumps in hexadecimal format.
- **4** — Also includes sensitive material in dumps (for example, encryption keys).

3. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## OpenVPN

OpenVPN is an open-source Virtual Private Network (VPN) technology that creates secure point-to-point or site-to-site connections in routed or bridged configurations. OpenVPN uses a custom security protocol that is Secure Socket Layer (SSL) / Transport Layer Security (TLS) for key exchange. It uses standard encryption and authentication algorithms for data privacy and authentication over TCP or UDP.

The OpenVPN server can push the network configuration, such as the topology and IP routes, to OpenVPN clients. This makes OpenVPN simpler to configure as it reduces the chances of a configuration mismatch between the client and server. OpenVPN also supports cipher negotiation between the client and server. This means you can configure the OpenVPN server and clients with a range of different cipher options and the server will negotiate with the client on the cipher to use for the connection.

---

**Note** The EX15 can only be configured as an OpenVPN client. It cannot be configured as an OpenVPN server.

---

For more information on OpenVPN, see [www.openvpn.net](http://www.openvpn.net).

### OpenVPN modes:

There are two modes for running OpenVPN:

- Routing mode, also known as TUN.
- Bridging mode, also known as TAP.

#### Routing (TUN) mode

In routing mode, each OpenVPN client is assigned a different IP subnet from the OpenVPN server and other OpenVPN clients. OpenVPN clients use Network Address Translation (NAT) to route traffic from devices connected on its LAN interfaces to the OpenVPN server.

The manner in which the IP subnets are defined depends on the OpenVPN topology in use. The EX15 device supports two types of OpenVPN topology:

| OpenVPN Topology | Subnet definition method                                                                                                                                                                                                                                                                                                        |
|------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| net30            | Each OpenVPN client is assigned a <b>/30</b> subnet within the IP subnet specified in the OpenVPN server configuration. With net30 topology, pushed routes are used, with the exception of the default route. . Automatic route pushing (exec) is not allowed, because this would not inform the firewall and would be blocked. |
| subnet           | Each OpenVPN client connected to the OpenVPN server is assigned an IP address within the IP subnet specified in the OpenVPN server configuration. For the EX15 device, pushed routes are not allowed; you will need to manually configure routes on the device.                                                                 |

For more information on OpenVPN topologies, see [OpenVPN topology](#).

#### Bridging (TAP) mode

In bridging mode, a LAN interface on the OpenVPN server is assigned to OpenVPN. The LAN interfaces of the OpenVPN clients are on the same IP subnet as the OpenVPN server's LAN interface. This means

that devices connected to the OpenVPN client's LAN interface are on the same IP subnet as devices. The EX15 device supports two mechanisms for configuring an OpenVPN server in TAP mode:

- OpenVPN managed—The EX15 device creates the interface and then uses its standard configuration to set up the connection (for example, its standard DHCP server configuration).
- Device only—IP addressing is controlled by the system, not by OpenVPN.

### **Additional OpenVPN information**

For more information on OpenVPN, see these resources:

[Bridging vs. routing](#)

[OpenVPN/Routing](#)

## **Configure an OpenVPN server**

### **Required configuration items**

- Enable the OpenVPN server.  
The OpenVPN server is enabled by default.
- The mode used by the OpenVPN server, one of:
  - **TUN (OpenVPN managed)**—Also known as routing mode. Each OpenVPN client is assigned a different IP subnet from the OpenVPN server and other OpenVPN clients. OpenVPN clients use Network Address Translation (NAT) to route traffic from devices connected on its LAN interfaces to the OpenVPN server.
  - **TAP - OpenVPN managed**—Also known as bridging mode. A more advanced implementation of OpenVPN. The EX15 device creates an OpenVPN interface and uses standard interface configuration (for example, a standard DHCP server configuration).
  - **TAP - Device only**—An alternate form of OpenVPN bridging mode, in which the device, rather than OpenVPN, controls the interface configuration. If this method is used, the OpenVPN server must be included as a device in either an interface or a bridge.
- The firewall zone to be used by the OpenVPN server.
- The IP network and subnet mask of the OpenVPN server.
- The server's Certificate authority (CA) certificate, and public, private and Diffie-Hellman (DH) keys.
- An OpenVPN authentication group and an OpenVPN user.
- Determine the method of certificate management:
  - Certificates managed by the server.
  - Certificates created externally and added to the server.
- If certificates are created and added to the server, determine the level of authentication:
  - Certificate authentication only.
  - Username and password authentication only.
  - Certificate and username and password authentication.

If username and password authentication is used, you must create an OpenVPN authentication group and user. See [Configure an OpenVPN Authentication Group and User](#) for instructions.

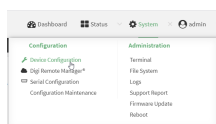
- Certificates and keys:
  - The **CA certificate** (usually in a ca.crt file).
  - The **Public key** (for example, server.crt)
  - The **Private key** (for example, server.key).
  - The **Diffie Hellman key** (usually in dh2048.pem).
- Active recovery configuration. See [Configure SureLink active recovery for OpenVPN](#) for information about OpenVPN active recovery.

### Additional configuration items

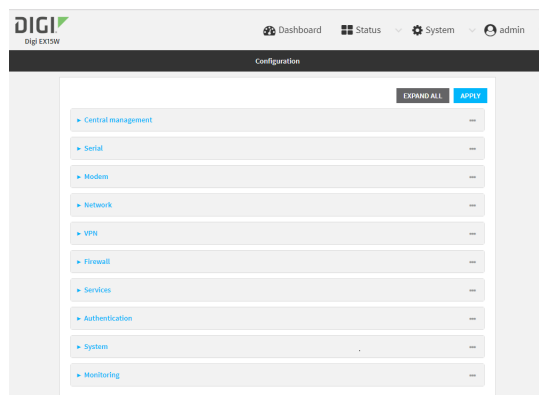
- The route metric for the OpenVPN server.
- The range of IP addresses that the OpenVPN server will provide to clients.
- The TCP/UDP port to use. By default, the EX15 device uses port **1194**.
- Access control list configuration to restrict access to the OpenVPN server through the firewall.
- Additional OpenVPN parameters.

## WebUI

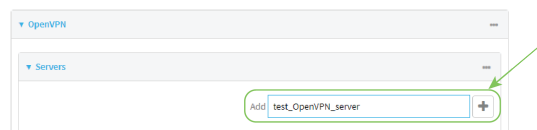
1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.



3. Click **VPN > OpenVPN > Servers**.
4. For **Add**, type a name for the OpenVPN server and click **+**.



The new OpenVPN server configuration is displayed.

The OpenVPN server is enabled by default. To disable, click **Enable**.

5. For **Device type**, select the mode used by the OpenVPN server, either:

- **TUN (OpenVPN managed)**
- **TAP - OpenVPN managed**
- **TAP - Device only**

See [OpenVPN](#) for information about OpenVPN server modes.

6. If **TUN (OpenVPN managed)** or **TAP - OpenVPN managed** is selected for **Device type**:
  - a. For **Zone**, select the firewall zone for the OpenVPN server. For TUN device types, this should be set to **Internal** to treat clients as LAN devices.
  - b. (Optional) Select the **Metric** for the OpenVPN server. If multiple active routes match a destination, the route with the lowest metric will be used. The default setting is **0**.
  - c. For **Address**, type the IP address and subnet mask of the OpenVPN server.
  - d. (Optional) For **First IP address** and **Last IP address**, set the range of IP addresses that the OpenVPN server will use when providing IP addresses to clients. The default is from **80** to **99**.
7. (Optional) Set the **VPN port** that the OpenVPN server will use. The default is **1194**.
8. For **Server managed certificates**, determine the method of certificate management. If enabled, the server will manage certificates. If not enabled, certificates must be created externally and added to the server.
9. If **Server managed certificates** is not enabled:
  - a. Select the **Authentication** type:
    - **Certificate only**: Uses only certificates for client authentication. Each client requires a public and private key.
    - **Username/password only**: Uses a username and password for client authentication. You must create an OpenVPN authentication group and user. See [Configure an OpenVPN Authentication Group and User](#) for instructions.
    - **Certificate and username/password**: Uses both certificates and a username and password for client authentication. Each client requires a public and private key,

- and you must create an OpenVPN authentication group and user. See [Configure an OpenVPN Authentication Group and User](#) for instructions.
- b. Paste the contents of the **CA certificate** (usually in a ca.crt file), the **Public key** (for example, server.crt), the **Private key** (for example, server.key), and the **Diffie Hellman key** (usually in dh2048.pem) into their respective fields. The contents will be hidden when the configuration is saved.
10. (Optional) Click to expand **Access control list** to restrict access to the OpenVPN server:
    - To limit access to specified IPv4 addresses and networks:
      - a. Click **IPv4 Addresses**.
      - b. For **Add Address**, click **+**.
      - c. For **Address**, enter the IPv4 address or network that can access the device's service-type. Allowed values are:
        - A single IP address or host name.
        - A network designation in CIDR notation, for example, 192.168.1.0/24.
        - **any**: No limit to IPv4 addresses that can access the service-type.
      - d. Click **+** again to list additional IP addresses or networks.
    - To limit access to specified IPv6 addresses and networks:
      - a. Click **IPv6 Addresses**.
      - b. For **Add Address**, click **+**.
      - c. For **Address**, enter the IPv6 address or network that can access the device's service-type. Allowed values are:
        - A single IP address or host name.
        - A network designation in CIDR notation, for example, 2001:db8::/48.
        - **any**: No limit to IPv6 addresses that can access the service-type.
      - d. Click **+** again to list additional IP addresses or networks.
    - To limit access to hosts connected through a specified interface on the EX15 device:
      - a. Click **Interfaces**.
      - b. For **Add Interface**, click **+**.
      - c. For **Interface**, select the appropriate interface from the dropdown.
      - d. Click **+** again to allow access through additional interfaces.
    - To limit access based on firewall zones:
      - a. Click **Zones**.
      - b. For **Add Zone**, click **+**.
      - c. For **Zone**, select the appropriate firewall zone from the dropdown.  
See [Firewall configuration](#) for information about firewall zones.
      - d. Click **+** again to allow access through additional firewall zones.
  11. (Optional) Click to expand **Advanced Options** to manually set additional OpenVPN parameters.
    - a. Click **Enable** to enable the use of additional OpenVPN parameters.
    - b. Click **Override** if the additional OpenVPN parameters should override default options.
    - c. For **OpenVPN parameters**, type the additional OpenVPN parameters.



- Click **Apply** to save the configuration and apply the change.



## Command line

- Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
- At the command line, type **config** to enter configuration mode:

```
> config
(config)>
```

- At the config prompt, type:

```
(config)> add vpn openvpn server name
(config vpn openvpn server name)>
```

where *name* is the name of the OpenVPN server.

The OpenVPN server is enabled by default. To disable the server, type:

```
(config vpn openvpn server name)> enable false
(config vpn openvpn server name)>
```

- Set the mode used by the OpenVPN server:

```
(config vpn openvpn server name)> device_type value
(config vpn openvpn server name)>
```

where *value* is one of:

- **TUN (OpenVPN managed)**—Also known as routing mode. Each OpenVPN client is assigned a different IP subnet from the OpenVPN server and other OpenVPN clients. OpenVPN clients use Network Address Translation (NAT) to route traffic from devices connected on its LAN interfaces to the OpenVPN server.
- **TAP - OpenVPN managed**—Also known as bridging mode. A more advanced implementation of OpenVPN. The EX15 device creates an OpenVPN interface and uses standard interface configuration (for example, a standard DHCP server configuration).
- **TAP - Device only**—An alternate form of OpenVPN bridging mode, in which the device, rather than OpenVPN, controls the interface configuration. If this method is used, the OpenVPN server must be included as a device in either an interface or a bridge.

See [OpenVPN](#) for information about OpenVPN modes. The default is **tun**.

5. If **tap** or **tun** are set for **device\_type**:

- a. Set the IP address and subnet mask of the OpenVPN server.

---

```
(config vpn openvpn server name)> address ip_address/netmask
(config vpn openvpn server name)>
```

---

- b. Set the firewall zone for the OpenVPN server. For TUN device types, this should be set to
- internal**
- to treat clients as LAN devices.

---

```
(config vpn openvpn server name)> zone value
(config vpn openvpn server name)>
```

---

To view a list of available zones:

---

```
(config vpn openvpn server name)> firewall zone ?
```

---

Zone: The zone for the local TUN interface. To treat clients as LAN devices this would usually be set to internal.

Format:

```
any
dynamic_routes
edge
external
internal
ipsec
loopback
setup
```

Current value:

---

```
(config vpn openvpn server name)>
```

---

- c. (Optional) Set the route metric for the OpenVPN server. If multiple active routes match a destination, the route with the lowest metric will be used.

---

```
(config vpn openvpn server name)> metric value
(config vpn openvpn server name)>
```

---

where *value* is an interger between **0** and **65535**. The default is **0**.

- d. (Optional) Set the range of IP addresses that the OpenVPN server will use when providing IP addresses to clients:

- i. Set the first address in the range limit:

---

```
(config vpn openvpn server name)> server_first_ip value
(config vpn openvpn server name)>
```

---

where *value* is a number between **1** and **255**. The number entered here will represent the first client IP address. For example, if **address** is set to **192.168.1.1/24** and **server\_first\_ip** is set to **80**, the first client IP address will be 192.168.1.80.

The default is from **80**.

- ii. Set the last address in the range limit:

---

```
(config vpn openvpn server name)> server_last_ip value
(config vpn openvpn server name)>
```

---

where *value* is a number between **1** and **255**. The number entered here will represent the last client IP address. For example, if **address** is set to **192.168.1.1/24** and **server\_last\_ip** is set to **99**, the last client IP address will be 192.168.1.80.

The default is from **80**.

6. (Optional) Set the port that the OpenVPN server will use:

---

```
(config vpn openvpn server name)> port port
(config vpn openvpn server name)>
```

---

The default is **1194**.

7. Determine the method of certificate management:

- a. To allow the server to manage certificates:

---

```
(config vpn openvpn server name)> autogenerate true
(config vpn openvpn server name)>
```

---

- b. To create certificates externally and add them to the server

---

```
(config vpn openvpn server name)> autogenerate false
(config vpn openvpn server name)>
```

---

The default setting is **false**.

- c. If **autogenerate** is set to false:

- i. Set the authentication type:

---

```
(config vpn openvpn server name)> authentication value
(config vpn openvpn server name)>
```

---

where *value* is one of:

- **cert**: Uses only certificates for client authentication. Each client requires a public and private key.
  - **passwd**: Uses a username and password for client authentication. You must create an OpenVPN authentication group and user. See [Configure an OpenVPN Authentication Group and User](#) for instructions.
  - **cert\_passwd**: Uses both certificates and a username and password for client authentication. Each client requires a public and private key, and you must create an OpenVPN authentication group and user. See [Configure an OpenVPN Authentication Group and User](#) for instructions.
- ii. Paste the contents of the CA certificate (usually in a ca.crt file) into the value of the **cacert** parameter:

---

```
(config vpn openvpn server name)> cacert value
(config vpn openvpn server name)>
```

---

- iii. Paste the contents of the public key (for example, server.crt) into the value of the **server\_cert** parameter:

---

```
(config vpn openvpn server name)> server_cert value
(config vpn openvpn server name)>
```

---

- iv. Paste the contents of the private key (for example, server.key) into the value of the **server\_key** parameter:

---

```
(config vpn openvpn server name)> server_key value
(config vpn openvpn server name)>
```

---

- v. Paste the contents of the Diffie Hellman key (usually in dh2048.pem) into the value of the **diffie** parameter:

---

```
(config vpn openvpn server name)> diffie value
(config vpn openvpn server name)>
```

---

8. (Optional) Set the access control list to restrict access to the OpenVPN server:

- To limit access to specified IPv4 addresses and networks:

---

```
(config vpn openvpn server name)> add acl address end value
(config vpn openvpn server name)>
```

---

Where *value* can be:

- A single IP address or host name.
- A network designation in CIDR notation, for example, 192.168.1.0/24.
- **any**: No limit to IPv4 addresses that can access the service-type.

Repeat this step to list additional IP addresses or networks.

- To limit access to specified IPv6 addresses and networks:

---

```
(config vpn openvpn server name)> add acl address6 end value
(config vpn openvpn server name)>
```

---

Where *value* can be:

- A single IP address or host name.
- A network designation in CIDR notation, for example, 2001:db8::/48.
- **any**: No limit to IPv6 addresses that can access the service-type.

Repeat this step to list additional IP addresses or networks.

- To limit access to hosts connected through a specified interface on the EX15 device:

---

```
(config vpn openvpn server name)> add acl interface end value
(config vpn openvpn server name)>
```

---

Where *value* is an interface defined on your device.

Display a list of available interfaces:

Use **... network interface ?** to display interface information:

Repeat this step to list additional interfaces.

- To limit access based on firewall zones:

---

```
(config vpn openvpn server name)> add acl zone end value
```

---

Where *value* is a firewall zone defined on your device, or the **any** keyword.

Display a list of available firewall zones:

Type ... **firewall zone ?** at the config prompt:

---

```
(config vpn openvpn server name)> ... firewall zone ?
```

---

Zones: A list of groups of network interfaces that can be referred to by packet filtering rules and access control lists.

Additional Configuration

-----

```
any
dynamic_routes
edge
external
internal
ipsec
loopback
setup
```

---

```
(config vpn openvpn server name)>
```

---

Repeat this step to list additional firewall zones.

9. (Optional) Set additional OpenVPN parameters.

- Enable the use of additional OpenVPN parameters:

---

```
(config vpn openvpn server name)> advanced_options enable true
(config vpn openvpn server name)>
```

---

- Configure whether the additional OpenVPN parameters should override default options:

---

```
(config vpn openvpn server name)> advanced_options override true
(config vpn openvpn server name)>
```

---

- Set the additional OpenVPN parameters:

---

```
(config vpn openvpn server name)> extra parameters
(config vpn openvpn server name)>
```

---

10. Save the configuration and apply the change:

---

```
(config)> save
Configuration saved.
>
```

---

11. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

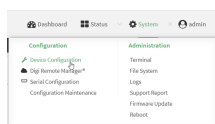
## Configure an OpenVPN Authentication Group and User

If username and password authentication is used for the OpenVPN server, you must create an OpenVPN authentication group and user.

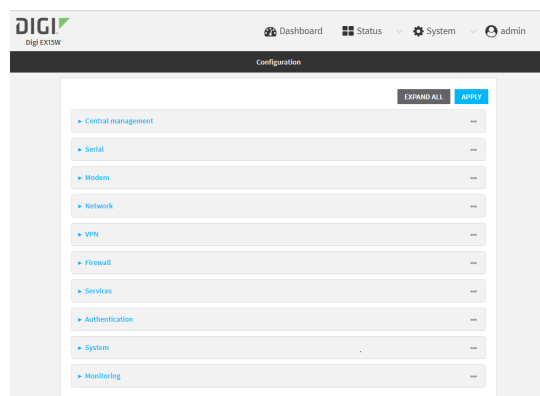
See [Configure an OpenVPN server](#) for information about configuring an OpenVPN server to use username and password authentication. See [EX15 user authentication](#) for more information about creating authentication groups and users.

### WebUI

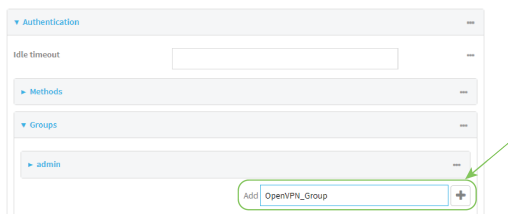
1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



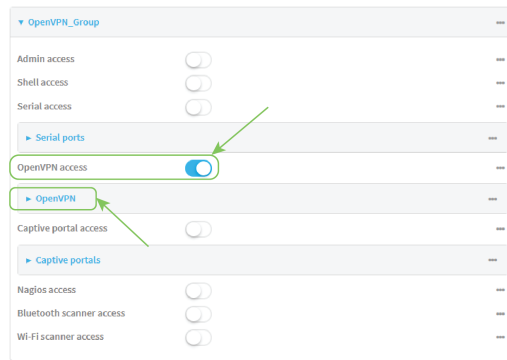
The **Configuration** window is displayed.



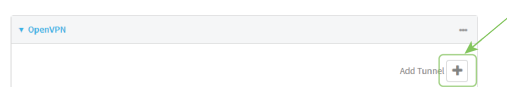
3. Add an OpenVPN authentication group:
  - a. Click **Authentication > Groups**.
  - b. For **Add Group**, type a name for the group (for example, **OpenVPN\_Group**) and click **+**.



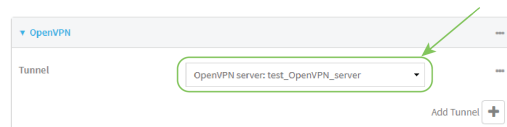
The new authentication group configuration is displayed.



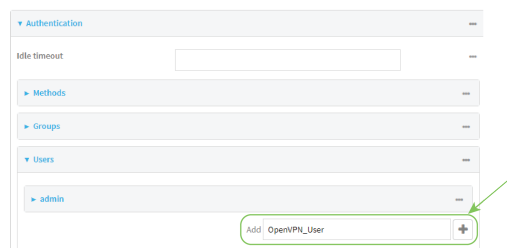
- c. Click **OpenVPN access** to enable OpenVPN access rights for users of this group.
- d. Click to expand the **OpenVPN** node.
- e. Click **+** to add a tunnel.



- f. For **Tunnel**, select an OpenVPN tunnel to which users of this group will have access.

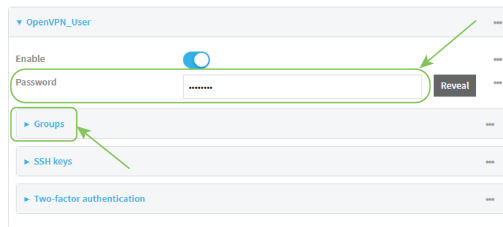


- g. Repeat to add additional OpenVPN tunnels.
4. Add an OpenVPN authentication user:
    - a. Click **Authentication > Users**.
    - b. For **Add**, type a name for the user (for example, **OpenVPN\_User**) and click **+**.

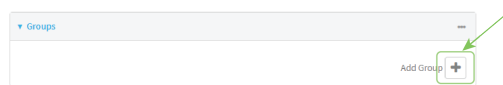


- c. Type a password for the user.  
This password is used for local authentication of the user. You can also configure the user to use RADIUS or TACACS+ authentication by configuring authentication methods. See [User authentication methods](#) for information.

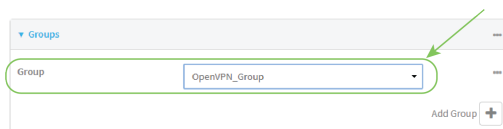
- d. Click to expand the **Groups** node.



- e. Click **+** to add a group to the user.



- f. Select a **Group** with **OpenVPN access** enabled.



5. Click **Apply** to save the configuration and apply the change.





## Command line

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.

2. At the command line, type **config** to enter configuration mode:

---

```
> config
(config)>
```

---

3. Use the **add auth group** command to add a new authentication. For example, to add a group named **OpenVPN\_Group**:

---

```
(config)> add auth group OpenVPN_Group
(config auth group OpenVPN_Group)>
```

---

4. Enable OpenVPN access rights for users of this group:

---

```
(config auth group OpenVPN_Group)> acl openvpn enable true
```

---

5. Add an OpenVPN tunnel to which users of this group will have access:

- a. Determine available tunnels:

---

```
(config auth group OpenVPN_Group)> vpn openvpn server ?
```

Servers: A list of openvpn servers

Additional Configuration

-----

OpenVPN\_server1                  OpenVPN server

```
(config auth group OpenVPN_Group)>
```

---

- b. Add a tunnel:

---

```
(config auth group OpenVPN_Group)> add auth group test acl openvpn
tunnels end /vpn/openvpn/server/OpenVPN_server1
(config auth group OpenVPN_Group)>
```

---

6. Save the configuration and apply the change:

---

```
(config)> save
Configuration saved.
>
```

---

7. Type **exit** to exit the Admin CLI.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Configure an OpenVPN client by using an .ovpn file

### Required configuration items

- Enable the OpenVPN client.  
The OpenVPN client is enabled by default.
- The firewall zone to be used by the OpenVPN client.

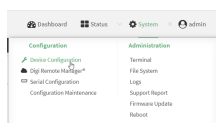
### Additional configuration items

- The route metric for the OpenVPN client.
- The login credentials for the OpenVPN client, if configured on the OpenVPN server.

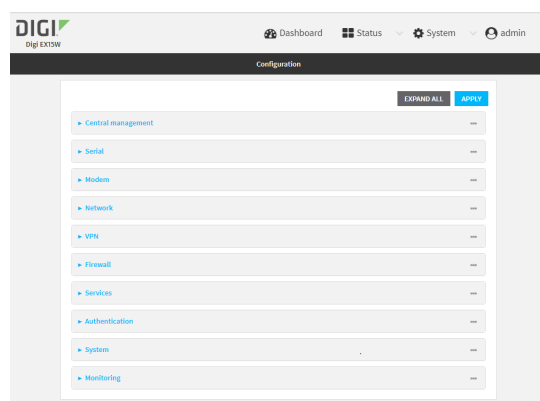
See [Configure SureLink active recovery for OpenVPN](#) for information about OpenVPN active recovery.

## WebUI

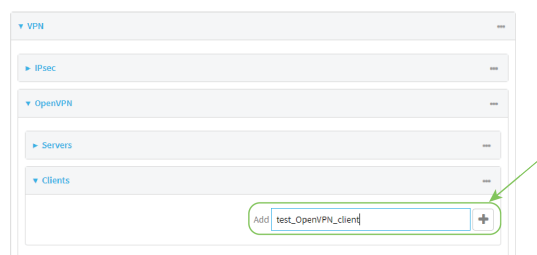
1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.



3. Click **VPN > OpenVPN > Clients**.
4. For **Add**, type a name for the OpenVPN client and click **+**.



The new OpenVPN client configuration is displayed.

5. The OpenVPN client is enabled by default. To disable, click **Enable**.
6. The default behavior is to use an OVPN file for client configuration. To disable this behavior and configure the client manually, click **Use .ovpn file** to disable. If **Use .ovpn file** is disabled, see [Configure an OpenVPN client without using an .ovpn file](#) for configuration information.
7. For **Zone**, select the firewall zone for the OpenVPN client.
8. (Optional) Select the **Metric** for the OpenVPN client. If multiple active routes match a destination, the route with the lowest metric will be used.
9. (Optional) For **Username** and **Password**, type the login credentials as configured on the OpenVPN server.
10. For **OVPN file**, paste the content of the client.ovpn file.
11. Click **Apply** to save the configuration and apply the change.



## Command line

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the command line, type **config** to enter configuration mode:

```
> config
(config)>
```

3. At the config prompt, type:

```
(config)> add vpn openvpn client name
(config vpn openvpn client name)>
```

where *name* is the name of the OpenVPN server.

The OpenVPN client is enabled by default. To disable the client, type:

---

```
(config vpn openvpn client name)> enable false
(config vpn openvpn client name)>
```

---

4. Set the firewall zone for the OpenVPN client:

---

```
(config vpn openvpn client name)> zone value
(config vpn openvpn client name)>
```

---

To view a list of available zones:

---

```
(config vpn openvpn client name)> zone ?
```

---

Zone: The zone for the openvpn client interface.

Format:

```
any
dynamic_routes
edge
external
internal
ipsec
loopback
setup
```

Current value:

---

```
(config vpn openvpn client name)>
```

---

5. (Optional) Set the route metric for the OpenVPN server. If multiple active routes match a destination, the route with the lowest metric will be used.

---

```
(config vpn openvpn client name)> metric value
(config vpn openvpn client name)>
```

---

where *value* is an interger between **0** and **65535**. The default is **0**.

6. (Optional) Set the login credentials as configured on the OpenVPN server:

---

```
(config vpn openvpn client name)> username value
(config vpn openvpn client name)> password value
(config vpn openvpn client name)>
```

---

7. Paste the content of the client.ovpn file into the value of the **config\_file** parameter:

---

```
(config vpn openvpn client name)> config_file value
(config vpn openvpn client name)>
```

---

8. Save the configuration and apply the change:

---

```
(config)> save
Configuration saved.
>
```

---

9. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Configure an OpenVPN client without using an .ovpn file

### Required configuration items

- Enable the OpenVPN client.  
The OpenVPN client is enabled by default.
- The mode used by the OpenVPN server, either routing (TUN), or bridging (TAP).
- The firewall zone to be used by the OpenVPN client.
- The IP address of the OpenVPN server.
- Certificates and keys:
  - The **CA certificate** (usually in a ca.crt file).
  - The **Public key** (for example, client.crt)
  - The **Private key** (for example, client.key).

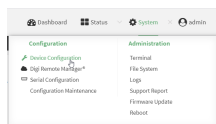
### Additional configuration items

- The route metric for the OpenVPN client.
- The login credentials for the OpenVPN client, if configured on the OpenVPN server.
- Additional OpenVPN parameters.

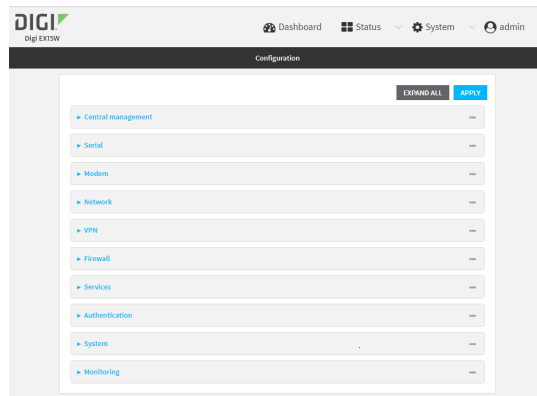
See [Configure SureLink active recovery for OpenVPN](#) for information about OpenVPN active recovery.

## WebUI

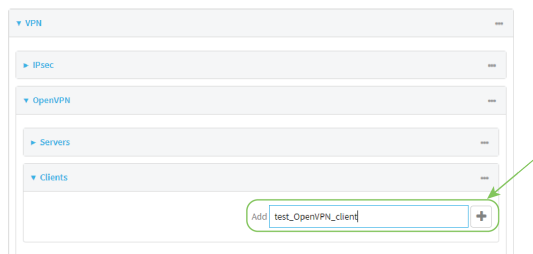
1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



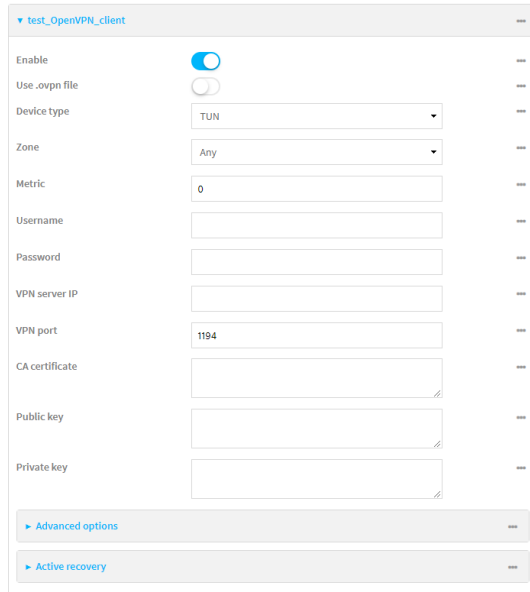
The **Configuration** window is displayed.



3. Click **VPN > OpenVPN > Clients**.
4. For **Add**, type a name for the OpenVPN client and click **+**.



The new OpenVPN client configuration is displayed.



5. The OpenVPN client is enabled by default. To disable, click **Enable**.
6. The default behavior is to use an OVPN file for client configuration. To disable this behavior and configure the client manually, click **Use .ovpn file** to disable.
7. For **Device type**, select the mode used by the OpenVPN server, either **TUN** or **TAP**.

8. For **Zone**, select the firewall zone for the OpenVPN client.
9. (Optional) Select the **Metric** for the OpenVPN client. If multiple active routes match a destination, the route with the lowest metric will be used.
10. (Optional) For **Username** and **Password**, type the login credentials as configured on the OpenVPN server.
11. For **VPN server IP**, type the IP address of the OpenVPN server.
12. (Optional) Set the **VPN port** used by the OpenVPN server. The default is **1194**.
13. Paste the contents of the **CA certificate** (usually in a ca.crt file), the **Public key** (for example, client.crt), and the **Private key** (for example, client.key) into their respective fields. The contents will be hidden when the configuration is saved.
14. (Optional) Click to expand **Advanced Options** to manually set additional OpenVPN parameters.
  - a. Click **Enable** to enable the use of additional OpenVPN parameters.
  - b. Click **Override** if the additional OpenVPN parameters should override default options.
  - c. For **OpenVPN parameters**, type the additional OpenVPN parameters. For example, to override the configuration by using a configuration file, enter **--config filename**, for example, **--config /etc/config/openvpn\_config**.
15. Click **Apply** to save the configuration and apply the change.



## Command line

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the command line, type **config** to enter configuration mode:

```
> config
(config)>
```

3. At the config prompt, type:

```
(config)> add vpn openvpn client name
(config vpn openvpn client name)>
```

where *name* is the name of the OpenVPN server.

The OpenVPN client is enabled by default. To disable the client, type:

```
(config vpn openvpn client name)> enable false
(config vpn openvpn client name)>
```

4. The default behavior is to use an OVPN file for client configuration. To disable this behavior and configure the client manually:

---

```
(config vpn openvpn client name)> use_file false
(config vpn openvpn client name)>
```

---

5. Set the mode used by the OpenVPN server:

---

```
(config vpn openvpn client name)> device_type value
(config vpn openvpn client name)>
```

---

where *value* is either **tun** or **tap**. The default is **tun**.

6. Set the firewall zone for the OpenVPN client:

---

```
(config vpn openvpn client name)> zone value
(config vpn openvpn client name)>
```

---

To view a list of available zones:

---

```
(config vpn openvpn client name)> zone ?
```

---

Zone: The zone for the openvpn client interface.

Format:

```
any
dynamic_routes
edge
external
internal
ipsec
loopback
setup
```

Current value:

---

```
(config vpn openvpn client name)>
```

---

7. (Optional) Set the route metric for the OpenVPN server. If multiple active routes match a destination, the route with the lowest metric will be used.

---

```
(config vpn openvpn client name)> metric value
(config vpn openvpn client name)>
```

---

where *value* is an interger between **0** and **65535**. The default is **0**.

8. (Optional) Set the login credentials as configured on the OpenVPN server:

---

```
(config vpn openvpn client name)> username value
(config vpn openvpn client name)> password value
(config vpn openvpn client name)>
```

---

9. Set the IP address of the OpenVPN server:

---

```
(config vpn openvpn client name)> server ip_address
(config vpn openvpn client name)>
```

---



10. (Optional) Set the port used by the OpenVPN server:

---

```
(config vpn openvpn client name)> port port
(config vpn openvpn client name)>
```

---

The default is **1194**.

11. Paste the contents of the CA certificate (usually in a ca.crt file) into the value of the **cacert** parameter:

---

```
(config vpn openvpn client name)> cacert value
(config vpn openvpn client name)>
```

---

12. Paste the contents of the public key (for example, client.crt) into the value of the **public\_cert** parameter:

---

```
(config vpn openvpn client name)> public_cert value
(config vpn openvpn client name)>
```

---

13. Paste the contents of the private key (for example, client.key) into the value of the **private\_key** parameter:

---

```
(config vpn openvpn client name)> private_key value
(config vpn openvpn client name)>
```

---

14. (Optional) Set additional OpenVPN parameters.

- a. Enable the use of additional OpenVPN parameters:

---

```
(config vpn openvpn client name)> advanced_options enable true
(config vpn openvpn client name)>
```

---

- b. Configure whether the additional OpenVPN parameters should override default options:

---

```
(config vpn openvpn client name)> advanced_options override true
(config vpn openvpn client name)>
```

---

- c. Set the additional OpenVPN parameters:

---

```
(config vpn openvpn client name)> advanced_options extra parameters
(config vpn openvpn client name)>
```

---

15. Save the configuration and apply the change:

---

```
(config)> save
Configuration saved.
>
```

---

16. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Configure SureLink active recovery for OpenVPN

You can configure the EX15 device to regularly probe OpenVPN client connections to determine if the connection has failed and take remedial action.

### Required configuration items

- A valid OpenVPN client configuration. See [Configure an OpenVPN client by using an .ovpn file](#) or [Configure an OpenVPN client without using an .ovpn file](#) for configuration instructions.
- Enable OpenVPN active recovery.
- The behavior of the EX15 device upon OpenVPN failure: either
  - Restart the OpenVPN interface
  - Reboot the device.

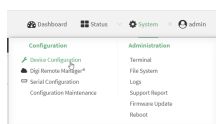
### Additional configuration items

- The interval between connectivity tests.
- Whether the interface should be considered to have failed if one of the test targets fails, or all of the test targets fail.
- The number of probe attempts before the OpenVPN connection is considered to have failed.
- The amount of time that the device should wait for a response to a probe attempt before considering it to have failed.

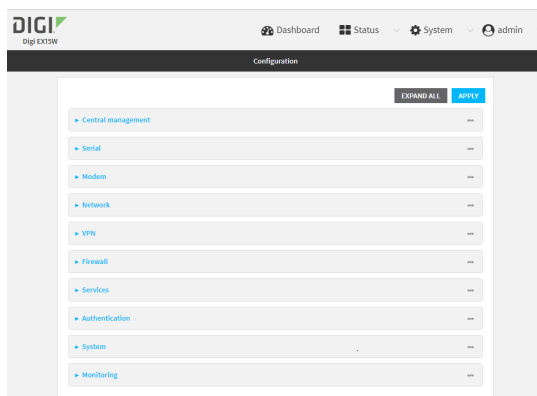
To configure the EX15 device to regularly probe the OpenVPN connection:

## WebUI

1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.



3. Click **VPN > OpenVPN > Clients**.
4. Create a new OpenVPN client or select an existing one:
  - To create a new OpenVPN client, see [Configure an OpenVPN client by using an .ovpn file](#) or [Configure an OpenVPN client without using an .ovpn file](#).
  - To edit an existing OpenVPN client, click to expand the appropriate client.

- After creating or selecting the OpenVPN client, click **Active recovery**.

▼ Active recovery

Enable ☐

Restart interface ☐

Reboot device ☐

Interval

Success condition

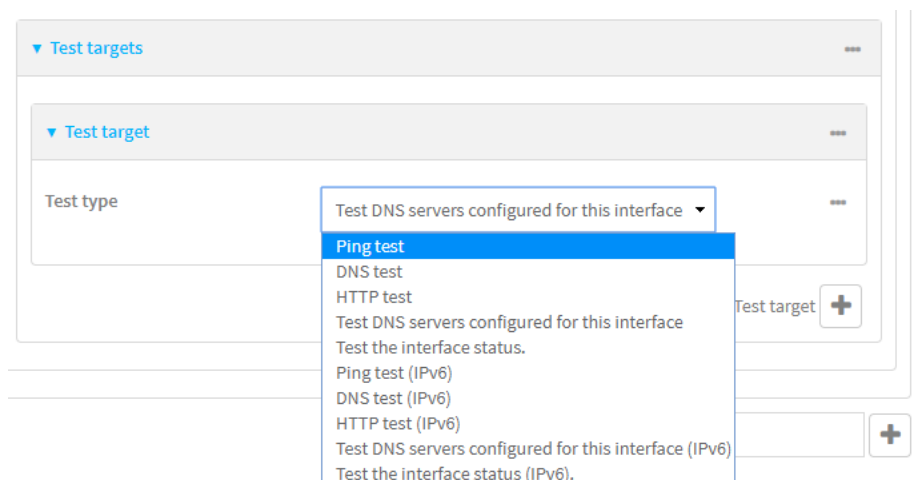
Attempts

Response timeout

► Test targets

- Enable** active recovery.
- For **Restart interface**, enable to configure the device to restart the interface when its connection is considered to have failed. This is useful for interfaces that may regain connectivity after restarting, such as a cellular modem.
- For **Reboot device**, enable to instruct the device to reboot when the WAN connection is considered to have failed.
- Change the **Interval** between connectivity tests.  
Allowed values are any number of weeks, days, hours, minutes, or seconds, and take the format **number{w|d|h|m|s}**.  
For example, to set **Interval** to ten minutes, enter **10m** or **600s**.  
The default is 15 minutes.
- For **Success condition**, determine whether the interface should fail over based on the failure of one of the test targets, or all of the test targets.
- For **Attempts**, type the number of probe attempts before the WAN is considered to have failed.
- For **Response timeout**, type the amount of time that the device should wait for a response to a probe attempt before considering it to have failed.  
Allowed values are any number of weeks, days, hours, minutes, or seconds, and take the format **number{w|d|h|m|s}**.  
For example, to set **Response timeout** to ten minutes, enter **10m** or **600s**.  
The default is 15 seconds.

13. Add a test target:
  - a. Click to expand **Test targets**.



- b. For **Add Test target**, click **+**.
  - c. Select the **Test type**:
    - **Ping test** or **Ping test (IPv6)**: Tests connectivity by sending an ICMP echo request to the hostname or IP address specified in **Ping host**. You can also optionally change the number of bytes in the **Ping payload size**.
    - **DNS test** or **DNS test (IPv6)**: Tests connectivity by sending a DNS query to the specified **DNS server**.
    - **HTTP test** or **HTTP test (IPv6)**: Tests connectivity by sending an HTTP or HTTPS GET request to the URL specified in **Web servers**. The URL should take the format of **http[s]://hostname/[path]**.
    - **Test DNS servers configured for this interface** or **Test DNS servers configured for this interface (IPv6)**: Tests connectivity by sending a DNS query to the DNS servers configured for this interface.
    - **Test the interface status** or **Test the interface status IPv6**: The interface is considered to be down based on:
      - **Down time**: The amount of time that the interface can be down before this test is considered to have failed.  
Allowed values are any number of weeks, days, hours, minutes, or seconds, and take the format **number{w|d|h|m|s}**.  
For example, to set **Down time** to ten minutes, enter **10m** or **600s**.  
The default is 60 seconds.
      - **Initial connection time**: The amount of time to wait for an initial connection to the interface before this test is considered to have failed.  
Allowed values are any number of weeks, days, hours, minutes, or seconds, and take the format **number{w|d|h|m|s}**.  
For example, to set **Initial connection time** to ten minutes, enter **10m** or **600s**.  
The default is 60 seconds.

- Click **Apply** to save the configuration and apply the change.



## Command line

- Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
- At the command line, type **config** to enter configuration mode:
 

```
> config
(config)>
```
- Create a new OpenVPN client, or edit an existing one:
  - To create a new OpenVPN client, see [Configure an OpenVPN client by using an .ovpn file](#) or [Configure an OpenVPN client without using an .ovpn file](#).
  - To edit an existing OpenVPN client, change to the OpenVPN client's node in the configuration schema. For example, for an OpenVPN client named **openvpn\_client1**, change to the **openvpn\_client1** node in the configuration schema:
 

```
(config)> vpn openvpn client openvpn_client1
(config vpn openvpn client openvpn_client1)>
```
- Enable active recovery:
 

```
(config vpn openvpn client openvpn_client1)> connection_monitor enable true
(config vpn openvpn client openvpn_client1)>
```
- To configure the device to restart the interface when its connection is considered to have failed:
 

```
(config vpn openvpn client openvpn_client1)> connection_monitor restart true
(config vpn openvpn client openvpn_client1)>
```

This is useful for interfaces that may regain connectivity after restarting, such as a cellular modem.
- To configure the device to reboot when the interface is considered to have failed:
 

```
(config vpn openvpn client openvpn_client1)> connection_monitor reboot enable
(config vpn openvpn client openvpn_client1)>
```
- Set the **Interval** between connectivity tests:

---

```
(config vpn openvpn client openvpn_client1)> connection_monitor interval
value
(config vpn openvpn client openvpn_client1)>
```

---

where *value* is any number of weeks, days, hours, minutes, or seconds, and takes the format **number{w|d|h|m|s}**.

For example, to set **interval** to ten minutes, enter either **10m** or **600s**:

---

```
(config vpn openvpn client openvpn_client1)> connection_monitor interval
600s
(config vpn openvpn client openvpn_client1)>
```

---

The default is 15 minutes.

8. Determine whether the interface should fail over based on the failure of one of the test targets, or all of the test targets:

---

```
(config vpn openvpn client openvpn_client1)> connection_monitor success_
condition value
(config vpn openvpn client openvpn_client1)>
```

---

Where *value* is either **one** or **all**.

9. Set the number of probe attempts before the WAN is considered to have failed:

---

```
(config vpn openvpn client openvpn_client1)> connection_monitor attempts
num
(config vpn openvpn client openvpn_client1)>
```

---

The default is **3**.

10. Set the amount of time that the device should wait for a response to a probe attempt before considering it to have failed:

---

```
(config vpn openvpn client openvpn_client1)> connection_monitor timeout
value
(config vpn openvpn client openvpn_client1)>
```

---

where *value* is any number of weeks, days, hours, minutes, or seconds, and takes the format **number{w|d|h|m|s}**.

For example, to set **timeout** to ten minutes, enter either **10m** or **600s**:

---

```
(config vpn openvpn client openvpn_client1)> connection_monitor interval
600s
(config vpn openvpn client openvpn_client1)>
```

---

The default is 15 seconds.

11. Configure test targets:
  - a. Add a test target:

---

```
(config vpn openvpn client openvpn_client1)> add connection_monitor
target end
(config vpn openvpn client openvpn_client1 connection_monitor target 0)>
```

---

- b. Set the test type:

---

```
(config vpn openvpn client openvpn_client1 connection_monitor target 0)>
test value
(config vpn openvpn client openvpn_client1 connection_monitor target 0)>
```

---

where *value* is one of:

- **ping** (IPv4) or **ping6** (IPv6): Tests connectivity by sending an ICMP echo request to a specified hostname or IP address.

- Specify the hostname or IP address by using **ping\_host** or **ping\_host6**:

---

```
(config vpn openvpn client openvpn_client1 connection_monitor
target 0)> ping_host host
(config vpn openvpn client openvpn_client1 connection_monitor
target 0)>
```

---

- (Optional) Set the size, in bytes, of the ping packet by using **ping\_size** or **ping\_size6**:

---

```
(config vpn openvpn client openvpn_client1 connection_monitor
target 0)> ping_size [num]
(config vpn openvpn client openvpn_client1 connection_monitor
target 0)>
```

---

- **dns** (IPv4) or **dns6** (IPv6): Tests connectivity by sending a DNS query to the specified DNS server.

- Specify the DNS server. Allowed value is the IP address of the DNS server.

---

```
(config vpn openvpn client openvpn_client1 connection_monitor
target 0)> dns_server ip_address
(config vpn openvpn client openvpn_client1 connection_monitor
target 0)>
```

---

- **dns\_configured** (IPv4) or **dns\_configured6** (IPv6): Tests connectivity by sending a DNS query to the DNS servers configured for this interface.

- **http** (IPv4) or **http6** (IPv6): Tests connectivity by sending an HTTP or HTTPS GET request to the specified URL.

- Specify the url. Allowed value uses the format **http[s]://hostname/[path]**.

---

```
(config vpn openvpn client openvpn_client1 connection_monitor
target 0)> http_url url
(config vpn openvpn client openvpn_client1 connection_monitor
target 0)>
```

---

- **interface\_up** (IPv4) or **interface\_up6** (IPv6): : The interface is considered to be down based on the interfaces down time, and the amount of time an initial connection to the interface takes before this test is considered to have failed.

- (Optional) Set the amount of time that the interface can be down before this test is considered to have failed:

---

```
(config vpn openvpn client openvpn_client1 connection_monitor
target 0)> interface_down_time value
(config vpn openvpn client openvpn_client1 connection_monitor
target 0)>
```

---

where *value* is any number of weeks, days, hours, minutes, or seconds, and takes the format ***number*{w|d|h|m|s}**.

For example, to set **interface\_down\_time** to ten minutes, enter either **10m** or **600s**:

---

```
(config vpn openvpn client openvpn_client1 connection_monitor
target 0)> interface_down_time 600s
(config vpn openvpn client openvpn_client1 connection_monitor
target 0)>
```

---

The default is 60 seconds.

- (Optional) Set the amount of time to wait for an initial connection to the interface before this test is considered to have failed:

---

```
(config vpn openvpn client openvpn_client1 connection_monitor
target 0)> interface_timeout value
(config vpn openvpn client openvpn_client1 connection_monitor
target 0)>
```

---

where *value* is any number of weeks, days, hours, minutes, or seconds, and takes the format ***number*{w|d|h|m|s}**.

For example, to set **interface\_timeout** to ten minutes, enter either **10m** or **600s**:

---

```
(config vpn openvpn client openvpn_client1 connection_monitor
target 0)> interface_timeout 600s
(config vpn openvpn client openvpn_client1 connection_monitor
target 0)>
```

---

The default is 60 seconds.

12. Save the configuration and apply the change:

---

```
(config vpn openvpn client openvpn_client1 connection_monitor target 0)>
save
Configuration saved.
>
```

---

13. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Show OpenVPN server status and statistics

You can view status and statistics for OpenVPN servers from either the web interface or the command line:





1. Log into the EX15 WebUI as a user with Admin access.
2. On the menu, select **Status > OpenVPN > Servers**.  
The **OpenVPN Servers** page appears.
3. To view configuration details about an OpenVPN server, click the  (configuration) icon in the upper right of the OpenVPN server's status pane.

## Command line

1. Log into the EX15 command line as a user with Admin access.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. To display details about all configured OpenVPN servers, type the following at the prompt:

---

```
> show openvpn server all
```

| Server          | Enable | Type | Zone     | Address         | Port |
|-----------------|--------|------|----------|-----------------|------|
| -----           | -----  | ---  | -----    | -----           | ---- |
| OpenVPN_server1 | true   | tun  | internal | 192.168.30.1/24 | 1194 |
| OpenVPN_server2 | false  | tun  | internal | 192.168.40.1/24 | 1194 |

```
>
```

---

3. To display details about a specific server:

---

```
> show openvpn server name OpenVPN_server1
```

```

Server : OpenVPN_server1
Enable : true
Type : tun
Zone : internal
Address : 192.168.30.1/24
Port : 1194
Use File : true
Metric : 0
Protocol : udp
First IP : 80
Last IP : 99

```

```
>
```

---

4. Type **exit** to exit the Admin CLI.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Show OpenVPN client status and statistics

You can view status and statistics for OpenVPN clients from either web interface or the command line:

## WebUI

1. Log into the EX15 WebUI as a user with Admin access.
2. On the menu, select **Status > OpenVPN > Clients**.  
The **OpenVPN Clients** page appears.
3. To view configuration details about an OpenVPN client, click the  (configuration) icon in the upper right of the OpenVPN client's status pane.



## Command line

1. Log into the EX15 command line as a user with Admin access.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. To display details about all configured OpenVPN clients, type the following at the prompt:

---

```
> show openvpn client all
```

| Client          | Enable | Status    | Username | Use File | Zone     |
|-----------------|--------|-----------|----------|----------|----------|
| -----           | -----  | -----     | -----    | -----    | -----    |
| OpenVPN_Client1 | true   | connected |          | true     | internal |
| OpenVPN_Client2 | true   | pending   |          | true     | internal |

```
>
```

---

3. To display details about a specific server:

---

```
> show openvpn client name OpenVPN_client1
```

---

4. Type **exit** to exit the Admin CLI.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Generic Routing Encapsulation (GRE)

Generic Routing Encapsulation (GRE) is an IP packet encapsulation protocol that allow for networks and routes to be advertized from one network device to another. You can use GRE to encapsulate a wide variety of network layer protocols inside virtual point-to-point links over an IP network.

### Configuring a GRE tunnel

Configuring a GRE tunnel involves the following items:

#### Required configuration items

- A GRE loopback endpoint interface.
- GRE tunnel configuration:
  - Enable the GRE tunnel.
  - The GRE tunnels are enabled by default.
  - The local endpoint interface.
  - The IP address of the remote device/peer.

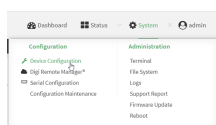
#### Additional configuration items

- A GRE key.
- Enable the device to respond to keepalive packets.

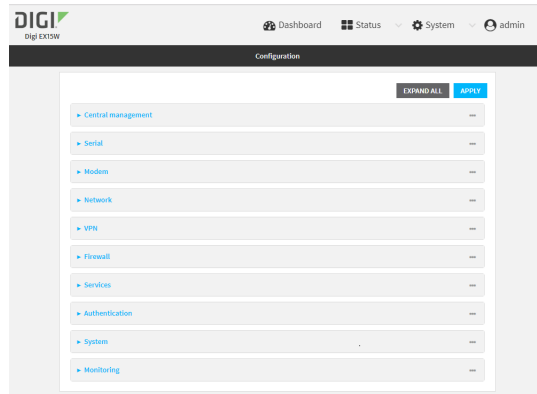
### Task One: Create a GRE loopback endpoint interface

#### WebUI

1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.



3. Click **Network > Interfaces**.
4. For **Add Interface**, type a name for the GRE loopback endpoint interface and click **+**.
5. **Enable** the interface.  
New interfaces are enabled by default. To disable, or to enable if it has been disabled, click **Enable**.
6. For **Interface type**, select **Ethernet**.
7. For **Zone**, select **Internal**.
8. For **Device**, select **Ethernet: Loopback**.
9. Click to expand **IPv4**.
10. For **Address**, enter the IP address and subnet mask of the local GRE endpoint, for example **10.10.1.1/24**.
11. Click **Apply** to save the configuration and apply the change.



## Command line

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the command line, type **config** to enter configuration mode:

```
> config
(config)>
```

3. Add the GRE endpoint interface. For example, to add an interface named **gre\_endpoint**:

```
(config)> add network interface gre_interface
(config network interface gre_interface)>
```

- Set the interface zone to **internal**:

```
(config network interface gre_interface)> zone internal
(config network interface gre_interface)>
```

- Set the interface device to **loopback**:

```
(config network interface gre_interface)> device /network/device/loopback
(config network interface gre_interface)>
```

- Set the IP address and subnet mask of the local GRE endpoint. For example, to set the local GRE endpoint's IP address and subnet mask to **10.10.1.1/24**:

```
(config network interface gre_interface)> ipv4 address 10.10.1.1/24
(config network interface gre_interface)>
```

- Save the configuration and apply the change:

```
(config network interface gre_interface)> save
Configuration saved.
>
```

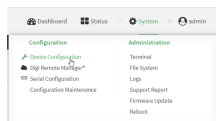
- Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

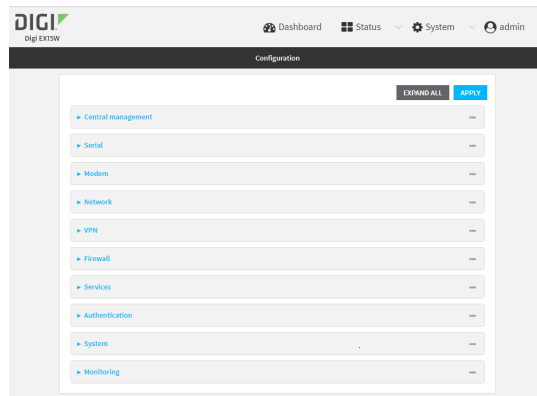
## Task Two: Configure the GRE tunnel

### WebUI

- Log into the EX15 WebUI as a user with full Admin access rights.
- On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.



3. Click **VPN > IP Tunnels**.
4. For **Add IP tunnel**, type a name for the GRE tunnel and click **+**.
5. **Enable** the tunnel.  
New tunnels are enabled by default. To disable, or to enable if it has been disabled, click **Enable**.
6. For **Local endpoint**, select the GRE endpoint interface created in [Task One](#).
7. For **Remote endpoint**, type the IP address of the GRE endpoint on the remote peer.
8. (Optional) For **Key**, enter a key that will be inserted in GRE packets created by this tunnel. It must match the key set by the remote endpoint. Allowed value is an interger between 0 and 4294967295, or an IP address.
9. (Optional) **Enable keepalive reply** to enable the device to reply to Cisco GRE keepalive packets.
10. Click **Apply** to save the configuration and apply the change.



## Command line

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the command line, type **config** to enter configuration mode:

```
> config
(config)>
```

3. Add the GRE endpoint tunnel. For example, to add a tunnel named **gre\_example**:

```
(config)> add vpn iptunnel gre_example
(config vpn iptunnel gre_example)>
```

GRE tunnels are enabled by default. To disable:

---

```
(config vpn iptunnel gre_example)> enable false
(config vpn iptunnel gre_example)>
```

---

4. Set the local endpoint to the GRE endpoint interface created in [Task One](#), for example:

---

```
(config vpn iptunnel gre_example)> local /network/interface/gre_endpoint
(config vpn iptunnel gre_example)>
```

---

5. Set the IP address of the GRE endpoint on the remote peer:

---

```
(config vpn iptunnel gre_example)> remote ip_address
(config vpn iptunnel gre_example)>
```

---

6. (Optional) Set a key that will be inserted in GRE packets created by this tunnel.

The key must match the key set by the remote endpoint.

---

```
(config vpn iptunnel gre_example)> key value
(config vpn iptunnel gre_example)>
```

---

where value is an interger between 0 and 4294967295, or an IP address.

7. (Optional) Enable the device to reply to Cisco GRE keepalive packets:

---

```
(config vpn iptunnel gre_example)> keepalive true
(config vpn iptunnel gre_example)>
```

---

8. Save the configuration and apply the change:

---

```
(config vpn iptunnel gre_example)> save
Configuration saved.
>
```

---

9. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Show GRE tunnels

To view information about currently configured GRE tunnels:

### WebUI

1. Log into the EX15 WebUI as a user with Admin access.
2. On the menu, click **Status > IP tunnels**.  
The **IP Tunnels** page appears.
3. To view configuration details about a GRE tunnel, click the  (configuration) icon in the upper right of the tunnel's status pane.



## Example: GRE tunnel over an IPsec tunnel

The EX15 device can be configured as an advertised set of routes through an IPsec tunnel. This allows you to leverage the dynamic route advertisement of GRE tunnels through a secured IPsec tunnel.

The example configuration provides instructions for configuring the EX15 device with a GRE tunnel through IPsec.



### EX15-1 configuration tasks

1. Create an IPsec tunnel named **ipsec\_gre1** with:
  - A pre-shared key.
  - **Remote endpoint** set to the public IP address of the EX15-2 device.
  - A policy with:
    - **Local network** set to the IP address and subnet of the local GRE tunnel, **172.30.0.1/32**.
    - **Remote network** set to the IP address and subnet of the remote GRE tunnel, **172.30.0.2/32**.
2. Create an IPsec endpoint interface named **ipsec\_endpoint1**:
  - a. **Zone** set to **Internal**.
  - b. **Device** set to **Ethernet: Loopback**.
  - c. IPv4 Address set to the IP address of the local GRE tunnel, **172.30.0.1/32**.
3. Create a GRE tunnel named **gre\_tunnel1**:
  - a. **Local endpoint** set to the IPsec endpoint interface, **Interface: ipsec\_endpoint1**.
  - b. **Remote endpoint** set to the IP address of the GRE tunnel on EX15-2, **172.30.0.2**.
4. Create an interface named **gre\_interface1** and add it to the GRE tunnel:
  - a. **Zone** set to **Internal**.
  - b. **Device** set to **IP tunnel: gre\_tunnel1**.
  - c. IPv4 Address set to a virtual IP address on the GRE tunnel, **172.31.0.1/30**.

### EX15-2 configuration tasks

1. Create an IPsec tunnel named **ipsec\_gre2** with:
  - The same pre-shared key as the **ipsec\_gre1** tunnel on EX15-1.
  - **Remote endpoint** set to the public IP address of EX15-1.
  - A policy with:
    - **Local network** set to the IP address and subnet of the local GRE tunnel, **172.30.0.2/32**.
    - **Remote network** set to the IP address of the remote GRE tunnel, **172.30.0.1/32**.

2. Create an IPsec endpoint interface named **ipsec\_endpoint2**:
  - a. **Zone** set to **Internal**.
  - b. **Device** set to **Ethernet: Loopback**.
  - c. IPv4 Address set to the IP address of the local GRE tunnel, **172.30.0.2/32**.
3. Create a GRE tunnel named **gre\_tunnel2**:
  - a. **Local endpoint** set to the IPsec endpoint interface, **Interface: ipsec\_endpoint2**.
  - b. Remote endpoint set to the IP address of the GRE tunnel on EX15-1, **172.30.0.1**.
4. Create an interface named **gre\_interface2** and add it to the GRE tunnel:
  - a. **Zone** set to **Internal**.
  - b. **Device** set to **IP tunnel: gre\_tunnel2**.
  - c. IPv4 Address set to a virtual IP address on the GRE tunnel, **172.31.1.1/30**.

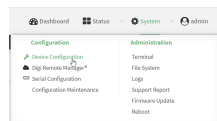
## Configuration procedures

### Configure the EX15-1 device

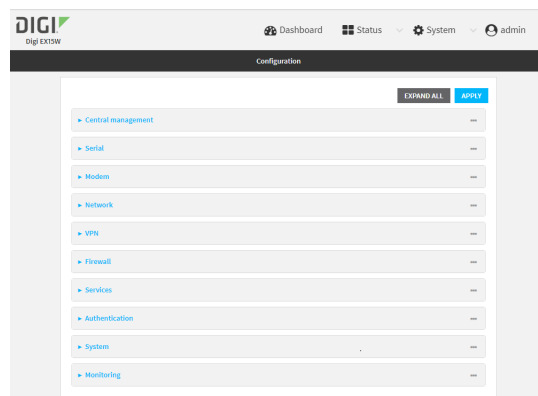
#### Task one: Create an IPsec tunnel

#### WebUI

1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.



3. Click **VPN > IPsec > Tunnels**.

4. For **Add IPsec Tunnel**, type **ipsec\_gre1** and click **+**.

5. Click to expand **Authentication**.  
6. For **Pre-shared key**, type **testkey**.

7. Click to expand **Remote endpoint**.  
8. For **Hostname**, type public IP address of the EX15-2 device.

9. Click to expand **Policies**.  
10. For **Add Policy**, click **+** to add a new policy.

11. Click to expand **Local network**.  
12. For **Type**, select **Custom network**.  
13. For **Address**, type the IP address and subnet of the local GRE tunnel, **172.30.0.1/32**.  
14. For **Remote network**, type the IP address and subnet of the remote GRE tunnel, **172.30.0.2/32**.

15. Click **Apply** to save the configuration and apply the change.

## Command line

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.

2. At the command line, type **config** to enter configuration mode:

---

```
> config
(config)>
```

---

3. Add an IPsec tunnel named **ipsec\_gre1**:

---

```
(config)> add vpn ipsec tunnel ipsec_gre1
(config vpn ipsec tunnel ipsec_gre1)>
```

---

4. Set the pre-shared key to **testkey**:

---

```
(config vpn ipsec tunnel ipsec_gre1)> auth secret testkey
(config vpn ipsec tunnel ipsec_gre1)>
```

---

5. Set the remote endpoint to public IP address of the EX15-2 device:

---

```
(config vpn ipsec tunnel ipsec_gre1)> remote hostname 192.168.101.1
(config vpn ipsec tunnel ipsec_gre1)>
```

---

6. Add a policy:

---

```
(config vpn ipsec tunnel ipsec_gre1)> add policy end
(config vpn ipsec tunnel ipsec_gre1 policy 0)>
```

---

7. Set the local network policy type to **custom**:

---

```
(config vpn ipsec tunnel ipsec_gre1 policy 0)> local type custom
(config vpn ipsec tunnel ipsec_gre1 policy 0)>
```

---

8. Set the local network address to the IP address and subnet of the local GRE tunnel, **172.30.0.1/32**:

---

```
(config vpn ipsec tunnel ipsec_gre1 policy 0)> local custom 172.30.0.1/32
(config vpn ipsec tunnel ipsec_gre1 policy 0)>
```

---

9. Set the remote network address to the IP address and subnet of the remote GRE tunnel, **172.30.0.2/32**:

---

```
(config vpn ipsec tunnel ipsec_gre1 policy 0)> remote network 172.30.0.2/32
(config vpn ipsec tunnel ipsec_gre1 policy 0)>
```

---

10. Save the configuration and apply the change:

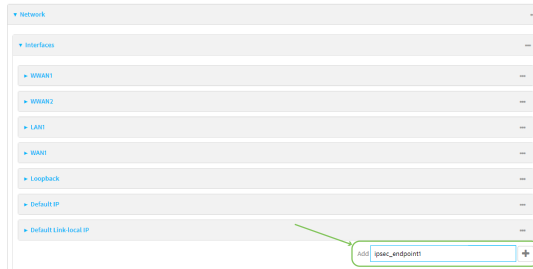
---

```
(config ipsec tunnel ipsec_gre1 policy 0)> save
Configuration saved.
>
```

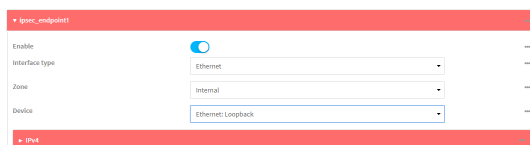
---

**Task two: Create an IPsec endpoint interface****WebUI**

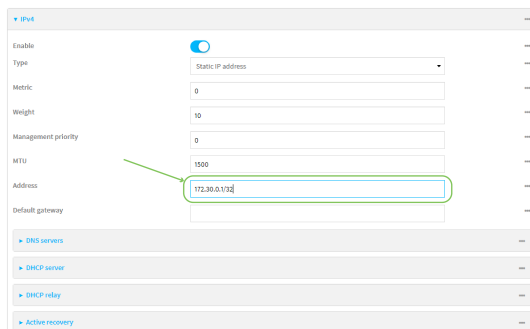
1. Click **Network > Interface**.
2. For **Add Interface**, type **ipsec\_endpoint1** and click **+**.



3. For **Zone**, select **Internal**.
4. For **Device**, select **Ethernet: loopback**.



5. Click to expand **IPv4**.
6. For **Address**, type the IP address of the local GRE tunnel, **172.30.0.1/32**.



7. Click **Apply** to save the configuration and apply the change.



## Command line

1. At the command line, type **config** to enter configuration mode:

```
> config
(config)>
```

2. Add an interface named **ipsec\_endpoint1**:

```
(config)> add network interface ipsec_endpoint1
(config network interface ipsec_endpoint1)>
```

3. Set the zone to **internal**:

```
(config network interface ipsec_endpoint1)> zone internal
(config network interface ipsec_endpoint1)>
```

4. Set the device to **/network/device/loopback**:

```
(config network interface ipsec_endpoint1)> device /network/device/loopback
(config network interface ipsec_endpoint1)>
```

5. Set the IPv4 address to the IP address of the local GRE tunnel, **172.30.0.1/32**:

```
(config network interface ipsec_endpoint1)> ipv4 address 172.30.0.1/32
(config network interface ipsec_endpoint1)>
```

6. Save the configuration and apply the change:

```
(config vpn ipsec tunnel ipsec_endpoint1 policy 0)> save
Configuration saved.
>
```

### Task three: Create a GRE tunnel

## WebUI

1. Click **VPN > IP Tunnels**.
2. For **Add IP Tunnel**, type **gre\_tunnel1** and click **+**.



3. For **Local endpoint**, select the IPsec endpoint interface created in [Task two](#) (**Interface: ipsec\_endpoint1**).

- For **Remote endpoint**, type the IP address of the GRE tunnel on EX15-2, **172.30.0.2**.

- Click **Apply** to save the configuration and apply the change.

## Command line

- At the command line, type **config** to enter configuration mode:

```
> config
(config)>
```

- Add a GRE tunnel named **gre\_tunnel1**:

```
(config)> add vpn iptunnel gre_tunnel1
(config vpn iptunnel gre_tunnel1)>
```

- Set the local endpoint to the IPsec endpoint interface created in [Task two](#) (**/network/interface/ipsec\_endpoint1**):

```
(config vpn iptunnel gre_tunnel1)> local /network/interface/ipsec_endpoint1
(config vpn iptunnel gre_tunnel1)>
```

- Set the remote endpoint to the IP address of the GRE tunnel on EX15-2, **172.30.0.2**:

```
(config vpn iptunnel gre_tunnel1)> remote 172.30.0.2
(config vpn iptunnel gre_tunnel1)>
```

- Save the configuration and apply the change:

```
(config vpn iptunnel gre_tunnel1)> save
Configuration saved.
>
```

**Task four: Create an interface for the GRE tunnel device****WebUI**

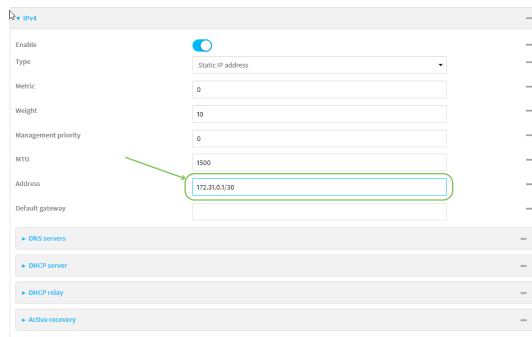
1. Click **Network > Interfaces**.
2. For **Add Interface**, type **gre\_interface1** and click **+**.



3. For **Zone**, select **Internal**.
4. For **Device**, select the GRE tunnel created in [Task three](#) (IP tunnel: **gre\_tunnel1**).



5. Click to expand **IPv4**.
6. For **Address**, type **172.31.0.1/30** for a virtual IP address on the GRE tunnel.



7. Click **Apply** to save the configuration and apply the change.





## Command line

1. At the command line, type **config** to enter configuration mode:

```
> config
(config)>
```

2. Add an interface named **gre\_interface1**:

```
(config)> add network interface gre_interface1
(config network interface gre_interface1)>
```

3. Set the zone to **internal**:

```
(config network interface gre_interface1)> zone internal
(config network interface gre_interface1)>
```

4. Set the device to the GRE tunnel created in [Task three \(/vpn/iptunnel/gre\\_tunnel1\)](#):

```
(config network interface gre_interface1)> device /vpn/iptunnel/gre_tunnel1
(config network interface gre_interface1)>
```

5. Set **172.31.0.1/30** as the virtual IP address on the GRE tunnel:

```
(config network interface gre_interface1)> ipv4 address 172.31.0.1/30
(config network interface gre_interface1)>
```

6. Save the configuration and apply the change:

```
(config network interface gre_interface1)> save
Configuration saved.
>
```

7. Type **exit** to exit the Admin CLI.

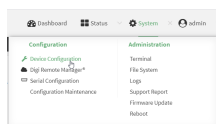
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Configure the EX15-2 device

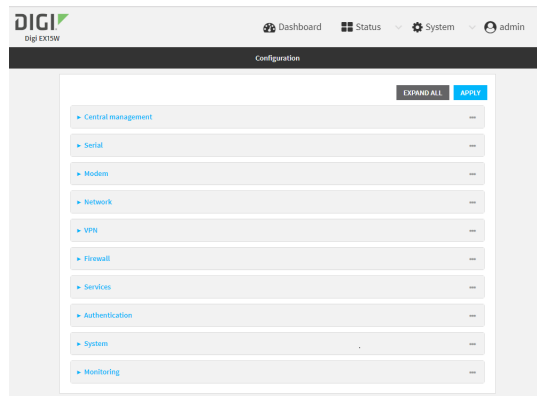
### Task one: Create an IPsec tunnel

## WebUI

1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



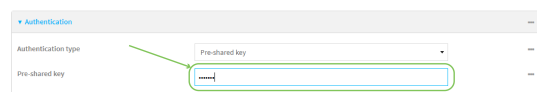
The **Configuration** window is displayed.



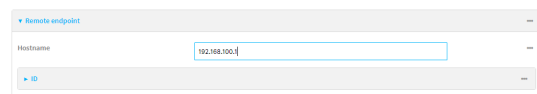
3. Click **VPN > IPsec > Tunnels**.
4. For **Add IPsec Tunnel**, type **ipsec\_gre2** and click **+**.



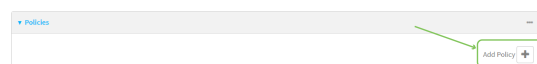
5. Click to expand **Authentication**.
6. For **Pre-shared key**, type the same pre-shared key that was configured for the EX15-1 (**testkey**).



7. Click to expand **Remote endpoint**.
8. For **Hostname**, type public IP address of the EX15-1 device.



9. Click to expand **Policies**.
10. For **Add Policy**, click **+** to add a new policy.



11. Click to expand **Local network**.
12. For **Type**, select **Custom network**.
13. For **Address**, type the IP address and subnet of the local GRE tunnel, **172.30.0.2/32**.
14. For **Remote network**, type the IP address and subnet of the remote GRE tunnel, **172.30.0.1/32**.

- Click **Apply** to save the configuration and apply the change.

## Command line

- Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.

- At the command line, type **config** to enter configuration mode:

```
> config
(config)>
```

- Add an IPsec tunnel named **ipsec\_gre2**:

```
(config)> add vpn ipsec tunnel ipsec_gre2
(config vpn ipsec tunnel ipsec_gre2)>
```

- Set the pre-shared key to the same pre-shared key that was configured for the EX15-1 (**testkey**):

```
(config vpn ipsec tunnel ipsec_gre2)> auth secret testkey
(config vpn ipsec tunnel ipsec_gre2)>
```

- Set the remote endpoint to public IP address of the EX15-1 device:

```
(config vpn ipsec tunnel ipsec_gre2)> remote hostname 192.168.100.1
(config vpn ipsec tunnel ipsec_gre2)>
```

- Add a policy:

```
(config vpn ipsec tunnel ipsec_gre2)> add policy end
(config vpn ipsec tunnel ipsec_gre2 policy 0)>
```

- Set the local network policy type to **custom**:

```
(config vpn ipsec tunnel ipsec_gre2 policy 0)> local type custom
(config vpn ipsec tunnel ipsec_gre2 policy 0)>
```

- Set the local network address to the IP address and subnet of the local GRE tunnel, **172.30.0.2/32**:

```
(config vpn ipsec tunnel ipsec_gre2 policy 0)> local custom 172.30.0.2/32
(config vpn ipsec tunnel ipsec_gre2 policy 0)>
```

- Set the remote network address to the IP address and subnet of the remote GRE tunnel, **172.30.0.1/32**:

```
(config vpn ipsec tunnel ipsec_gre2 policy 0)> remote network 172.30.0.1/32
(config vpn ipsec tunnel ipsec_gre2 policy 0)>
```

- Save the configuration and apply the change:

```
(config vpn ipsec tunnel ipsec_gre2 policy 0)> save
Configuration saved.
>
```

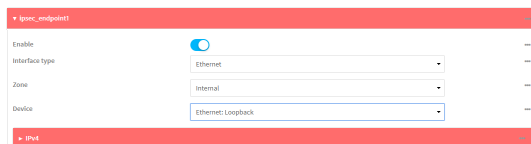
## Task two: Create an IPsec endpoint interface

### WebUI

- Click **Network > Interfaces**.
- For **Add Interface**, type **ipsec\_endpoint2** and click **+**.



- For **Zone**, select **Internal**.
- For **Device**, select **Ethernet: loopback**.



- Click to expand **IPv4**.

6. For **Address**, type the IP address of the local GRE tunnel, **172.30.0.2/32**.

The screenshot shows a configuration page for an IPv4 interface. The 'Address' field is highlighted with a green circle and contains the text '172.30.0.2/32'. A green arrow points to this field from the left. Other fields like 'Enable', 'Type', 'Metric', 'Weight', 'Management priority', and 'MTU' are visible but not highlighted.

7. Click **Apply** to save the configuration and apply the change.

The screenshot shows the 'Configuration' page with a dark header bar. The 'Apply' button is highlighted with a green arrow. Below the header, there are sections for 'Control management', 'Serial', and 'Network'.

## Command line

1. At the command line, type **config** to enter configuration mode:

```
> config
(config)>
```

2. Add an interface named **ipsec\_endpoint2**:

```
(config)> add network interface ipsec_endpoint2
(config network interface ipsec_endpoint2)>
```

3. Set the zone to **internal**:

```
(config network interface ipsec_endpoint2)> zone internal
(config network interface ipsec_endpoint2)>
```

4. Set the device to **/network/device/loopback**:

```
(config network interface ipsec_endpoint2)> device /network/device/loopback
(config network interface ipsec_endpoint2)>
```

5. Set the IPv4 address to the IP address of the local GRE tunnel, **172.30.0.2/32**:

```
(config network interface ipsec_endpoint2)> ipv4 address 172.30.0.2/32
(config network interface ipsec_endpoint2)>
```

6. Save the configuration and apply the change:

```
(config vpn ipsec tunnel ipsec_endpoint2)> save
Configuration saved.
>
```

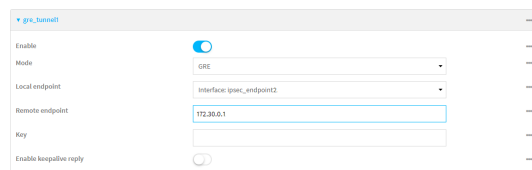
## Task three: Create a GRE tunnel

## WebUI

1. Click **VPN > IP Tunnels**.
2. For **Add IP Tunnel**, type **gre\_tunnel2** and click **+**.



3. For **Local endpoint**, select the IPsec endpoint interface created in [Task two](#) (**Interface: ipsec\_endpoint2**).
4. For **Remote endpoint**, type the IP address of the GRE tunnel on EX15-1, **172.30.0.1**.



5. Click **Apply** to save the configuration and apply the change.



## Command line

1. At the command line, type **config** to enter configuration mode:

```
> config
(config)>
```

2. Add a GRE tunnel named **gre\_tunnel2**:

```
(config)> add vpn iptunnel gre_tunnel2
(config vpn iptunnel gre_tunnel2)>
```

3. Set the local endpoint to the IPsec endpoint interface created in [Task two](#) (**/network/interface/ipsec\_endpoint2**):

```
(config vpn iptunnel gre_tunnel2)> local /network/interface/ipsec_endpoint2
(config vpn iptunnel gre_tunnel2)>
```

4. Set the remote endpoint to the IP address of the GRE tunnel on EX15-1, **172.30.0.1**:

```
(config vpn iptunnel gre_tunnel2)> remote 172.30.0.1
(config vpn iptunnel gre_tunnel2)>
```

5. Save the configuration and apply the change:

```
(config vpn iptunnel gre_tunnel2)> save
Configuration saved.
>
```

#### Task four: Create an interface for the GRE tunnel device

##### WebUI

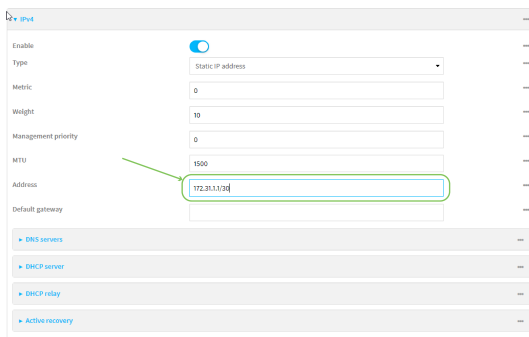
1. Click **Network > Interfaces**.
2. For **Add Interface**, type **gre\_interface2** and click **+**.



3. For **Zone**, select **Internal**.
4. For **Device**, select the GRE tunnel created in [Task three](#) (IP tunnel: **gre\_tunnel2**).



5. Click to expand **IPv4**.
6. For **Address**, type **172.31.1.1/30** for a virtual IP address on the GRE tunnel.



7. Click **Apply** to save the configuration and apply the change.



## Command line

1. At the command line, type **config** to enter configuration mode:

---

```
> config
(config)>
```

---

2. Add an interface named **gre\_interface2**:

---

```
(config)> add network interface gre_interface2
(config network interface gre_interface2)>
```

---

3. Set the zone to **internal**:

---

```
(config network interface gre_interface2)> zone internal
(config network interface gre_interface2)>
```

---

4. Set the device to the GRE tunnel created in [Task three](#) (**/vpn/iptunnel/gre\_tunnel2**):

---

```
(config network interface gre_interface2)> device /vpn/iptunnel/gre_tunnel2
(config network interface gre_interface2)>
```

---

5. Set **172.31.0.1/30** as the virtual IP address on the GRE tunnel:

---

```
(config network interface gre_interface2)> ipv4 address 172.31.1.1/30
(config network interface gre_interface2)>
```

---

6. Save the configuration and apply the change:

---

```
(config network interface gre_interface2)> save
Configuration saved.
>
```

---

7. Type **exit** to exit the Admin CLI.

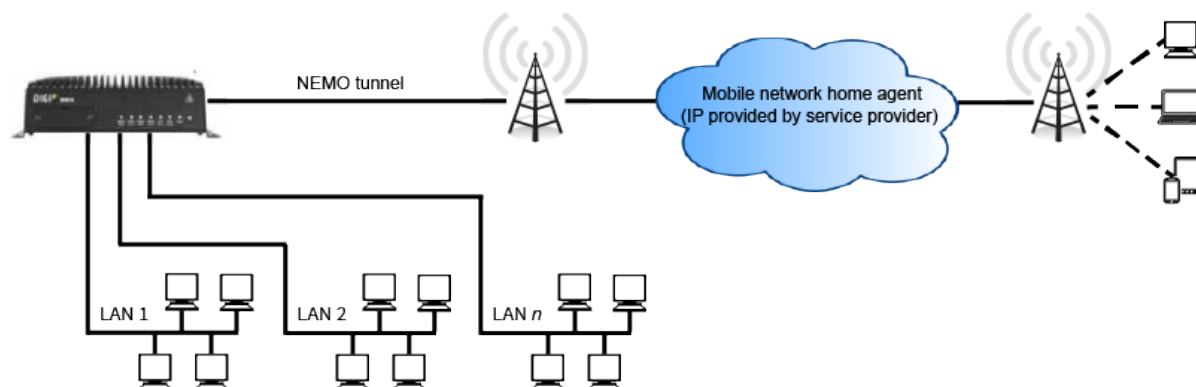
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## NEMO

Network Mobility (NEMO) is a mobile networking technology that provides access to one or more Local Area Networks (LANs) on your device. NEMO creates a tunnel between the home agent on the mobile private network and the EX15 device, isolating the connection from internet traffic and advertising the IP subnets of the LANs for remote access and device management.

Dynamic Mobile Network Routing (DMNR) is the implementation of NEMO for Verizon Wireless Private Networks. DMNR support requires the use of Verizon SIM cards that have DMNR enabled.





## Configure a NEMO tunnel

Configuring an NEMO tunnel with a remote device involves configuring the following items:

### Required configuration items

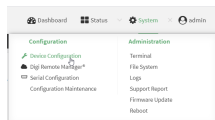
- Enable the NEMO tunnel.  
The NEMO tunnel is enabled by default.
- The IP address of the NEMO virtual network interface.
- The firewall zone of the NEMO tunnel.
- The IP address of the NEMO home agent server. This is provided by your cellular carrier.
- The home agent's authentication key. This is provided by your cellular carrier.
- Home agent registration lifetime. This is provided by your cellular carrier.
- The local network interfaces that will be advertised on NEMO.

### Additional configuration items

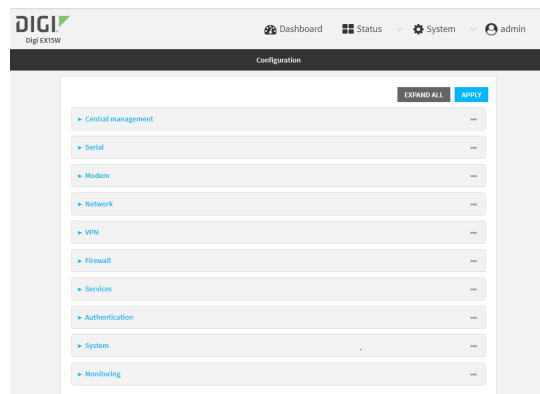
- The home agent Software Parameter Index (SPI).
- Path MTU discovery.  
Path MTU discovery is enabled by default. If it is disabled, identify the MTU.
- Care of address: the local network interface that is used to communicate with the peer.
  - If set to **Interface**, identify the local interface to be used. Generally, this will be the Wireless WAN (**Modem**).
  - If set to **IP address**, enter the IP address.
- The local network of the GRE endpoint negotiated by NEMO.
  - If the local network is set to Interface, identify the local interface to be used.



1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.



3. Click **VPN > NEMO**.

The NEMO tunnel is enabled by default. To disable, click to toggle off **Enable**.

4. For **Home IP address**, type the IPv4 address of the NEMO virtual network interface.
5. For **Zone**, select the firewall zone for the NEMO tunnel.
6. For **Home agent server IP** address, type the IPv4 address of the NEMO home agent. This is provided by your cellular carrier.
7. For **Key**, type the key used to authenticate to the home agent. This is provided by your cellular carrier.
8. For **Home agent SPI**, type the Security Parameter Index (SPI) value, which is used in the authentication extension when registering. This should be normally left at the default setting of **256** unless your service provider indicates a different value.
9. For **Home agent registration lifetime, in seconds**, type the number of seconds number of seconds until the authorization key expires. This is provided by your cellular carrier.
10. For **MTU discovery**, leave enabled to determine the maximum transmission unit (MTU) size. If disabled, for **MTU**, type the MTU size. The default MTU size for LANs on the EX15 device is 1500. The MTU size of the NEMO tunnel will be smaller, to take into account the required headers.
11. Click to expand **Care of address** to configure the local WAN interface of the internet facing network.
  - a. For **Type**, select the method to determine the local network interface that is used to communicate with the peer.
    - If **Default route** is selected, the network interface that is used will be the same as the default route.

- If **Interface** is selected, specify the local network interface.
- If **IP address** is selected, type the IP address.

The default is **Default route**.

12. Click to expand **GRE tunnel local endpoint**.

- a. For **Type**, select the local endpoint of the GRE endpoint negotiated by NEMO.
  - If **Default route** is selected, the network interface that is used will be the same as the default route.
  - If **Interface** is selected, specify the local network interface.

The default is **Default route**.

13. Click to expand **Local networks**.

- a. For **Add Interface**, click **+** to add a local network to use as a virtual NEMO network interface.



- b. For **Interface**, select the local interface to use as a virtual NEMO network interface. Generally, this will be the a Local Area Network (LAN).
- c. (Optional) Repeat for additional interfaces.

14. Click **Apply** to save the configuration and apply the change.



## Command line

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the command line, type **config** to enter configuration mode:

```
> config
(config)>
```

3. Add a NEMO tunnel. For example, to add a NEMO tunnel named **nemo\_example**:

```
(config)> add vpn nemo nemo_example
(config vpn nemo nemo_example)>
```

The NEMO tunnel is enabled by default. To disable:

```
(config vpn nemo nemo_example)> enable false
(config vpn nemo nemo_example)>
```

- Set the IPv4 address of the NEMO virtual network interface:

---

```
(config vpn nemo nemo_example)> home_address IPv4_address
(config vpn nemo nemo_example)>
```

---

- Set the IPv4 address of the NEMO home agent. This is provided by your cellular carrier.

---

```
(config vpn nemo nemo_example)> home_agent IPv4_address
(config vpn nemo nemo_example)>
```

---

- Set the key used to authenticate to the home agent. This is provided by your cellular carrier.

---

```
(config vpn nemo nemo_example)> key value
(config vpn nemo nemo_example)>
```

---

- Set the the number of seconds number of seconds until the authorization key expires. This is provided by your cellular carrier.

---

```
(config vpn nemo nemo_example)> lifetime integer
(config vpn nemo nemo_example)>
```

---

Allowed values are any integer between 1 and 65535.

- MTU discovery is enabled by default, which allows the device to determine the maximum transmission unit (MTU) size. To disable:

---

```
(config vpn nemo nemo_example)> mtu_discovery false
(config vpn nemo nemo_example)>
```

---

If disabled, set the MTU size. The default MTU size for LANs on the EX15 device is 1500. The MTU size of the NEMO tunnel will be smaller, to take into account the required headers.

---

```
(config vpn nemo nemo_example)> mtu integer
(config vpn nemo nemo_example)>
```

---

Allowed values are any integer between 68 and 1476.

- Set the Security Parameter Index (SPI) value, which is used in the authentication extension when registering. This should be normally left at the default setting of **256** unless your service provider indicates a different value.

---

```
(config vpn nemo nemo_example)> spi integer
(config vpn nemo nemo_example)>
```

---

Allowed values are any integer between 256 and 4294967295.

- Set the firewall zone for the NEMO tunnel:

---

```
(config vpn nemo nemo_example)> zone zone
(config vpn nemo nemo_example)>
```

---

To view a list of available zones:

---

```
(config vpn nemo nemo_example)> zone ?
```

---

---

Zone: The firewall zone assigned to this network interface. This can be used by packet filtering rules and access control lists to restrict network traffic on this interface.

Format:

any  
dynamic\_routes  
edge  
external  
internal  
ipsec  
loopback  
setup

Current value:

---

```
(config vpn nemo nemo_example)> zone
```

---

11. Configure the Care-of-Address, the local WAN interface of the internet facing network.
  - a. Set the method to determine the Care-of-Address:

---

```
(config vpn nemo nemo_example)> coaddress type value
(config vpn nemo nemo_example)>
```

---

where *value* is one of:

- **defaultroute**: Uses the same network interface as the default route.
- **interface**

If **interface** is used, set the interface:

- i. Use the **?** to determine available interfaces:

---

```
(config vpn nemo nemo_example)>coaddress interface ?
```

---

Interface: Use the IP address of this network interface as this node's Care-of-Address.

Format:

defaultip  
defaultlinklocal  
lan  
loopback  
modem  
wan

Current value:

---

```
(config vpn nemo nemo_example)> coaddress interface
```

---

- ii. Set the interface. For example:

---

```
(config vpn nemo nemo_example)> coaddress interface wan
(config vpn nemo nemo_example)>
```

---

- **ip**

If **ip** is used, set the IP address:

---

```
(config vpn nemo nemo_example)> coaddress address IP_address
(config vpn nemo nemo_example)>
```

---

The default is **defaultroute**.

12. Set the GRE tunnel local endpoint:

a. Set the method to determine the GRE tunnel local endpoint:

---

```
(config vpn nemo nemo_example)> tun_local type value
(config vpn nemo nemo_example)>
```

---

where *value* is one of:

- **defaultroute**: Uses the same network interface as the default route.

- **interface**

If **interface** is used, set the interface.

i. Use the **?** to determine available interfaces:

---

```
(config vpn nemo nemo_example)>tun_local interface ?
```

---

Interface: The network interface to use to communicate with the peer. Set this field to blank if using the default route.

Format:

```
defaultip
defaultlinklocal
lan
loopback
modem
wan
```

Current value:

---

```
(config vpn nemo nemo_example)> tun_local interface
```

---

ii. Set the interface. For example:

---

```
(config vpn nemo nemo_example)> tun_local interface wan
(config vpn nemo nemo_example)>
```

---

The default is **defaultroute**.

13. Configure one or more local networks to use as a virtual NEMO network interface. Generally, this will be a Local Area Network (LAN):

a. Add a local network to use as a virtual NEMO network interface:

---

```
(config vpn nemo nemo_example)> add network end lan
(config vpn nemo nemo_example)>
```

---

b. (Optional) Repeat for additional interfaces.

14. Save the configuration and apply the change:

---

```
(config)> save
Configuration saved.
>
```

---

15. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Show NEMO status

### WebUI

1. Log into the EX15 WebUI as a user with Admin access.
2. On the menu, select **Status > NEMO**.  
The **NEMO** page appears.
3. To view configuration details about an NEMO tunnel, click the  (configuration) icon in the upper right of the tunnel's status pane.

### Command line

1. Log into the EX15 command line as a user with Admin access.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. To display details about all configured NEMO tunnel, type the following at the prompt:

---

```
> show nemo
```

| NEMO | Enable | Status | Address | Agent   | CoAddress  |
|------|--------|--------|---------|---------|------------|
| demo | false  |        |         |         |            |
| test | true   | up     | 1.2.3.4 | 4.3.2.1 | 10.10.10.1 |

```
>
```

---

3. To display details about a specific tunnel:

---

```
> show nemo name test
```

```
test NEMO Status

```

|                 |                          |
|-----------------|--------------------------|
| Enabled         | : true                   |
| Status          | : up                     |
| Home Agent      | : 4.3.2.1                |
| Care of Address | : 10.10.10.1             |
| Interface       | : modem                  |
| GRE Tunnel      | : 10.10.10.1 === 4.3.2.1 |
| Metric          | : 255                    |

---

---

|                   |                |            |
|-------------------|----------------|------------|
| MTU               | :              | 1476       |
| Lifetime (Actual) | :              | 600        |
| Local Network     | Subnet         | Status     |
| -----             | -----          | -----      |
| lan1              | 192.168.2.1/24 | Advertized |
| LAN2              | 192.168.3.1/24 | Advertized |

---

>

---

4. Type **exit** to exit the Admin CLI.
- Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.



## Services

---

This chapter contains the following topics:

|                                                          |     |
|----------------------------------------------------------|-----|
| Allow remote access for web administration and SSH ..... | 398 |
| Configure the web administration service .....           | 402 |
| Configure SSH access .....                               | 411 |
| Use SSH with key authentication .....                    | 417 |
| Configure telnet access .....                            | 420 |
| Configure DNS .....                                      | 425 |
| Simple Network Management Protocol (SNMP) .....          | 431 |
| Location information .....                               | 437 |
| Modbus gateway .....                                     | 467 |
| System time .....                                        | 484 |
| Configure the system time .....                          | 484 |
| Network Time Protocol .....                              | 487 |
| Configure the device as an NTP server .....              | 487 |
| Configure a multicast route .....                        | 493 |
| Ethernet network bonding .....                           | 496 |
| Enable service discovery (mDNS) .....                    | 498 |
| Use the iPerf service .....                              | 502 |
| Configure the ping responder service .....               | 506 |

## Allow remote access for web administration and SSH

By default, only devices connected to the EX15's LAN have access to the device via web administration and SSH. To enable these services for access from remote devices:

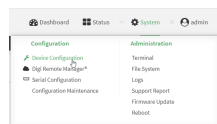
- The EX15 device must have a publicly reachable IP address.
- The **External** firewall zone must be added to the web administration or SSH service. See [Firewall configuration](#) for information on zones.
- See [Set the idle timeout for EX15 users](#) for information about setting the inactivity timeout for the web administration and SSH services.

To allow web administration or SSH for the External firewall zone:

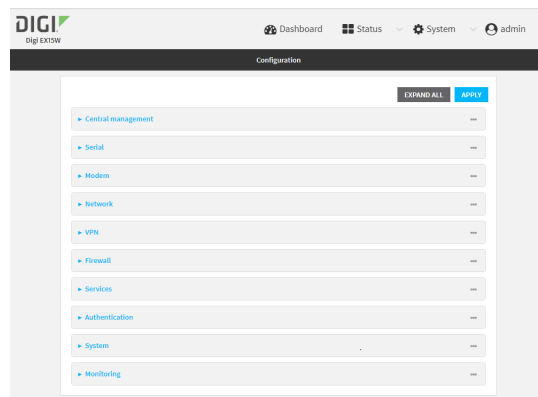
### Add the External firewall zone to the web administration service

#### WebUI

1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.

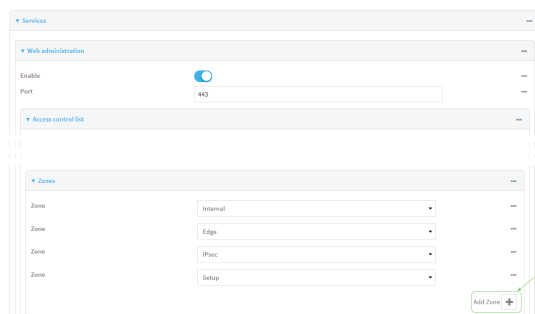


The **Configuration** window is displayed.

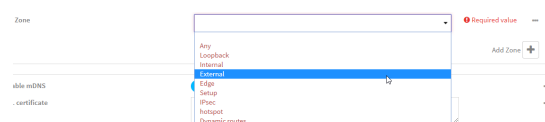


3. Click **Services > Web administration > Access Control List > Zones**.

4. For **Add Zone**, click **+**.



5. Select **External**.



6. Click **Apply** to save the configuration and apply the change.



## Command line

- Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
- At the command line, type **config** to enter configuration mode:
 

```
> config
(config)>
```
- Add the external zone to the web administration service:
 

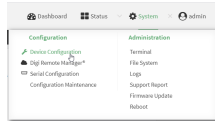
```
(config)> add service web_admin acl zone end external
(config)>
```
- Save the configuration and apply the change:
 

```
(config)> save
Configuration saved.
>
```
- Type **exit** to exit the Admin CLI.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

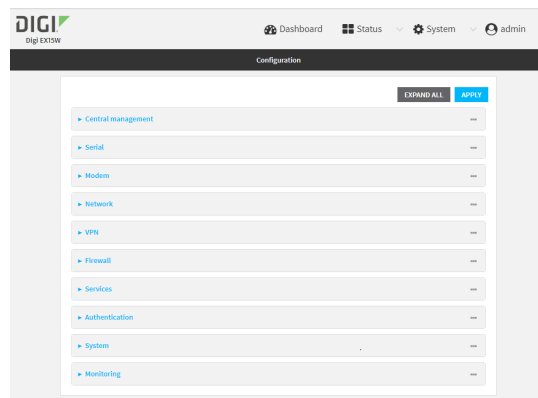
## Add the External firewall zone to the SSH service

## WebUI

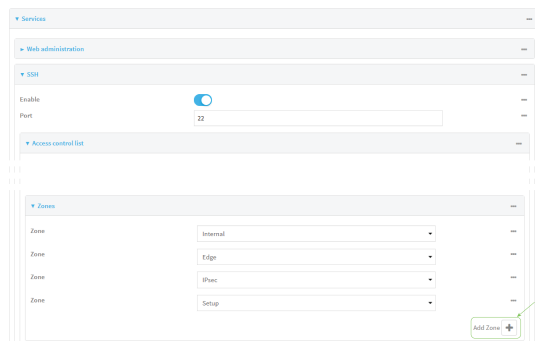
1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



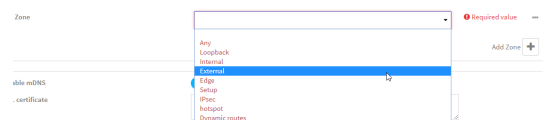
The **Configuration** window is displayed.



3. Click **Configuration > Services > SSH > Access Control List > Zones**.
4. For **Add Zone**, click **+**.



5. Select **External**.



6. Click **Apply** to save the configuration and apply the change.



 **Command line**

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the command line, type **config** to enter configuration mode:  

---

```
> config
(config)>
```

---
3. Add the **External** zone to the SSH service:  

---

```
(config)> add service ssh acl zone end external
(config)>
```

---
4. Save the configuration and apply the change:  

---

```
(config)> save
Configuration saved.
>
```

---
5. Type **exit** to exit the Admin CLI.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Configure the web administration service

The web administration service allows you to monitor and configure the EX15 device by using the WebUI, a browser-based interface.

By default, the web administration service is enabled and uses the standard HTTPS port, 443. The default access control for the service uses the **Internal** firewall zone, which means that only devices connected to the EX15's LAN can access the WebUI. If this configuration is sufficient for your needs, no further configuration is required. See [Allow remote access for web administration and SSH](#) for information about configuring the web administration service to allow access from remote devices.

### **Required configuration items**

- The web administration service is enabled by default.
- Configure access control for the service.

### **Additional configuration items**

- Port to use for web administration service communication.
- Multicast DNS (mDNS) support.
- An SSL certificate to use for communications with the service.
- Support for legacy encryption protocols.

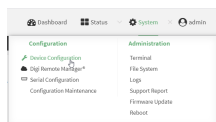
See [Set the idle timeout for EX15 users](#) for information about setting the inactivity timeout for the web administration services.

## Enable or disable the web administration service

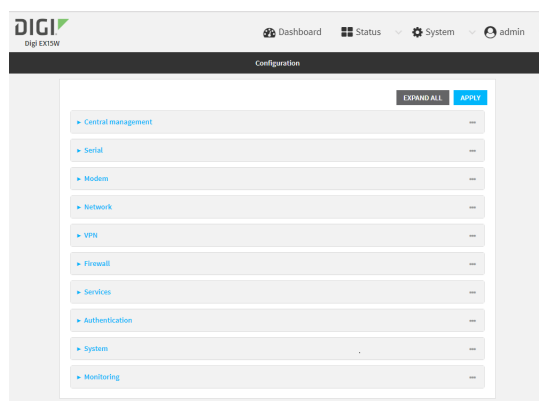
The web administration service is enabled by default. To disable the service, or enable it if it has been disabled:

### WebUI

1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.



3. Click **Services > Web administration**.
4. Click **Enable**.
5. Click **Apply** to save the configuration and apply the change.



### Command line

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the command line, type **config** to enter configuration mode:

```
> config
(config)>
```

3. Enable or disable the web administration service:

- To enable the service:

```
(config)> service web_admin enable true
(config)>
```

- To disable the service:

```
(config)> service web_admin enable false
(config)>
```

4. Save the configuration and apply the change:

```
(config)> save
Configuration saved.
>
```

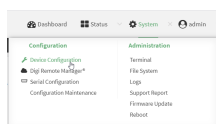
5. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

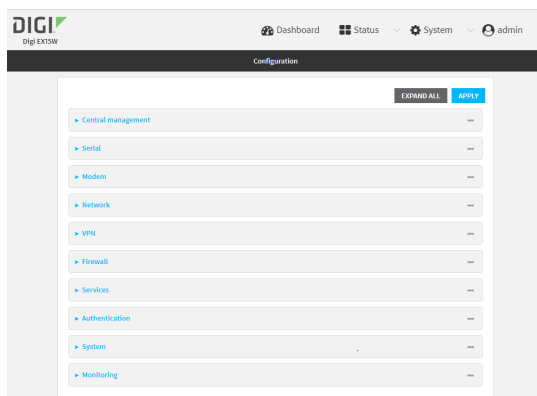
## Configure the service

### WebUI

1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.



3. Click **Services > Web administration**.
4. (Optional) For **Port**, enter the port number for the service. Normally this should not be changed.
5. Click **Access control list** to configure access control:



- To limit access to specified IPv4 addresses and networks:
    - a. Click **IPv4 Addresses**.
    - b. For **Add Address**, click **+**.
    - c. For **Address**, enter the IPv4 address or network that can access the device's web administration service. Allowed values are:
      - A single IP address or host name.
      - A network designation in CIDR notation, for example, 192.168.1.0/24.
      - **any**: No limit to IPv4 addresses that can access the web administration service.
    - d. Click **+** again to list additional IP addresses or networks.
  - To limit access to specified IPv6 addresses and networks:
    - a. Click **IPv6 Addresses**.
    - b. For **Add Address**, click **+**.
    - c. For **Address**, enter the IPv6 address or network that can access the device's web administration service. Allowed values are:
      - A single IP address or host name.
      - A network designation in CIDR notation, for example, 2001:db8::/48.
      - **any**: No limit to IPv6 addresses that can access the web administration service.
    - d. Click **+** again to list additional IP addresses or networks.
  - To limit access to hosts connected through a specified interface on the EX15 device:
    - a. Click **Interfaces**.
    - b. For **Add Interface**, click **+**.
    - c. For **Interface**, select the appropriate interface from the dropdown.
    - d. Click **+** again to allow access through additional interfaces.
  - To limit access based on firewall zones:
    - a. Click **Zones**.
    - b. For **Add Zone**, click **+**.
    - c. For **Zone**, select the appropriate firewall zone from the dropdown.  
See [Firewall configuration](#) for information about firewall zones.
    - d. Click **+** again to allow access through additional firewall zones.
6. Multicast DNS (mDNS) is enabled by default. mDNS is a protocol that resolves host names in small networks that do not have a DNS server. To disable mDNS, or enable it if it has been disabled, click **Enable mDNS**.
7. For **SSL certificate**, if you have your own signed SSL certificate, paste the certificate and private key. If **SSL certificate** is blank, the device will use an automatically-generated, self-signed certificate.
- The SSL certificate and private key must be in PEM format.
  - The private key can use one of the following algorithms:
    - RSA
    - DSA
    - ECDSA



2. At the command line, type **config** to enter configuration mode:

---

```
> config
(config)>
```

---

3. Configure access control:

- To limit access to specified IPv4 addresses and networks:

---

```
(config)> add service web_admin acl address end value
(config)>
```

---

Where *value* can be:

- A single IP address or host name.
- A network designation in CIDR notation, for example, 192.168.1.0/24.
- **any**: No limit to IPv4 addresses that can access the web administration service.

Repeat this step to list additional IP addresses or networks.

- To limit access to specified IPv6 addresses and networks:

---

```
(config)> add service web_admin acl address6 end value
(config)>
```

---

Where *value* can be:

- A single IP address or host name.
- A network designation in CIDR notation, for example, 2001:db8::/48.
- **any**: No limit to IPv6 addresses that can access the web administration service.

Repeat this step to list additional IP addresses or networks.

- To limit access to hosts connected through a specified interface on the EX15 device:

---

```
(config)> add service web_admin acl interface end value
(config)>
```

---

Where *value* is an interface defined on your device.

Display a list of available interfaces:

Use **... network interface ?** to display interface information:

Repeat this step to list additional interfaces.

- To limit access based on firewall zones:

---

```
(config)> add service web_admin acl zone end value
```

---

Where *value* is a firewall zone defined on your device, or the **any** keyword.

Display a list of available firewall zones:

Type **... firewall zone ?** at the config prompt:

---

```
(config)> ... firewall zone ?
```

---

Zones: A list of groups of network interfaces that can be

---

---

```
referred to by packet
filtering rules and access control lists.
```

#### Additional Configuration

---

```
any
dynamic_routes
edge
external
internal
ipsec
loopback
setup
```

```
(config)>
```

---

Repeat this step to list additional firewall zones.

4. (Optional) If you have your own signed SSL certificate, if you have your own signed SSL certificate, set the certificate and private key by pasting their contents into the **service web\_admin cert** command. Enclose the certificate and private key contents in quotes (").

---

```
(config)> service web_admin cert "ssl-cert-and-private-key"
(config)>
```

---

- If **SSL certificate** is blank, the device will use an automatically-generated, self-signed certificate.
- The SSL certificate and private key must be in PEM format.
- The private key can use one of the following algorithms:
  - RSA
  - DSA
  - ECDSA
  - ECDH

---

**Note** Password-protected certificate keys are not supported.

---

#### Example

- a. Generate the SSL certificate and private key, for example:

---

```
openssl req -newkey rsa:2048 -nodes -keyout key.pem -x509 -days 365 -
out certificate.pem
```

---

- b. Paste the contents of **certificate.pem** and **key.pem** into the **service web\_admin cert** command. Enclose the contents of **certificate.pem** and **key.pem** in quotes. For example:

---

```
(config)> service web_admin cert "-----BEGIN CERTIFICATE-----
MIID8TCCAtmgAwIBAgIUL0wezcmBnQmIC9pT9txwCfUbkWQwDQYJKoZIhvcNAQEL
BQAwgYcx CzAJBgNVBAYTAlVTMQ8wDQYDVQQIDAZPcmVnb24xDjAMBgNVBACMBUFs
b2hhMRMwEQYDVQQKDAPNY0JhbmUgSW5jMRAwDgYDVQQLDAdTdXBwb3J0MQ8wDQYD
```

---

```

VQQDDAZtY2JhbmUxHZAAdBgkqhkiG9w0BCQEWEGptY2JhbmVhZGlnaS5jb20wHhcN
MjAwOTIyMTY1OTUyWhcNMjEwOTIyMTY1OTUyWjCBhZELMAkGA1UEBhMCVVMxZDAN
BgNVBAGyZWdvdjEOMAwGA1UEBwwFQWxvaGExEzARBgNVBAoMCK1jQmFuZSBJ
bmMxEDA0BgNVBAsMB1N1cHBvcnQxDzANBgNVBAMMBm1jYmFuZTEfMB0GCSqGSIb3
DQEJARYQam1jYmFuZUBkaWdpLmNvbTCCASIwDQYJKoZIhvcNAQEBBQADggEPADCC
AQoCggEBA0Bn19AX01L09pLytfRZq0bETwNwSCYGeEIOGJ7gHt/rihLVBJs1woYv
u10q1ohYxIawBY1iIPBD2GtzyEJXzBZdQRhwi/dRyRi4vr7EkjGDr0Vb/NVT0L5w
UzcMeT+71DYvKYm6GpcWx+LoKqFTjbMFBIZE5pbBfru+SicId6joCHIuYq8Ehflx
6sy6s4MDbyTUAEN2YhsBa0ljeje64LNzcsHeISbAWibXWj0SsK+N1MivQq5uwIYw/
1fsnD8KDS43Wg57+far9fQ2MIHsgnoAGz+w6PIKJR594y/MfqQffDFNCh2lJY49F
h0QEtA5B9TyXRKwoa3j/LIC/t5cpIBcCAwEAAaTMFEwHQYDVR00BBYEFDVtrWBH
E1ZcBg9TRRxMn7chKYjXMB8GA1UdIwQYMBaAFDVtrWBHE1ZcBg9TRRxMn7chKYjX
MA8GA1UdEwEB/wQFMAMBAf8wDQYJKoZIhvcNAQELBQADggEBALj/mrgaKDNtspv9
ThyZTBLRQ59wIzWRWYRrXUmKvCR8eBcjwdBTWjSBLnFLD2WFOEEEnVz2Dzcixmj4
/Fw7GQNCYIKj+aIGJzbcKgox10mZB3VKYRmPpnpzHCkvFi4o81+bC8HJQfK9U80e
vDV0/vA50B2j/DrjvL0rapCTkuyA0TVyGvgTASx2ATu9U45KZofm4odThQs/9FRQ
+cwStb5v47KYffeyY+g3dyJw1/KgMJGpBUYNJDI5FQC9RfzPjKE2kz41hx4VksT/
q81WGstDXH++QTu2sj7vWkFJH5xPfT80HjtWKKpIfe0ILBPGeRHvdH2PQjibx000t
Sa+P508=
-----END CERTIFICATE-----
-----BEGIN PRIVATE KEY-----
MIIIEvQIBADANBgkqhkiG9w0BAQEFAASCBKcwggSjAgEAAoIBAQDgZ9fQF9NSzvaZ
WLX0WatGxE8DcEgmBnhCDhie4B7f64oS1QSUTCGL7tTqtaIWMSGsAWNYiDwQ9hr
c8hCV8wWxUEYcIv3UckYuL6+xJIXg69FW/zVU9C+cFM3DHk/u9Q2LymJuhqXFsf
i6CqhU42zBQSM3uaWwX67vkonCheo6AhyLmKvBIX5cerMurODA28k1ABDdmIbAwjp
Y3o+uCzc3LB3iEmwFom1lozkrCvjdTir0KubsCGMP9X7Jw/Cg0uN1o0e/n2q/X0N
jCB7D56ABs/s0jYciUefeMvzH6kH3wxTQodpSWOPRYTqhLQ0QfU8l0SsKgt4/5SA
v7eXKSAXAgMBAECggEBAMDkdi7hStyrclDsVeZH4044+WkK3fFNPaQCWESmZ+AY
i9cCC513S1feSiHnc8hP+wd70klVNNc2coheQH4+z6enFnXYu2cPbKVAkx9x4eeI
Ktx72wuprnr2JYf1v3Vx+S9T9WvN52pGuBPJQla3YdWbSf18wr5iHm9NXIeMTsFc
esdjEW07JRnxQEMZ1GPWT+YtH1+FzQ3+W9rFsFFzt0vcp5Lh1RGg0huzL2NQ5EcF
3brzIZjNAavMsdBFzdc2hcbYnbv7o1uGLujbtZ7WurNy7+Tc54gu2Ds25J0/0mgf
OxmQFevIqVkp2w0meLtI4o77y6uCbhFA6I+GWTZEYECgYEA/uDzlbPMRcWuUig0
Cym0KlHepx9qid2Ike0G57ykFaEsKxVMKHkv/yvAEHwazIEzlc2kcQrbLWnDQYx
oKmXf87Y1T5AXs+m1lPlepXgveKpKrWwORSdDBd+OS34lyNJ0KCqqIzwAaf8lcSW
tyShAZzvH9GW9WLCc8g3ifp9WUCgYEA4WSSfFkQLA09sI76VLvUqMbb31bNgOk
ZuPg7uxuDk3yNY58LGQCoV8tUZuHtBJdrBDctcJa5sasJZQrWULZ8y/5zgCZmqQn
MzTD062xaqTenL0jKgKQrWig4DpUUhfc4BFJmHyeitosDPG98oCxuh6HfUM0eM1v
Xag6Z391VcsCgYBgBnpFFU1JoC+L7m+lIPPZykWbPT/qBeYBBki5+0lhzebr9Stn
VicrmR0jojqk/sRGxR7fdixaGZolUwCRg7N7SH/y3zA7SDp4WvhjFeKFR8b601d4
PFnW02envUUiE/50ZoPFWsv1o8eK2XT67Qbn56t9NB5a7QPvzSSR7jG77QKBgd/w
BrqTT9wL4DBrsxEiLK+1g0/iMKcm8dkaJbHBMgsuw1m7/K+fAzWBwtpWk21alGX+
Ly3eX2j9zNGwMYfXjg01hViRxQEgNdqJyk9fA2gsMtYltTbYmVYHyZMweMD88fRC
Ey2FLHfxIfPeE7MaHNCeXnN556/McTSUJcRihh3AoGAey0BGi4xLqSJEsqZZ58p
e71JHg4M46rLlrx+4FXaop64LCxM8kPpR0fasJJU5nLpPYHye959BBQnYcAheZZ
0siGswIauBd8BrZMIwf8JBUIc5EGkMiIyNpLJqPbGEImMUXk4Zane/cl7e06U8ft
BUtOtMeFbBDDxpP+E+iIiuM=
-----END PRIVATE KEY-----"
(config)>

```

5. (Optional) Configure Multicast DNS (mDNS):

mDNS is a protocol that resolves host names in small networks that do not have a DNS server. mDNS is enabled by default. To disable mDNS, or enable it if it has been disabled:

- To enable the mDNS protocol:

---

```
(config)> service web_admin mdns enable true
(config)>
```

---

- To disable the mDNS protocol:

---

```
(config)> service web_admin mdns enable false
(config)>
```

---

6. (Optional) Set the port number for this service.

The default setting of 443 normally should not be changed.

---

```
(config)> service web_admin port 444
(config)>
```

---

7. (Optional) Configure the device to allow legacy encryption protocols.

Legacy encryption protocols allow clients to connect to the HTTPS session by using encryption protocols older than TLS 1.2, in addition to TLS 1.2 and later protocols. This option is disabled by default, which means that only TLS 1.2 and later encryption protocols are allowed with HTTPS connections.

To enable legacy encryption protocols:

---

```
(config)> service web_admin legacy_encryption true
(config)>
```

---

8. (Optional) Disable legacy port redirection.

Legacy port redirection is used to redirect client HTTP requests to the HTTPS service. Legacy port redirection is enabled by default, and normally these settings should not be changed.

To disable legacy port redirection:

---

```
(config)> service web_admin legacy enable false
(config)>
```

---

9. Save the configuration and apply the change:

---

```
(config)> save
Configuration saved.
>
```

---

10. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Configure SSH access

The EX15's default configuration has SSH access enabled, and allows SSH access to the device from authorized users within the **Internal** firewall zone. If this configuration is sufficient for your needs, no further configuration is required. See [Allow remote access for web administration and SSH](#) for information about configuring the SSH service to allow access from remote devices.

### Required configuration items

- Enable SSH access.
- Configure access control for the SSH service.

### Additional configuration items

- Port to use for communications with the SSH service.
- Multicast DNS (mDNS) support.
- A private key to use for communications with the SSH service.

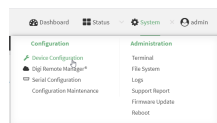
See [Set the idle timeout for EX15 users](#) for information about setting the inactivity timeout for the SSH service.

### Enable or disable the SSH service

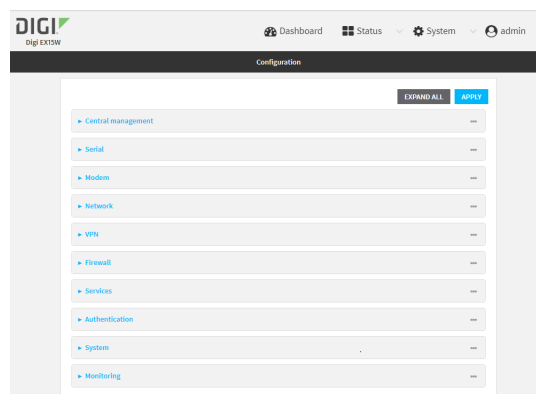
The SSH service is enabled by default. To disable the service, or enable it if it has been disabled:

#### WebUI

1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.



3. Click **Services > SSH**.

- Click **Enable**.
- Click **Apply** to save the configuration and apply the change.



## Command line

- Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
- At the command line, type **config** to enter configuration mode:

```
> config
(config)>
```

- Enable or disable the SSH service:

- To enable the service:

```
(config)> service ssh enable true
(config)>
```

- To disable the service:

```
(config)> service ssh enable false
(config)>
```

- Save the configuration and apply the change:

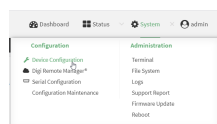
```
(config)> save
Configuration saved.
>
```

- Type **exit** to exit the Admin CLI.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Configure the service

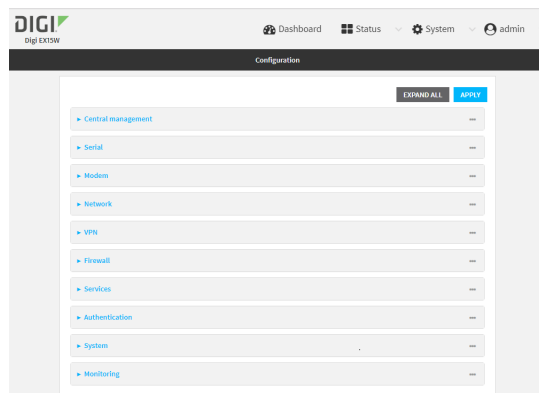
### WebUI

- Log into the EX15 WebUI as a user with full Admin access rights.
- On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.





3. Click **Services > SSH**.
4. (Optional) For **Port**, enter the port number for the service. Normally this should not be changed.
5. Click **Access control list** to configure access control:
  - To limit access to specified IPv4 addresses and networks:
    - a. Click **IPv4 Addresses**.
    - b. For **Add Address**, click **+**.
    - c. For **Address**, enter the IPv4 address or network that can access the device's SSH service. Allowed values are:
      - A single IP address or host name.
      - A network designation in CIDR notation, for example, 192.168.1.0/24.
      - **any**: No limit to IPv4 addresses that can access the SSH service.
    - d. Click **+** again to list additional IP addresses or networks.
  - To limit access to specified IPv6 addresses and networks:
    - a. Click **IPv6 Addresses**.
    - b. For **Add Address**, click **+**.
    - c. For **Address**, enter the IPv6 address or network that can access the device's SSH service. Allowed values are:
      - A single IP address or host name.
      - A network designation in CIDR notation, for example, 2001:db8::/48.
      - **any**: No limit to IPv6 addresses that can access the SSH service.
    - d. Click **+** again to list additional IP addresses or networks.
  - To limit access to hosts connected through a specified interface on the EX15 device:
    - a. Click **Interfaces**.
    - b. For **Add Interface**, click **+**.
    - c. For **Interface**, select the appropriate interface from the dropdown.
    - d. Click **+** again to allow access through additional interfaces.
  - To limit access based on firewall zones:
    - a. Click **Zones**.
    - b. For **Add Zone**, click **+**.

- c. For **Zone**, select the appropriate firewall zone from the dropdown.  
See [Firewall configuration](#) for information about firewall zones.
  - d. Click **+** again to allow access through additional firewall zones.
6. Multicast DNS (mDNS) is enabled by default. mDNS is a protocol that resolves host names in small networks that do not have a DNS server. To disable mDNS, or enable it if it has been disabled, click **Enable mDNS**.
7. For **Private key**, type the private key in PEM format. If **Private key** is blank, the device will use an automatically-generated key.
8. Click **Apply** to save the configuration and apply the change.



## Command line

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the command line, type **config** to enter configuration mode:

```
> config
(config)>
```

3. Configure access control:

- To limit access to specified IPv4 addresses and networks:

```
(config)> add service ssh acl address end value
(config)>
```

Where *value* can be:

- A single IP address or host name.
- A network designation in CIDR notation, for example, 192.168.1.0/24.
- **any**: No limit to IPv4 addresses that can access the SSH service.

Repeat this step to list additional IP addresses or networks.

- To limit access to specified IPv6 addresses and networks:

```
(config)> add service ssh acl address6 end value
(config)>
```

Where *value* can be:

- A single IP address or host name.
- A network designation in CIDR notation, for example, 2001:db8::/48.
- **any**: No limit to IPv6 addresses that can access the SSH service.

Repeat this step to list additional IP addresses or networks.

- To limit access to hosts connected through a specified interface on the EX15 device:

---

```
(config)> add service ssh acl interface end value
(config)>
```

---

Where *value* is an interface defined on your device.

Display a list of available interfaces:

Use ... **network interface ?** to display interface information:

Repeat this step to list additional interfaces.

- To limit access based on firewall zones:

---

```
(config)> add service ssh acl zone end value
```

---

Where *value* is a firewall zone defined on your device, or the **any** keyword.

Display a list of available firewall zones:

Type ... **firewall zone ?** at the config prompt:

---

```
(config)> ... firewall zone ?
```

Zones: A list of groups of network interfaces that can be referred to by packet filtering rules and access control lists.

Additional Configuration

-----

```
any
dynamic_routes
edge
external
internal
ipsec
loopback
setup
```

---

```
(config)>
```

---

Repeat this step to list additional firewall zones.

4. (Optional) Set the private key in PEM format. If not set, the device will use an automatically-generated key.

---

```
(config)> service ssh key key.pem
(config)>
```

---

5. (Optional) Configure Multicast DNS (mDNS)

mDNS is a protocol that resolves host names in small networks that do not have a DNS server. mDNS is enabled by default. To disable mDNS, or enable it if it has been disabled:

- To enable the mDNS protocol:

---

```
(config)> service ssh mdns enable true
(config)>
```

---

- To disable the mDNS protocol:

---

```
(config)> service ssh mdns enable false
(config)>
```

---

6. (Optional) Set the port number for this service.

The default setting of 22 normally should not be changed.

---

```
(config)> service ssh port 24
(config)>
```

---

7. Save the configuration and apply the change:

---

```
(config)> save
Configuration saved.
>
```

---

8. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Use SSH with key authentication

Rather than using passwords, you can use SSH keys to authenticate users connecting via SSH, SFTP, or SCP. SSH keys provide security and scalability:

- **Security:** Using SSH keys for authentication is more secure than using passwords. Unlike a password that can be guessed by an unauthorized user, SSH key pairs provide more sophisticated security. A public key configured on the EX15 device is paired with a private key on the user's PC. The private key, once generated, remains on the user's PC.
- **Scalability:** SSH keys can be used on more than one EX15 device.

### Generating SSH key pairs

On a Microsoft Windows PC, you can generate SSH key pairs using a terminal emulator application, such as **PuTTY** or **Tera Term**.

On a Linux host, an SSH key pair is usually created automatically in the user's **.ssh** directory. The private and public keys are named **id\_rsa** and **id\_rsa.pub**. If you need to generate an SSH key pair, you can use the **ssh-keygen** application.

For example, the following entry generates an RSA key pair in the user's **.ssh** directory:

```
ssh-keygen -t rsa -f ~/.ssh/id_rsa
```

The private key file is named **id\_rsa** and the public key file is named **id\_rsa.pub**. (The **.pub** extension is automatically appended to the name specified for the private key output file.)

### Required configuration items

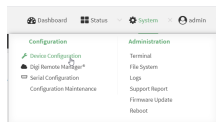
- Name for the user
- SSH public key for the user

### Additional configuration items

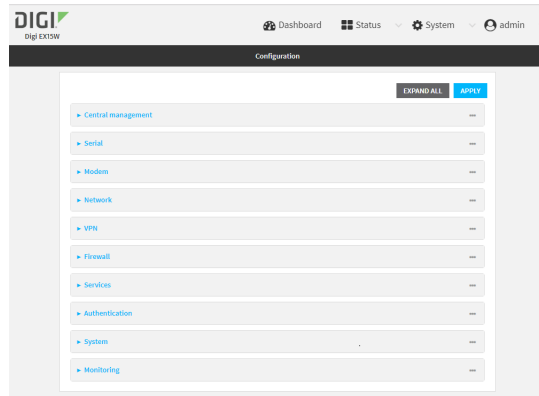
- If you want to access the EX15 device using SSH over a WAN interface, configure the access control list for the SSH service to allow SSH access for the **External** firewall zone.

## WebUI

1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.



3. Click **Authentication > Users**.
4. Select an existing user or create a new user. See [User authentication](#) for information about creating a new user.
5. Click **SSH keys**.
6. In **Add SSH key**, enter a name for the SSH key and click **+**.
7. Enter the public SSH key by pasting or typing a public encryption key that this user can use for passwordless SSH login.
8. Click **Apply** to save the configuration and apply the change.



## Command line

You can add configure passwordless SSH login for an existing user or include the support when creating a new user. See [User authentication](#) for information about creating a new user. These instructions assume an existing user named **temp\_user**.

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the command line, type **config** to enter configuration mode:

```
> config
(config)>
```

3. Add an SSH key for the user by using the `ssh_key` command and pasting or typing a public encryption key:

```
(config)> add auth user maria ssh_key key_name key
(config)>
```

where:

- *key\_name* is a name for the key.
  - *key* is a public SSH key, which you can enter by pasting or typing a public encryption key that this user can use for passwordless SSH login
4. Save the configuration and apply the change:

---

```
(config)> save
Configuration saved.
>
```

---

5. Type **exit** to exit the Admin CLI.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Configure telnet access

By default, the telnet service is disabled.

**Note** Telnet is an insecure protocol and should only be used for backward-compatibility reasons, and only if the network connection is otherwise secured.

### Required configuration items

- Enable telnet access.
- Configure access control for the telnet service.

### Additional configuration items

- Port to use for communications with the telnet service.
- Multicast DNS (mDNS) support.

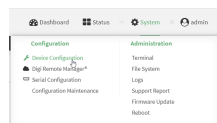
See [Set the idle timeout for EX15 users](#) for information about setting the inactivity timeout for the telnet service.

### Enable the telnet service

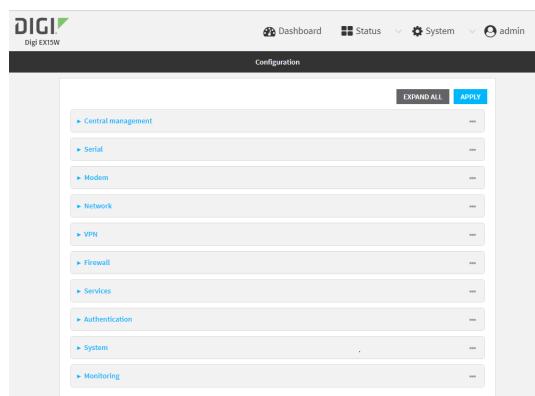
The telnet service is disabled by default. To enable the service:

#### WebUI

1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.



3. Click **Services > telnet**.
4. Click **Enable**.



- Click **Apply** to save the configuration and apply the change.



## Command line

- Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
- At the command line, type **config** to enter configuration mode:
 

```
> config
(config)>
```
- Enable the telnet service:
 

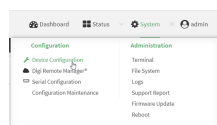
```
(config)> service telnet enable true
(config)>
```
- Save the configuration and apply the change:
 

```
(config)> save
Configuration saved.
>
```
- Type **exit** to exit the Admin CLI.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

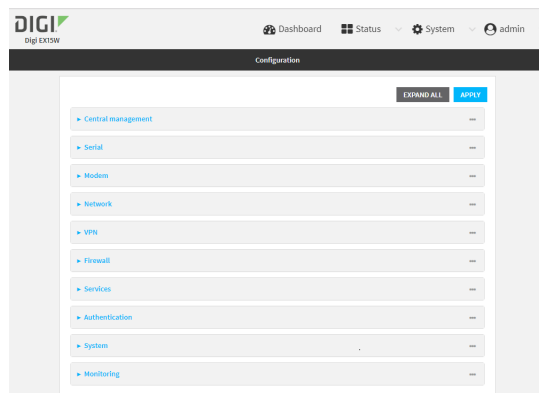
## Configure the service

### WebUI

- Log into the EX15 WebUI as a user with full Admin access rights.
- On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.



3. Click **Services > telnet**.
4. (Optional) For **Port**, enter the port number for the service. Normally this should not be changed.
5. Click **Access control list** to configure access control:
  - To limit access to specified IPv4 addresses and networks:
    - a. Click **IPv4 Addresses**.
    - b. For **Add Address**, click **+**.
    - c. For **Address**, enter the IPv4 address or network that can access the device's telnet service. Allowed values are:
      - A single IP address or host name.
      - A network designation in CIDR notation, for example, 192.168.1.0/24.
      - **any**: No limit to IPv4 addresses that can access the telnet service.
    - d. Click **+** again to list additional IP addresses or networks.
  - To limit access to specified IPv6 addresses and networks:
    - a. Click **IPv6 Addresses**.
    - b. For **Add Address**, click **+**.
    - c. For **Address**, enter the IPv6 address or network that can access the device's telnet service. Allowed values are:
      - A single IP address or host name.
      - A network designation in CIDR notation, for example, 2001:db8::/48.
      - **any**: No limit to IPv6 addresses that can access the telnet service.
    - d. Click **+** again to list additional IP addresses or networks.
  - To limit access to hosts connected through a specified interface on the EX15 device:
    - a. Click **Interfaces**.
    - b. For **Add Interface**, click **+**.
    - c. For **Interface**, select the appropriate interface from the dropdown.
    - d. Click **+** again to allow access through additional interfaces.
  - To limit access based on firewall zones:
    - a. Click **Zones**.
    - b. For **Add Zone**, click **+**.

- c. For **Zone**, select the appropriate firewall zone from the dropdown.  
See [Firewall configuration](#) for information about firewall zones.
  - d. Click **+** again to allow access through additional firewall zones.
6. Multicast DNS (mDNS) is disabled by default. mDNS is a protocol that resolves host names in small networks that do not have a DNS server. To enable mDNS, click **Enable mDNS**.
7. Click **Apply** to save the configuration and apply the change.



## Command line

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the command line, type **config** to enter configuration mode:

```
> config
(config)>
```

3. Configure access control:

- To limit access to specified IPv4 addresses and networks:

```
(config)> add service telnet acl address end value
(config)>
```

Where *value* can be:

- A single IP address or host name.
- A network designation in CIDR notation, for example, 192.168.1.0/24.
- **any**: No limit to IPv4 addresses that can access the telnet service.

Repeat this step to list additional IP addresses or networks.

- To limit access to specified IPv6 addresses and networks:

```
(config)> add service telnet acl address6 end value
(config)>
```

Where *value* can be:

- A single IP address or host name.
- A network designation in CIDR notation, for example, 2001:db8::/48.
- **any**: No limit to IPv6 addresses that can access the telnet service.

Repeat this step to list additional IP addresses or networks.

- To limit access to hosts connected through a specified interface on the EX15 device:

```
(config)> add service telnet acl interface end value
(config)>
```

Where *value* is an interface defined on your device.

Display a list of available interfaces:

Use **... network interface ?** to display interface information:

Repeat this step to list additional interfaces.

- To limit access based on firewall zones:

---

```
(config)> add service telnet acl zone end value
```

---

Where *value* is a firewall zone defined on your device, or the **any** keyword.

Display a list of available firewall zones:

Type **... firewall zone ?** at the config prompt:

---

```
(config)> ... firewall zone ?
```

Zones: A list of groups of network interfaces that can be referred to by packet filtering rules and access control lists.

Additional Configuration

-----

```
any
dynamic_routes
edge
external
internal
ipsec
loopback
setup
```

---

```
(config)>
```

---

Repeat this step to list additional firewall zones.

4. (Optional) Configure Multicast DNS (mDNS)

mDNS is a protocol that resolves host names in small networks that do not have a DNS server. mDNS is disabled by default. To enable:

---

```
(config)> service telnet mdns enable true
(config)>
```

---

5. (Optional) Set the port number for this service.

The default setting of 23 normally should not be changed.

---

```
(config)> service telnet port 25
(config)>
```

---

6. Save the configuration and apply the change:

---

```
(config)> save
Configuration saved.
>
```

---

7. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Configure DNS

The EX15 device includes a caching DNS server which forwards queries to the DNS servers that are associated with the network interfaces, and caches the results. This server is used within the device, and cannot be disabled. Use the access control list to restrict external access to this server.

### ***Required configuration items***

- Configure access control for the DNS service.

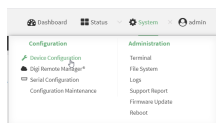
### ***Additional configuration items***

- Whether the device should cache negative responses.
- Whether the device should always perform DNS queries to all available DNS servers.
- Whether to prevent upstream DNS servers from returning private IP addresses.
- Additional DNS servers, in addition to the ones associated with the device's network interfaces.
- Specific host names and their IP addresses.

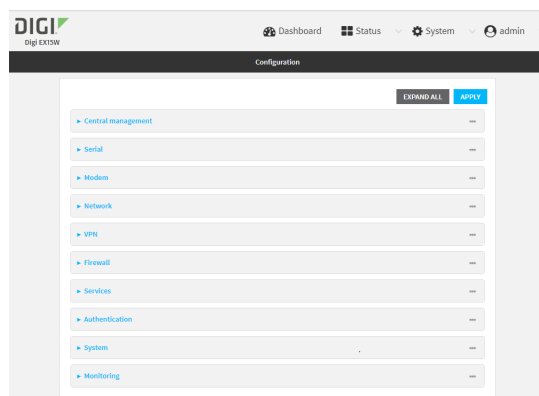
To configure the DNS server:

## WebUI

1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.



3. Click **Services > DNS**.
4. Click **Access control list** to configure access control:
  - To limit access to specified IPv4 addresses and networks:
    - a. Click **IPv4 Addresses**.
    - b. For **Add Address**, click **+**.
    - c. For **Address**, enter the IPv4 address or network that can access the device's DNS service. Allowed values are:
      - A single IP address or host name.
      - A network designation in CIDR notation, for example, 192.168.1.0/24.
      - **any**: No limit to IPv4 addresses that can access the DNS service.
    - d. Click **+** again to list additional IP addresses or networks.
  - To limit access to specified IPv6 addresses and networks:
    - a. Click **IPv6 Addresses**.
    - b. For **Add Address**, click **+**.
    - c. For **Address**, enter the IPv6 address or network that can access the device's DNS service. Allowed values are:
      - A single IP address or host name.
      - A network designation in CIDR notation, for example, 2001:db8::/48.
      - **any**: No limit to IPv6 addresses that can access the DNS service.
    - d. Click **+** again to list additional IP addresses or networks.

- To limit access to hosts connected through a specified interface on the EX15 device:
    - a. Click **Interfaces**.
    - b. For **Add Interface**, click **+**.
    - c. For **Interface**, select the appropriate interface from the dropdown.
    - d. Click **+** again to allow access through additional interfaces.
  - To limit access based on firewall zones:
    - a. Click **Zones**.
    - b. For **Add Zone**, click **+**.
    - c. For **Zone**, select the appropriate firewall zone from the dropdown.  
See [Firewall configuration](#) for information about firewall zones.
    - d. Click **+** again to allow access through additional firewall zones.
5. (Optional) **Cache negative responses** is enabled by default. Disabling this option may improve performance on networks with transient DNS results, when one or more DNS servers may have positive results. To disable, click **Cache negative responses**.
  6. (Optional) **Query all servers** is enabled by default. This option is useful when only some DNS servers will be able to resolve hostnames. To disable, click **Query all servers**.
  7. (Optional) **Rebind protection**, if enabled, prevents upstream DNS servers from returning private IP addresses. To enable, click **Rebind protection**.
  8. (Optional) **Allow localhost rebinding** is enabled by default if **Rebind protection** is enabled. This is useful for Real-time Black List (RBL) servers.
  9. (Optional) To add additional DNS servers:
    - a. Click **DNS servers**.
    - b. For **Add Server**, click **+**.
    - c. (Optional) Enter a label for the DNS server.
    - d. For **DNS server**, enter the IP address of the DNS server.
    - e. **Domain** restricts the device's use of this DNS server based on the domain. If no domain are listed, then all queries may be sent to this server.
  10. (Optional) To add host names and their IP addresses that the device's DNS server will resolve:
    - a. Click **Additional DNS hostnames**.
    - b. For **Add Host**, click **+**.
    - c. Type the **IP address** of the host.
    - d. For **Name**, type the hostname.
  11. Click **Apply** to save the configuration and apply the change.



## Command line

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the command line, type **config** to enter configuration mode:

---

```
> config
(config)>
```

---

3. Configure access control:

- To limit access to specified IPv4 addresses and networks:

---

```
(config)> add service dns acl address end value
(config)>
```

---

Where *value* can be:

- A single IP address or host name.
- A network designation in CIDR notation, for example, 192.168.1.0/24.
- **any**: No limit to IPv4 addresses that can access the DNS service.

Repeat this step to list additional IP addresses or networks.

- To limit access to specified IPv6 addresses and networks:

---

```
(config)> add service dns acl address6 end value
(config)>
```

---

Where *value* can be:

- A single IP address or host name.
- A network designation in CIDR notation, for example, 2001:db8::/48.
- **any**: No limit to IPv6 addresses that can access the DNS service.

Repeat this step to list additional IP addresses or networks.

- To limit access to hosts connected through a specified interface on the EX15 device:

---

```
(config)> add service dns acl interface end value
(config)>
```

---

Where *value* is an interface defined on your device.

Display a list of available interfaces:

Use **... network interface ?** to display interface information:

Repeat this step to list additional interfaces.

- To limit access based on firewall zones:

---

```
(config)> add service dns acl zone end value
```

---

Where *value* is a firewall zone defined on your device, or the **any** keyword.

Display a list of available firewall zones:



Type ... **firewall zone ?** at the config prompt:

---

```
(config)> ... firewall zone ?
```

Zones: A list of groups of network interfaces that can be referred to by packet filtering rules and access control lists.

Additional Configuration

---

```
any
dynamic_routes
edge
external
internal
ipsec
loopback
setup
```

---

```
(config)>
```

Repeat this step to list additional firewall zones.

4. (Optional) Cache negative responses

By default, the device's DNS server caches negative responses. Disabling this option may improve performance on networks with transient DNS results, when one or more DNS servers may have positive results. To disable:

---

```
(config)> service dns cache_negative_responses false
(config)>
```

---

5. (Optional) Query all servers

By default, the device's DNS server queries all available DNS servers. Disabling this option may improve performance on networks with transient DNS results, when one or more DNS servers may have positive results. To disable:

---

```
(config)> service dns query_all_servers false
(config)>
```

---

6. (Optional) Rebind protection

By default, rebind protection is disabled. If enabled, this prevents upstream DNS servers from returning private IP addresses. To enable:

---

```
(config)> service dns stop_dns_rebind false
(config)>
```

---

7. (Optional) Allow localhost rebinding

By default, localhost rebinding is enabled by default if rebind protection is enabled. This is useful for Real-time Black List (RBL) servers. To disable:

---

```
(config)> service dns rebind_localhost_ok false
(config)>
```

---

8. (Optional) Add additional DNS servers

a. Add a DNS server:

---

```
(config)> add service dns server end
(config service dns server 0)>
```

---

b. Set the IP address of the DNS server:

---

```
(config service dns server 0)> address ip-addr
(config service dns server 0)>
```

---

c. To restrict the device's use of this DNS server based on the domain, use the **domain** command. If no domain are listed, then all queries may be sent to this server.

---

```
(config service dns server 0)> domain domain
(config service dns server 0)>
```

---

d. (Optional) Set a label for this DNS server:

---

```
(config service dns server 0)> label label
(config service dns server 0)>
```

---

9. (Optional) Add host names and their IP addresses that the device's DNS server will resolve

a. Add a host:

---

```
(config)> add service dns host end
(config service dns host 0)>
```

---

b. Set the IP address of the host:

---

```
(config service dns host 0)> address ip-addr
(config service dns host 0)>
```

---

c. Set the host name:

---

```
(config service dns host 0)> name host-name
(config service dns host 0)>
```

---

10. Save the configuration and apply the change:

---

```
(config)> save
Configuration saved.
>
```

---

11. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Simple Network Management Protocol (SNMP)

Simple Network Management Protocol (SNMP) is a protocol for remotely managing and monitoring network devices. Network administrators can use the SNMP architecture to manage nodes, including servers, workstations, routers, switches, hubs, and other equipment on an IP network, manage network performance, find and solve network problems, and plan for network growth.

The EX15 device supports SNMPv3, read-only mode. SNMPv1 and v2 are not supported.

### SNMP Security

By default, the EX15 device automatically blocks SNMP packets from being received over WAN and LAN interfaces. As a result, if you want a EX15 device to receive SNMP packets, you must configure the SNMP access control list to allow the device to receive the packets. See [Configure Simple Network Management Protocol \(SNMP\)](#).

## Configure Simple Network Management Protocol (SNMP)

### Required configuration items

- Enable SNMP.
- Firewall configuration using access control to allow remote connections to the SNMP agent.
- The user name and password used to connect to the SNMP agent.

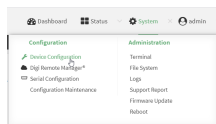
### Additional configuration items

- The port used by the SNMP agent.
- Authentication type (either MD5 or SHA).
- Privacy protocol (either DES or AES).
- Privacy passphrase, if different than the SNMP user password.
- Enable Multicast DNS (mDNS) support.

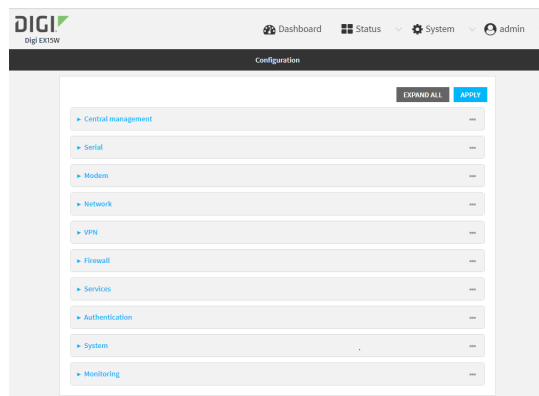
To configure the SNMP agent on your EX15 device:

### WebUI

1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.



3. Click **Services > SNMP**.
4. Click **Enable**.
5. Click **Access control list** to configure access control:
  - To limit access to specified IPv4 addresses and networks:
    - a. Click **IPv4 Addresses**.
    - b. For **Add Address**, click **+**.
    - c. For **Address**, enter the IPv4 address or network that can access the device's SNMP agent. Allowed values are:
      - A single IP address or host name.
      - A network designation in CIDR notation, for example, 192.168.1.0/24.
      - **any**: No limit to IPv4 addresses that can access the SNMP agent.
    - d. Click **+** again to list additional IP addresses or networks.
  - To limit access to specified IPv6 addresses and networks:
    - a. Click **IPv6 Addresses**.
    - b. For **Add Address**, click **+**.
    - c. For **Address**, enter the IPv6 address or network that can access the device's SNMP agent. Allowed values are:
      - A single IP address or host name.
      - A network designation in CIDR notation, for example, 2001:db8::/48.
      - **any**: No limit to IPv6 addresses that can access the SNMP agent.
    - d. Click **+** again to list additional IP addresses or networks.
  - To limit access to hosts connected through a specified interface on the EX15 device:
    - a. Click **Interfaces**.
    - b. For **Add Interface**, click **+**.
    - c. For **Interface**, select the appropriate interface from the dropdown.
    - d. Click **+** again to allow access through additional interfaces.
  - To limit access based on firewall zones:
    - a. Click **Zones**.
    - b. For **Add Zone**, click **+**.

- c. For **Zone**, select the appropriate firewall zone from the dropdown.  
See [Firewall configuration](#) for information about firewall zones.
  - d. Click **+** again to allow access through additional firewall zones.
6. Type the **Username** used to connect to the SNMP agent.
7. Type the **Password** used to connect to the SNMP agent.
8. (Optional) For **Port**, type the port number. The default is **161**.
9. (Optional) Multicast DNS (mDNS) is disabled by default. mDNS is a protocol that resolves host names in small networks that do not have a DNS server. To enable mDNS, click **Enable mDNS**.
10. (Optional) Select the **Authentication type**, either **MD5** or **SHA**. The default is **MD5**.
11. (Optional) Type the **Privacy passphrase**. If not set, the password, entered above, is used.
12. (Optional) Select the **Privacy protocol**, either **DES** or **AES**. The default is **DES**.
13. Click **Apply** to save the configuration and apply the change.



## Command line

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the command line, type **config** to enter configuration mode:

```
> config
(config)>
```

3. Enable the SNMP agent:

```
(config)> service snmp enable true
(config)>
```

4. Configure access control:

- To limit access to specified IPv4 addresses and networks:

```
(config)> add service snmp acl address end value
(config)>
```

Where *value* can be:

- A single IP address or host name.
- A network designation in CIDR notation, for example, 192.168.1.0/24.
- **any**: No limit to IPv4 addresses that can access the SNMP service.

Repeat this step to list additional IP addresses or networks.

- To limit access to specified IPv6 addresses and networks:

---

```
(config)> add service snmp acl address6 end value
(config)>
```

---

Where *value* can be:

- A single IP address or host name.
- A network designation in CIDR notation, for example, 2001:db8::/48.
- **any**: No limit to IPv6 addresses that can access the SNMP service.

Repeat this step to list additional IP addresses or networks.

- To limit access to hosts connected through a specified interface on the EX15 device:

---

```
(config)> add service snmp acl interface end value
(config)>
```

---

Where *value* is an interface defined on your device.

Display a list of available interfaces:

Use **... network interface ?** to display interface information:

Repeat this step to list additional interfaces.

- To limit access based on firewall zones:

---

```
(config)> add service snmp acl zone end value
```

---

Where *value* is a firewall zone defined on your device, or the **any** keyword.

Display a list of available firewall zones:

Type **... firewall zone ?** at the config prompt:

---

```
(config)> ... firewall zone ?
```

Zones: A list of groups of network interfaces that can be referred to by packet filtering rules and access control lists.

Additional Configuration

```

any
dynamic_routes
edge
external
internal
ipsec
loopback
setup

(config)>
```

---

Repeat this step to list additional firewall zones.

5. Set the name of the user that will be used to connect to the SNMP agent.

---

```
(config)> service snmp username name
(config)>
```

---

6. Set the password for the user that will be used to connect to the SNMP agent:

---

```
(config)> service snmp password pwd
(config)>
```

---

7. (Optional) Set the port number for the SNMP agent. The default is **161**.

---

```
(config)> service snmp port port
(config)>
```

---

8. (Optional) Configure Multicast DNS (mDNS)

mDNS is a protocol that resolves host names in small networks that do not have a DNS server. For the SNMP agent, mDNS is disabled by default. To enable:

---

```
(config)> service snmp mdns enable true
(config)>
```

---

9. (Optional) Set the authentication type. Allowed values are **MD5** or **SHA**. The default is **MD5**.

---

```
(config)> service snmp auth_type SHA
(config)>
```

---

10. (Optional) Set the privacy passphrase. If not set, the password, entered above, is used.

---

```
(config)> service snmp privacy pwd
(config)>
```

---

11. (Optional) Set the privacy protocol, either **DES** or **AES**. The default is **DES**.

---

```
(config)> service snmp privacy_protocol AES
(config)>
```

---

12. Save the configuration and apply the change:

---

```
(config)> save
Configuration saved.
>
```

---

13. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Download MIBs

This procedure is available from the WebUI only.

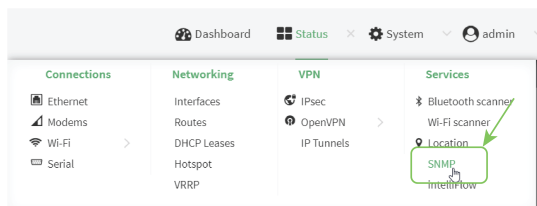
### Required configuration items

- Enable SNMP.

To download a .zip archive of the SNMP MIBs supported by this device:

## WebUI

1. Log into the EX15 WebUI as a user with Admin access.
2. Enable SNMP.  
See [Configure Simple Network Management Protocol \(SNMP\)](#) for information about enabling and configuring SNMP support on the EX15 device.
3. On the main menu, click **Status**. Under **Services**, click **SNMP**.



The **SNMP** page is displayed.



4. Click **Download**.



# Location information

Your EX15 device can be configured to use the following location sources:

- In conjunction with the with the CM07 CORE modem, the modem's internal Global Navigation Satellite System (GNSS) module that provides information about the current location of the device.
- User-defined static location.
- Location messages forwarded to the device from other location-enabled devices.

By default, the modem's internal GNSS module is enabled.

You can also configure your EX15 device to forward location messages, either from the EX15 device or from external sources, to a remote host. Additionally, the device can be configured to use a geofence, to allow you to determine actions that will be taken based on the physical location of the device.

This section contains the following topics:

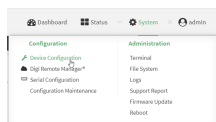
|                                                                              |     |
|------------------------------------------------------------------------------|-----|
| Configure the location service .....                                         | 438 |
| Enable or disable modem GNSS support .....                                   | 440 |
| Configure the device to use a user-defined static location .....             | 442 |
| Configure the device to accept location messages from external sources ..... | 444 |
| Forward location information to a remote host .....                          | 448 |
| Configure geofencing .....                                                   | 454 |
| Show location information .....                                              | 466 |

## Configure the location service

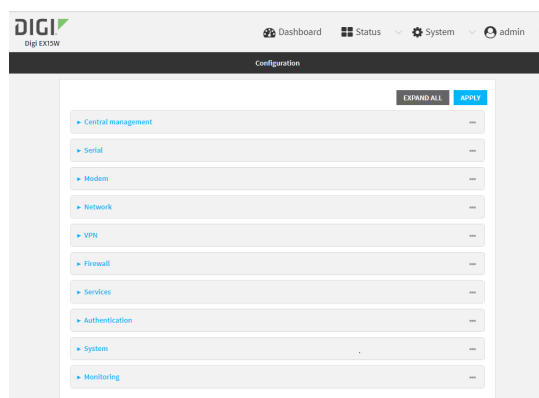
The location service is enabled by default. You can disable it, or you can enable it if it has been disabled.

### WebUI

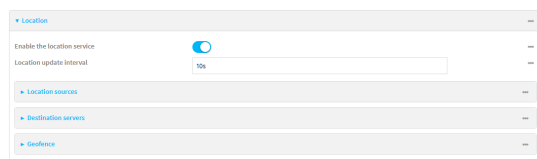
1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.



3. Click **Services > Location**.



4. The location service is enabled by default. To disable, or to enable if it has been disabled, click **Enable**.
5. For **Location update interval**, type the amount of time to wait between polling location sources for new location data. The default is ten seconds.  
Allowed values are any number of weeks, days, hours, minutes, or seconds, and take the format **number{w|d|h|m|s}**.  
For example, to set **Location update interval** to ten minutes, enter **10m** or **600s**.
6. For information about configuring **Location sources**, see the following:
  - a. For modem-based GNSS, see [Enable or disable modem GNSS support](#).
  - b. To set a static location for the device, see [Configure the device to use a user-defined static location](#).

- c. To accept location information from an external location-enabled server, see [Configure the device to accept location messages from external sources](#).

If multiple location sources are enabled at the same time, the device's location will be determined based on the order that the location sources are listed here.

7. For information about configuring **Destination servers**, see [Forward location information to a remote host](#).
8. For information about configuring **Geofence**, see [Configure geofencing](#).
9. Click **Apply** to save the configuration and apply the change.



## Command line

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the command line, type **config** to enter configuration mode:

```
> config
(config)>
```

3. Enable or disable the GNSS module:

- To enable the module:

```
(config)> service location gnss true
(config)>
```

- To disable the module:

```
(config)> service location gnss false
(config)>
```

4. Set the amount of time that the EX15 device will wait before polling location sources for updated location data:

```
(config)> service location interval value
(config)>
```

where *value* is any number of hours, minutes, or seconds, and takes the format **number{h|m|s}**. For example, to set **interval** to ten minutes, enter either **10m** or **600s**:

```
(config)> service location interval 600s
(config)>
```

The default is 10 seconds.

5. Save the configuration and apply the change:

```
(config)> save
Configuration saved.
>
```

6. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Enable or disable modem GNSS support

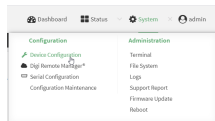
**Note** Modem GNSS support is currently only available with the CM07 CORE modem.

The EX15 device supports the CM07 CORE modem, which provides a GNSS module to determine the device's location.

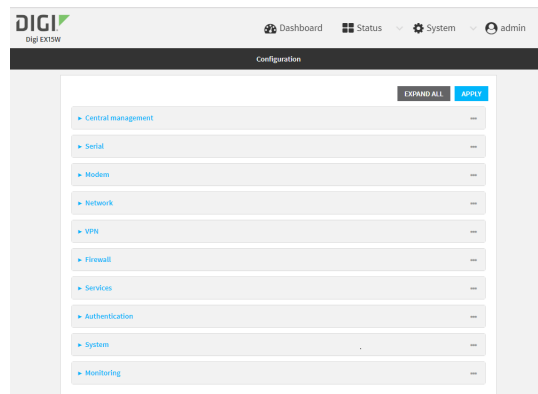
To disable support for the modem's GNSS receiver, or enable it if it has been disabled:

### WebUI

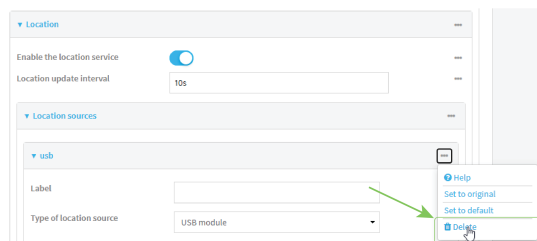
1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.



3. Click **Services > Location > Location sources > modem**.
4. Click **Enable the location source** to disable the GNSS receiver, or to enable it if it has been disabled.
5. Alternatively, you can also delete the **modem** location source:
  - a. Click the menu icon (...) next to the **modem** location source.
  - b. Click **Delete**.



6. Click **Apply** to save the configuration and apply the change.



## Command line

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the command line, type **config** to enter configuration mode:

```
> config
(config)>
```

3. Enable or disable the modem GNSS module:
  - a. Use the show command to determine the index number of the modem GNSS location source:

```
(config)> show service location source
0
 enable true
 no label
 type modem
(config)>
```

- b. Use the index number to enable or disable the module:

- To enable the module:

```
(config)> service location source 0 enable true
(config)>
```

- To disable the module:

```
(config)> service location source 0 enable false
(config)>
```

4. Alternatively, you can use the index number to delete the USB location source:

```
(config)> del service location 0
(config)>
```

5. Save the configuration and apply the change:

```
(config)> save
Configuration saved.
>
```

6. Type **exit** to exit the Admin CLI.

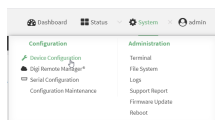
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Configure the device to use a user-defined static location

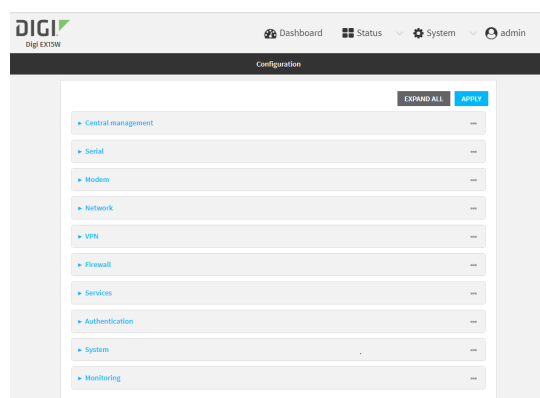
You can configured your EX15 device to use a user-defined static location.

### WebUI

1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.



3. Click **Services > Location > Location sources**.
4. Click **+** to add a location source.
5. (Optional) Type a **Label** for this location source.
6. For **Latitude**, type the latitude of the device. Allowed values are **-90** and **90**, with up to six decimal places.
7. For **Longitude**, type the longitude of the device. Allowed values are **-180** and **180**, with up to six decimal places.
8. For **Altitude**, type the altitude of the device. Allowed values are an integer followed by **m** or **km**, for example, **100m** or **1km**.
9. The location source is enabled by default. Click **Enable the location source** to disable the location source, or to enable it if it has been disabled.

- Click **Apply** to save the configuration and apply the change.



## Command line

- Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.

- At the command line, type **config** to enter configuration mode:

```
> config
(config)>
```

- Add a location source:

```
(config)> add service location source end
(config service location source 1)>
```

- (Optional) Set a label for this location source:

```
(config service location source 1)> label "label"
(config)>
```

- Set the **type** of location source to **server**:

```
(config service location source 1)> type user_defined
(config service location source 1)>
```

- Set the latitude of the device:

```
(config service location source 1 coordinates latitude int
(config service location source 1)>
```

where *int* is any integer between **-90** and **90**, with up to six decimal places.

- Set the longitude of the device:

```
(config service location source 1 coordinates longitude int
(config service location source 1)>
```

where *int* is any integer between **-180** and **180**, with up to six decimal places.

- Set the altitude of the device:

```
(config service location source 1 coordinates altitude alt
(config service location source 1)>
```

Where *alt* is an integer followed by **m** or **km**, for example, **100m** or **1km**.

9. Save the configuration and apply the change:

```
(config)> save
Configuration saved.
>
```

10. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Configure the device to accept location messages from external sources

You can configure the EX15 device to accept NMEA and TAIP messages from external sources. For example, location-enabled devices connected to the EX15 device can forward their location information to the device, and then the EX15 device can serve as a central repository for this location information and forward it to a remote host. See [Forward location information to a remote host](#) for information about configuring the EX15 device to forward location messages.

This procedure configures a UDP port on the EX15 device that will be used to listen for incoming messages.

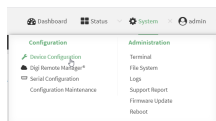
### Required configuration items

- The location server must be enabled.
- UDP port that the EX15 device will listen to for incoming location messages.
- Access control list configuration to provide access to the port through the firewall.

To configure the device to accept location messages from external sources:

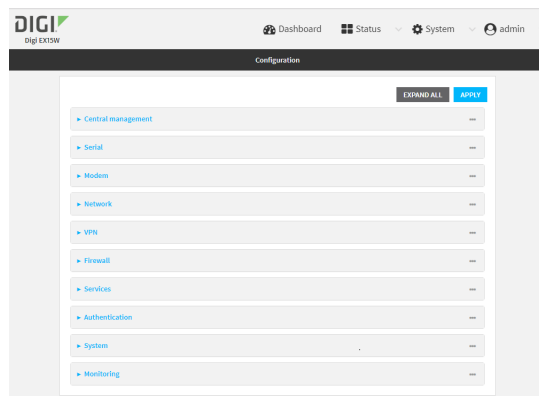
### WebUI

1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.





3. Click **Services > Location > Location sources**.
4. Click **+** to add a location source.
5. (Optional) Type a **Label** for this location source.
6. For **Type of location source**, select **Server**.
7. For **Location server port**, type the number of the UDP port that will receive incoming location messages.
8. Click **Access control list** to configure access control:
  - To limit access to specified IPv4 addresses and networks:
    - a. Click **IPv4 Addresses**.
    - b. For **Add Address**, click **+**.
    - c. For **Address**, enter the IPv4 address or network that can access the device's location server UDP port. Allowed values are:
      - A single IP address or host name.
      - A network designation in CIDR notation, for example, 192.168.1.0/24.
      - **any**: No limit to IPv4 addresses that can access the location server UDP port.
    - d. Click **+** again to list additional IP addresses or networks.
  - To limit access to specified IPv6 addresses and networks:
    - a. Click **IPv6 Addresses**.
    - b. For **Add Address**, click **+**.
    - c. For **Address**, enter the IPv6 address or network that can access the device's location server UDP port. Allowed values are:
      - A single IP address or host name.
      - A network designation in CIDR notation, for example, 2001:db8::/48.
      - **any**: No limit to IPv6 addresses that can access the location server UDP port.
    - d. Click **+** again to list additional IP addresses or networks.
  - To limit access to hosts connected through a specified interface on the EX15 device:
    - a. Click **Interfaces**.
    - b. For **Add Interface**, click **+**.
    - c. For **Interface**, select the appropriate interface from the dropdown.
    - d. Click **+** again to allow access through additional interfaces.

- To limit access based on firewall zones:
  - a. Click **Zones**.
  - b. For **Add Zone**, click **+**.
  - c. For **Zone**, select the appropriate firewall zone from the dropdown.  
See [Firewall configuration](#) for information about firewall zones.
  - d. Click **+** again to allow access through additional firewall zones.
- 9. Click **Apply** to save the configuration and apply the change.



## Command line

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the command line, type **config** to enter configuration mode:

```
> config
(config)>
```

3. Add a location source:

```
(config)> add service location source end
(config service location source 1)>
```

4. (Optional) Set a label for this location source:

```
(config service location source 1)> label "label"
(config service location source 1)>
```

5. Set the **type** of location source to **server**:

```
(config service location source 1)> type server
(config service location source 1)>
```

6. Set the UDP port that will receive incoming location messages.

```
(config service location source 1)> server port port
(config service location source 1)>
```

7. Click **Access control list** to configure access control:

- To limit access to specified IPv4 addresses and networks:

```
(config)> add service location source 1 acl address end value
(config)>
```

Where *value* can be:

- A single IP address or host name.
- A network designation in CIDR notation, for example, 192.168.1.0/24.
- **any**: No limit to IPv4 addresses that can access the location server UDP port.

Repeat this step to list additional IP addresses or networks.

- To limit access to specified IPv6 addresses and networks:

---

```
(config)> add service location source 1 acl address6 end value
(config)>
```

---

Where *value* can be:

- A single IP address or host name.
- A network designation in CIDR notation, for example, 2001:db8::/48.
- **any**: No limit to IPv6 addresses that can access the location server UDP port.

Repeat this step to list additional IP addresses or networks.

- To limit access to hosts connected through a specified interface on the EX15 device:

---

```
(config)> add service location source 1 acl interface end value
(config)>
```

---

Where *value* is an interface defined on your device.

Display a list of available interfaces:

Use ... **network interface ?** to display interface information:

Repeat this step to list additional interfaces.

- To limit access based on firewall zones:

---

```
(config)> add service location source 1 acl zone end value
```

---

Where *value* is a firewall zone defined on your device, or the **any** keyword.

Display a list of available firewall zones:

Type ... **firewall zone ?** at the config prompt:

---

```
(config)> ... firewall zone ?
```

---

Zones: A list of groups of network interfaces that can be referred to by packet filtering rules and access control lists.

Additional Configuration

---

```
any
dynamic_routes
edge
external
internal
ipsec
```

---

---

```
loopback
setup

(config)>
```

---

Repeat this step to list additional firewall zones.

8. Save the configuration and apply the change:

---

```
(config)> save
Configuration saved.
>
```

---

2. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Forward location information to a remote host

You can configure location clients on the EX15 device that forward location messages in either NMEA or TAIP format to a remote host.

### Required configuration items

- Enable the location service.
- The hostname or IP address of the remote host to which the location messages will be forwarded.
- The communication protocol, either TCP or UDP.
- The destination port on the remote host to which the messages will be forwarded.
- Message protocol type of the messages being forwarded, either NMEA or TAIP.

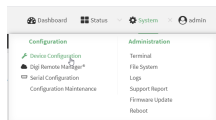
### Additional configuration items

- Additional remote hosts to which the location messages will be forwarded.
- Location update interval, which determines how often the device will forward location information to the remote hosts.
- A description of the remote hosts.
- Specific types of NMEA or TAIP messages that should be forwarded.
- Text that will be prepended to the forwarded message.
- A vehicle ID that is used in the TAIP ID message and can also be prepended to the forwarded message.

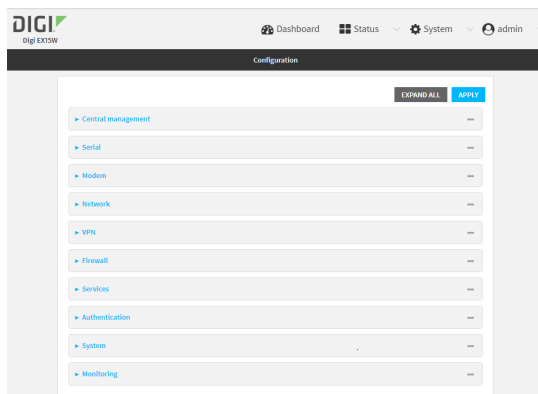
Configure the EX15 device to forward location information:



1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.



3. Click **Services > Location > Destination servers**.
4. For **Add destination server**, click **+**.
5. (Optional) For **Label**, type a description of the location destination server.
6. For **Destination server**, enter the hostname or IP address of the remote host to which location messages will be sent.
7. For **Destination server port**, enter the UDP or TCP port on the remote host to which location messages will be sent.
8. For **Communication protocol**, select either **UDP** or **TCP**.
9. For **Forward interval multiplier**, select the number of **Location update intervals** to wait before forwarding location data to this server. See [Configure the location service](#) for more information about setting the **Location update interval**.
10. For **NMEA filters**, select the filters that represent the types of messages that will be forwarded. By default, all message types are forwarded.
  - To remove a filter:
    - a. Click the down arrow (▼) next to the appropriate message type.
    - b. Click **Delete**.
  - To add a message type:
    - a. For **Add NMEA filter** or **Add TAIP filter**, click **+**.
    - b. Select the filter type. Allowed values are:
      - **GGA**: Reports time, position, and fix related data.
      - **GLL**: Reports position data: position fix, time of position fix, and status.
      - **GSA**: Reports GPS DOP and active satellites.
      - **GSV**: Reports the number of SVs in view, PRN, elevation, azimuth, and SNR.

- **RMC**: Reports position, velocity, and time.
  - **VTG**: Reports direction and speed over ground.
11. For **TAIP filters**, select the filters that represent the types of messages that will be forwarded. By default, all message types are forwarded.
    - To remove a filter:
      - a. Click the down arrow (▼) next to the appropriate message type.
      - b. Click **Delete**.
    - To add a message type:
      - a. For **Add NMEA filter** or **Add TAIP filter**, click **+**.
      - b. Select the filter type. Allowed values are:
        - **AL**: Reports altitude and vertical velocity.
        - **CP**: Compact position: reports time, latitude, and longitude.
        - **ID**: Reports the vehicle ID.
        - **LN**: Long navigation: reports the latitude, longitude, and altitude, the horizontal and vertical speed, and heading.
        - **PV**: Position/velocity: reports the latitude, longitude, and heading.
  12. For **Outgoing message type**, select either NMEA or TAIP for the type of message that the device will forward to a remote host.
  13. (Optional) For **Prepend text**, enter text to prepend to the forwarded message. Two variables can be included in the prepended text:
    - **%s**: Includes the EX15 device's serial number in the prepended text.
    - **%v**: Includes the vehicle ID in the prepended text.

For example, to include both the device's serial number and vehicle ID in the prepend message, you can enter the following in the **Prepend** field:

---

```
__| %s | __| %v | __
```

---
  14. Type a four-digit alphanumeric **Vehicle ID** that will be included with to location messages. If no vehicle ID is configured, this setting defaults to 0000.
  15. Click **Apply** to save the configuration and apply the change.



## Command line

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the command line, type **config** to enter configuration mode:

---

```
> config
(config)>
```

---

3. Add a remote host to which location messages will be sent:

---

```
(config)> add service location forward end
(config service location forward 0)>
```

---

4. Set the hostname or IP address of the remote host to which location messages will be sent:

---

```
(config service location forward 0)> server host
(config service location forward 0)>
```

---

5. Set the communication protocol to either **udp** or **tcp**:

---

```
(config service location forward 0)> protocol protocol
(config service location forward 0)>
```

---

6. Set the TCP or UDP port on the remote host to which location messages will be sent:

---

```
(config service location forward 0)> server_port 8000
(config service location forward 0)>
```

---

7. Set the number of **Location update intervals** to wait before forwarding location data to this server. See [Configure the location service](#) for more information about setting the **Location update interval**.

---

```
(config service location forward 0)> interval_multiplier int
(config service location forward 0)>
```

---

8. Set the protocol type for the messages. Allowed values are **taip** or **nmea**; the default is **taip**:

---

```
(config service location forward 0)> type nmea
(config service location forward 0)>
```

---

9. (Optional) Set the text to prepend to the forwarded message. Two variables can be included in the prepended text:

- **%s**: Includes the EX15 device's serial number in the prepended text.
- **%v**: Includes the vehicle ID in the prepended text.

---

```
(config service location forward 0)> prepend __|s|__|v|__
(config service location forward 0)>
```

---

10. (Optional) Set the vehicle ID.

Allowed value is a four digit alphanumerical string (for example, 01A3 or 1234). If no vehicle ID is configured, this setting defaults to 0000.

---

```
(config service location forward 0)> vehicle-id 1234
(config service location forward 0)>
```

---

11. (Optional) Provide a description of the remote host:

---

```
(config service location forward 0)> label "Remote host 1"
(config service location forward 0)>
```

---

12. (Optional) Specify types of messages that will be forwarded. Allowed values vary depending on the message protocol type. By default, all message types are forwarded.

■ If the message protocol type is NMEA:

Allowed values are:

- **gga**: Reports time, position, and fix related data.
- **gll**: Reports position data: position fix, time of position fix, and status.
- **gsa**: Reports GPS DOP and active satellites.
- **gsv**: Reports the number of SVs in view, PRN, elevation, azimuth, and SNR.
- **rmc**: Reports position, velocity, and time.
- **vtg**: Reports direction and speed over ground.

To remove a message type:

- a. Use the **show** command to determine the index number of the message type to be deleted:

---

```
(config service location forward 0)> show filter_nmea
0 gga
1 gll
2 gsa
3 gsv
4 rmc
5 vtg
(config service location forward 0)>
```

---

- b. Use the index number to delete the message type. For example, to delete the **gsa** (index number 2) message type:

---

```
(config service location forward 0)> del filter_nmea 2
(config service location forward 0)>
```

---

To add a message type:

- a. Change to the **filter\_nmea** node:

---

```
(config service location forward 0)> filter_nmea
(config service location forward 0 filter_nmea)>
```

---

- b. Use the **add** command to add the message type. For example, to add the **gsa** message type:

---

```
(config service location forward 0 filter_nmea)> add gsa end
(config service location forward 0 filter_nmea)>
```

---

■ If the message protocol type is TAIP:

Allowed values are:

- **al**: Reports altitude and vertical velocity.
- **cp**: Compact position: reports time, latitude, and longitude.
- **id**: Reports the vehicle ID.
- **ln**: Long navigation: reports the latitude, longitude, and altitude, the horizontal and vertical speed, and heading.
- **pvt**: Position/velocity: reports the latitude, longitude, and heading.



To remove a message type:

- a. Use the **show** command to determine the index number of the message type to be deleted:

---

```
(config service location forward 0)> show filter_taip
0 al
1 cp
2 id
3 ln
4 pv
(config service location forward 0)>
```

---

- b. Use the index number to delete the message type. For example, to delete the **id** (index number 2) message type:

---

```
(config service location forward 0)> del filter_taip 2
(config service location forward 0)>
```

---

To add a message type:

- a. Change to the **filter\_taip** node:

---

```
(config service location forward 0)> filter_taip
(config service location forward 0 filter_taip)>
```

---

- b. Use the **add** command to add the message type. For example, to add the **id** message type:

---

```
(config service location forward 0 filter_taip)> add id end
(config service location forward 0 filter_taip)>
```

---

13. Save the configuration and apply the change:

---

```
(config)> save
Configuration saved.
>
```

---

14. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Configure geofencing

Geofencing is a mechanism to create a virtual perimeter that allows you configure your EX15 device to perform actions when entering or exiting the perimeter. For example, you can configure a device to factory default if its location service indicates that it has been moved outside of the geofence.

Multiple geofences can be defined for one device, allowing for a complex configuration in which different actions are taken depending on the physical location of the device.

### Required configuration items

- Location services must be enabled.
- The geofence must be enabled.
- The boundary type of the geofence, either circular or polygonal.
  - If boundary type is circular, the latitude and longitude of the center point of the circle, and the radius.
  - If boundary type is polygonal, the latitude and longitude of the polygon's vertices (a vertex is the point at which two sides of a polygon meet). Three vertices will create a triangular polygon; four will create a square, etc. Complex polygons can be defined.
- Actions that will be taken when the device's location triggers a geofence event. You can define actions for two types of events:
  - Actions taken when the device enters the boundary of the geofence, or is inside the boundary when the device boots.
  - Actions taken when the device exits the boundary of the geofence, or is outside the boundary when the device boots.

For each event type:

- Determine if the action(s) associated with the event type should be performed when the device boots inside or outside of the geofence boundary.
- The number of update intervals that should take place before the action(s) are taken.

Multiple actions can be configured for each type of event. For each action:

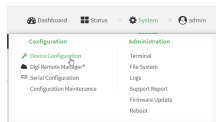
- The type of action, either a factory erase or executing a custom script.
- If a custom script is used:
  - The script that will be executed.
  - Whether to log output and errors from the script.
  - The maximum memory that the script will have available.
  - Whether the script should be executed within a sandbox that will prevent the script from affecting the system itself.

### Additional configuration items

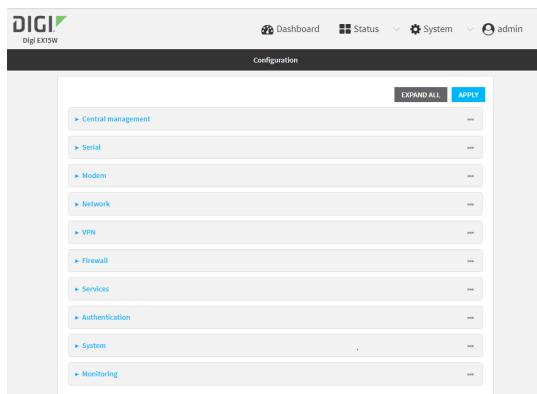
- Update interval, which determines the amount of time that the geofence should wait between polling for updated location data.



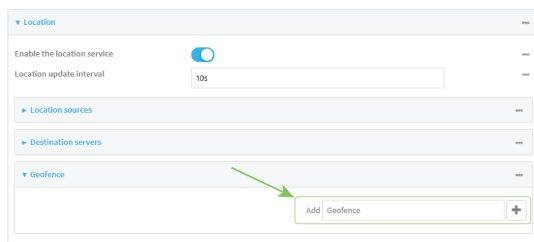
1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.



3. Click **Services > Location > Geofence**.
4. For **Add Geofence**, type a name for the geofence and click **+**.



The geofence is enabled by default. Click **Enable** to disable, or to enable if it has been disabled.

5. For **Update interval**, type the amount of time that the geofence should wait between polling for updated location data. The default is one minute.

Allowed values are any number of weeks, days, hours, minutes, or seconds, and take the format **number{w|d|h|m|s}**.

For example, to set **Update interval** to ten minutes, enter **10m** or **600s**.

6. For **Boundary type**, select the type of boundary that the geofence will have.
  - If **Circular** is selected:
    - a. Click to expand **Center**.
    - b. Type the **Latitude** and **Longitude** of the center point of the circle. Allowed values are:
      - For **Latitude**, any integer between **-90** and **90**, with up to six decimal places.
      - For **Longitude**, any integer between **-180** and **180**, with up to six decimal places.

- c. For **Radius**, type the radius of the circle. Allowed values are an integer followed by **m** or **km**, for example, **100m** or **1km**.
- If **Polygonal** is selected:
  - a. Click to expand **Coordinates**.
  - b. Click **+** to add a point that represents a vertex of the polygon. A vertex is the point at which two sides of a polygon meet.
  - c. Type the **Latitude** and **Longitude** of one of the vertices of the polygon. Allowed values are:
    - For **Latitude**, any integer between **-90** and **90**, with up to six decimal places.
    - For **Longitude**, any integer between **-180** and **180**, with up to six decimal places.
  - d. Click **+** again to add an additional point, and continue adding points to create the desired polygon.

For example, to configure a square polygon around the Digi headquarters, configure a polygon with four points:

The screenshot shows a configuration window for a 'Boundary type' set to 'Polygonal'. Under the 'Coordinates' section, four points are listed, each with 'Latitude' and 'Longitude' fields. The points are defined as follows:

| Point   | Latitude  | Longitude  |
|---------|-----------|------------|
| Point 1 | 44.927220 | -93.399200 |
| Point 2 | 44.927220 | -93.395800 |
| Point 3 | 44.928101 | -93.395800 |
| Point 4 | 44.928101 | -93.399200 |

An 'Add Point' button with a plus icon is located at the bottom right of the coordinates section.

This defines a square-shaped polygon equivalent to the following:



7. Define actions to be taken when the device's location triggers a geofence event:
  - To define actions that will be taken when the device enters the geofence, or is inside the geofence when it boots:

- a. Click to expand **On entry**.

- b. (Optional) Enable **Bootup action** to configure the device to perform the **On entry** actions if the device is inside the geofence when it boots.
- c. For **Number of intervals**, type or select the number of **Update Intervals** that must take place prior to performing the **On entry** actions.

For example, if the **Update interval** is **1m** (one minute) and the **Number of intervals** is **3**, the **On entry** actions will not be performed until the device has been inside the geofence for three minutes.

- d. Click to expand **Actions**.
- e. Click **+** to create a new action.

- f. For Action type, select either:
- **Factory erase** to erase the device configuration when the action is triggered.
  - **Custom script** to execute a custom script when the action is triggered.

If **Custom script** is selected:

- Click to expand **Custom script**.
  - For **Commands**, type the script that will be executed when the action is triggered. If the script begins with **#!**, then the proceeding file path will be used to invoke the script interpreter. If not, then the default shell will be used.
  - Enable **Log script output** to log the output of the script to the [system log](#).
  - Enable **Log script errors** to log errors from the script to the [system log](#).
  - (Optional) For **Maximum memory**, type the maximum amount of system memory that will be available for the script and its spawned processes.  
Allowed values are any integer followed by one of the following:  
**b|bytes|KB|k|MB|M|GB|G|TB|T**.  
For example. the allocate one megabyte of memory to the script and its spawned processes, type **1MB** or **1M**.
  - Sandbox** is enabled by default. This prevents the script from adversely affecting the system. If you disable **Sandbox**, the script may render the system unusable.
  - Repeat for any additional actions.
- To define actions that will be taken when the device exits the geofence, or is outside the geofence when it boots:

- a. Click to expand **On exit**.

- b. (Optional) Enable **Bootup action** to configure the device to perform the **On exit** actions if the device is inside the geofence when it boots.
- c. For **Number of intervals**, type or select the number of **Update Intervals** that must take place prior to performing the **On exit** actions.

For example, if the **Update interval** is **1m** (one minute) and the **Number of intervals** is **3**, the **On entry** actions will not be performed until the device has been inside the geofence for three minutes.

- d. Click to expand **Actions**.
- e. Click **+** to create a new action.

- f. For Action type, select either:
- **Factory erase** to erase the device configuration when the action is triggered.
  - **Custom script** to execute a custom script when the action is triggered.

If **Custom script** is selected:

- Click to expand **Custom script**.
  - For **Commands**, type the script that will be executed when the action is triggered. If the script begins with **#!**, then the proceeding file path will be used to invoke the script interpreter. If not, then the default shell will be used.
  - Enable **Log script output** to log the output of the script to the **system log**.
  - Enable **Log script errors** to log errors from the script to the **system log**.
  - (Optional) For **Maximum memory**, type the maximum amount of system memory that will be available for the script and its spawned processes.  
Allowed values are any integer followed by one of the following:  
**b|bytes|KB|k|MB|M|GB|G|TB|T**.  
For example. the allocate one megabyte of memory to the script and its spawned processes, type **1MB** or **1M**.
  - Sandbox** is enabled by default. This prevents the script from adversely affecting the system. If you disable **Sandbox**, the script may render the system unusable.
  - Repeat for any additional actions.
8. Click **Apply** to save the configuration and apply the change.



## Command line

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the command line, type **config** to enter configuration mode:

```
> config
(config)>
```

3. Add a geofence:

```
(config)> add service location geofence name
(config service location geofence name)>
```

where *name* is a name for the geofence. For example:

```
(config)> add service location geofence test_geofence
(config service location geofence test_geofence)>
```

The geofence is enabled by default. To disable:

```
(config service location geofence test_geofence)> enable false
(config service location geofence test_geofence)>
```

4. Set the amount of time that the geofence should wait between polling for updated location data:

```
(config service location geofence test_geofence)> update_interval value
(config service location geofence test_geofence)>
```

where *value* is any number of weeks, days, hours, minutes, or seconds, and takes the format **number{w|d|h|m|s}**.

For example, to set **update\_interval** to ten minutes, enter either **10m** or **600s**:

```
(config service location geofence test_geofence)> update_interval 600s
(config service location geofence test_geofence)>
```

The default is **1m** (one minute).

5. Set the boundary type for the geofence:

```
(config service location geofence test_geofence)> boundary value
(config service location geofence test_geofence)>
```

where *value* is either **circular** or **polygonal**.

■ If **boundary** is set to **circular** :

- a. Set the latitude and longitude of the center point of the circle:

---

```
(config service location geofence test_geofence)> center latitude
int
(config service location geofence test_geofence)> center longitude
int
(config service location geofence test_geofence)>
```

---

where *int* is:

- For **latitude**, any integer between **-90** and **90**, with up to six decimal places.
- For **longitude**, any integer between **-180** and **180**, with up to six decimal places.

- b. Set the radius of the circle:

---

```
(config service location geofence test_geofence)> radius radius
(config service location geofence test_geofence)>
```

---

where *radius* is an integer followed by **m** or **km**, for example, **100m** or **1km**.

■ If **boundary** is set to **polygonal**:

- a. Set the coordinates of one vertex of the polygon. A vertex is the point at which two sides of a polygon meet.

- i. Add a vertex:

---

```
(config service location geofence test_geofence)> add
coordinates end
(config service location geofence test_geofence coordinates
0)>
```

---

- ii. Set the latitude and longitude of the vertex:

---

```
(config service location geofence test_geofence coordinates
0)> latitude int
(config service location geofence test_geofence coordinates
0)> longitude int
(config service location geofence test_geofence coordinates
0)>
```

---

where *int* is:

- For **latitude**, any integer between **-90** and **90**, with up to six decimal places.
- For **longitude**, any integer between **-180** and **180**, with up to six decimal places.

- iii. Configure additional vortices:

---

```
(config service location geofence test_geofence coordinates
0)> ..
(config service location geofence test_geofence coordinates)>
```

---



---

```

add end
(config service location geofence test_geofence coordinates
1)> latitude int
(config service location geofence test_geofence coordinates
1)> longitude int
(config service location geofence test_geofence coordinates
1)>

```

---

where *int* is:

- For **latitude**, any integer between **-90** and **90**, with up to six decimal places.
- For **longitude**, any integer between **-180** and **180**, with up to six decimal places.

Repeat for each vortex of the polygon.

For example, to configure a square polygon around the Digi headquarters, configure a polygon with four points:

---

```

(config service location geofence test_geofence)> add
coordinates end
(config service location geofence test_geofence coordinates
0)> latitude 44.927220
(config service location geofence test_geofence coordinates
0)> longitude -93.399200
(config service location geofence test_geofence coordinates
0)> ..
(config service location geofence test_geofence coordinates)>
add end
(config service location geofence test_geofence coordinates
1)> latitude 44.927220
(config service location geofence test_geofence coordinates
1)> longitude -93.39589
(config service location geofence test_geofence coordinates
1)> ..
(config service location geofence test_geofence coordinates)>
add end
(config service location geofence test_geofence coordinates
2)> latitude 44.925161
(config service location geofence test_geofence coordinates
2)> longitude -93.39589
(config service location geofence test_geofence coordinates
2)> ..
(config service location geofence test_geofence coordinates)>
add end
(config service location geofence test_geofence coordinates
3)> latitude 44.925161
(config service location geofence test_geofence coordinates
3)> longitude -93.399200
(config service location geofence test_geofence coordinates

```

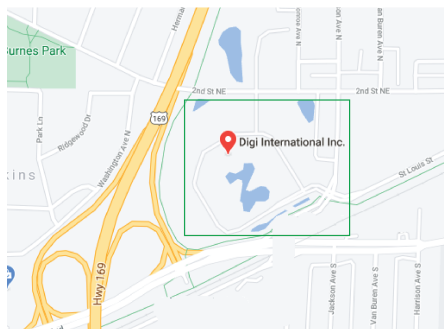
---

---

3)>

---

This defines a square-shaped polygon equivalent to the following:



6. Define actions to be taken when the device's location triggers a geofence event:
  - To define actions that will be taken when the device enters the geofence, or is inside the geofence when it boots:
    - a. (Optional) Configure the device to preform the actions if the device is inside the geofence when it boots:

---

```
(config)> service location geofence test_geofence on_entry bootup
true
(config)>
```

---

- b. Set the number of **update\_intervals** that must take place prior to performing the actions:

---

```
(config)> service location geofence test_geofence on_entry num_
intervals int
(config)>
```

---

For example, if the update interval is **1m** (one minute) and the **num\_intervals** is set to **3**, the actions will not be performed until the device has been inside the geofence for three minutes.

- c. Add an action:
      - i. Type ... to return to the root of the configuration:

---

```
(config service location geofence test_geofence coordinates
3)> ...
(config)>
```

---

- ii. Add the action:

---

```
(config)> add service location geofence test_geofence on_entry
action end
(config service location geofence test_geofence on_entry
action 0)>
```

---

## d. Set the type of action:

---

```
(config service location geofence test_geofence on_entry action
0)> type value
(config service location geofence test_geofence on_entry action
0)>
```

---

where *value* is either:

- **factory\_erase**—Erases the device configuration when the action is triggered.
- **script**—Executes a custom script when the action is triggered.

**factory\_erase** or **script**.

If **type** is set to **script**:

## i. Type or paste the script, closed in quote marks:

---

```
(config service location geofence test_geofence on_entry
action 0)> commands "script"
(config service location geofence test_geofence on_entry
action 0)>
```

---

If the script begins with **#!/**, then the proceeding file path will be used to invoke the script interpreter. If not, then the default shell will be used.

ii. To log the output of the script to the [system log](#):

---

```
(config service location geofence test_geofence on_entry
action 0)> syslog_stdout true
(config service location geofence test_geofence on_entry
action 0)>
```

---

iii. To log the errors from the script to the [system log](#):

---

```
(config service location geofence test_geofence on_entry
action 0)> syslog_stderr true
(config service location geofence test_geofence on_entry
action 0)>
```

---

## iv. (Optional) Set the maximum amount of system memory that will be available for the script and its spawned processes:

---

```
(config service location geofence test_geofence on_entry
action 0)> max_memory value
(config service location geofence test_geofence on_entry
action 0)>
```

---

where *value* is any integer followed by one of the following:

**b|bytes|KB|k|MB|M|GB|G|TB|T.**

For example, the allocate one megabyte of memory to the script and its spawned processes:

---

```
(config service location geofence test_geofence on_entry
action 0)> max_memory 1MB
(config service location geofence test_geofence on_entry
action 0)>
```

---

- v. A sandbox is enabled by default to prevent the script from adversely affecting the system. To disable the sandbox:

---

```
(config service location geofence test_geofence on_entry
action 0)> sandbox false
(config service location geofence test_geofence on_entry
action 0)>
```

---

If you disable the sandbox, the script may render the system unusable.

- vi. Repeat for any additional actions.
- To define actions that will be taken when the device exits the geofence, or is outside the geofence when it boots:
  - a. (Optional) Configure the device to preform the actions if the device is outside the geofence when it boots:

---

```
(config)> service location geofence test_geofence on_exit bootup
true
(config)>
```

---

- b. Set the number of [update\\_intervals](#) that must take place prior to performing the actions:

---

```
(config)> service location geofence test_geofence on_exit num_
intervals int
(config)>
```

---

For example, if the update interval is **1m** (one minute) and the **num\_intervals** is set to **3**, the actions will not be performed until the device has been outside the geofence for three minutes.

- c. Add an action:
  - i. Type **...** to return to the root of the configuration:

---

```
(config service location geofence test_geofence coordinates
3)> ...
(config)>
```

---

- ii. Add the action:

---

```
(config)> add service location geofence test_geofence on_exit
action end
(config service location geofence test_geofence on_exit action
0)>
```

---

- d. Set the type of action:

---

```
(config service location geofence test_geofence on_exit action 0)>
type value
(config service location geofence test_geofence on_exit action 0)>
```

---

where *value* is either:

- **factory\_erase**—Erases the device configuration when the action is triggered.
- **script**—Executes a custom script when the action is triggered.

**factory\_erase** or **script**.

If **type** is set to **script**:

- i. Type or paste the script, closed in quote marks:

---

```
(config service location geofence test_geofence on_exit action
0)> commands "script"
(config service location geofence test_geofence on_exit action
0)>
```

---

If the script begins with **#!**, then the proceeding file path will be used to invoke the script interpreter. If not, then the default shell will be used.

- ii. To log the output of the script to the [system log](#):

---

```
(config service location geofence test_geofence on_exit action
0)> syslog_stdout true
(config service location geofence test_geofence on_exit action
0)>
```

---

- iii. To log the errors from the script to the [system log](#):

---

```
(config service location geofence test_geofence on_exit action
0)> syslog_stderr true
(config service location geofence test_geofence on_exit action
0)>
```

---

- iv. (Optional) Set the maximum amount of system memory that will be available for the script and its spawned processes:

---

```
(config service location geofence test_geofence on_exit action
0)> max_memory value
(config service location geofence test_geofence on_exit action
0)>
```

---

where *value* is any integer followed by one of the following:

**b|bytes|KB|k|MB|M|GB|G|TB|T.**

For example, the allocate one megabyte of memory to the script and its spawned processes:

---

```
(config service location geofence test_geofence on_exit action
0)> max_memory 1MB
```

---

---

```
(config service location geofence test_geofence on_exit action
0)>
```

---

- v. A sandbox is enabled by default to prevent the script from adversely affecting the system. To disable the sandbox:

---

```
(config service location geofence test_geofence on_exit action
0)> sandbox false
(config service location geofence test_geofence on_exit action
0)>
```

---

If you disable the sandbox, the script may render the system unusable.

- vi. Repeat for any additional actions.

7. Save the configuration and apply the change:

---

```
(config)> save
Configuration saved.
>
```

---

8. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Show location information

You can view status and statistics about location information from either the WebUI or the command line.

### WebUI

1. Log into the EX15 WebUI as a user with Admin access.
2. At the **Status** page, click **Location**.  
The device's current location is displayed, along with the status of any configured geofences.

### Command line

#### Show location information

1. Log into the EX15 command line as a user with Admin access.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. Use the [show location](#) command at the system prompt:

---

```
> show location

Location Status

State : enabled
Source : 192.168.2.3
```

---

```
Latitude : 44* 55' 14.809" N (44.92078)
Longitude : 93* 24' 47.262" w (-93.413128)
Altitude : 279 meters
Velocity : 0 meters per second
Direction : None
Quality : Standard GNSS (2D/3D)
UTC Date and Time : Fri, 26 Feb 2021 8:04:23 03
No. of Satelllites : 7

>
```

- 3. Type **exit** to exit the Admin CLI.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

**Show geofence information**

- 1. Log into the EX15 command line as a user with Admin access.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
- 2. Use the `show location geofence` command at the system prompt:

```
> show location geofence

Geofence Status State Transitions Last Transition

test_geofence Up Inside 0

>
```

- 3. Type **exit** to exit the Admin CLI.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

**Modbus gateway**

The EX15 supports the ability to function as a Modbus gateway, to provide serial-to-Ethernet connectivity to Programmable Logic Controllers (PLCs), Remote Terminal Units (RTUs), and other industrial devices. MODBUS provides client/server communication between devices connected on different types of buses and networks, and the EX15 gateway allows for communication between buses and and networks that use the Modbus protocol.

This section contains the following topics:

|                                                 |     |
|-------------------------------------------------|-----|
| Configure the Modbus gateway .....              | 468 |
| Show Modbus gateway status and statistics ..... | 481 |

## Configure the Modbus gateway

### Required configuration items

- Server configuration:
  - Enable the server.
  - Connection type, either socket or serial.
    - If the connection type is socket, the IP protocol to be used.
    - If the connection type is serial, the serial port to be used.
- Client configuration:
  - Enable the client.
  - Connection type, either socket or serial.
    - If the connection type is socket:
      - The IP protocol to be used.
      - The hostname or IPv4 address of the remote host on which the Modbus server is running.
    - If the connection type is serial:
      - The serial port to be used.
  - Modbus address or addresses to determine if messages should be forwarded to a destination device.

### Additional configuration items

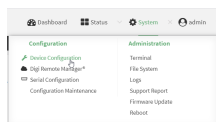
- Server configuration:
  - The packet mode.
  - The maximum time between bytes in a packet.
  - If the connection type is set to socket:
    - The port to use.
    - The inactivity timeout.
    - Access control list.
  - If the connection type is set to serial:
    - Whether to use half duplex (two wire) mode.
- Client configuration:
  - The packet mode.
  - The maximum time between bytes in a packets.
  - Whether to send broadcast messages.
  - Response timeout
  - If connection type is set to socket:
    - The port to use.
    - The inactivity timeout.
  - If connection type is set to serial:
    - Whether to use half duplex (two wire) mode.



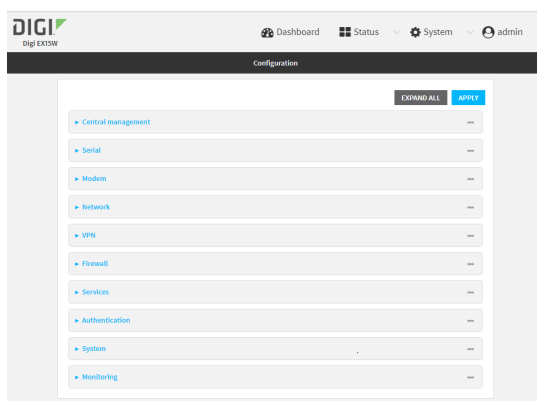
- Whether packets should be delivered to a fixed Modbus address.
- Whether packets should have their Modbus address adjusted downward before to delivery.

## WebUI

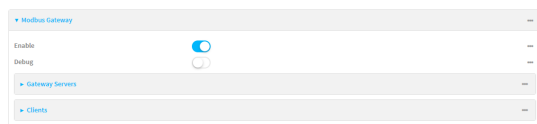
1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.



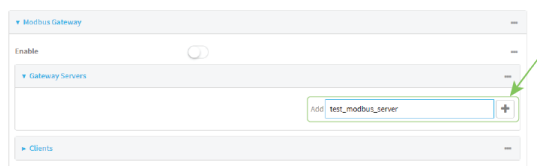
3. Click **Services > Modbus Gateway**.



4. Click **Enable** to enable the gateway.
5. Click **Debug** to allow verbose logging in the system log.

### Configure gateway servers

1. Click to expand **Gateway Servers**.
2. For **Add Modbus server**, type a name for the server and click **+**.



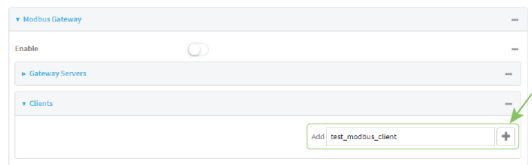
The new Modbus gateway server configuration is displayed.

3. The new Modbus gateway server is enabled by default. Toggle off **Enable the server** to disable.
4. For **Connection type**, select **Socket** or **Serial**. Available options in the gateway server configuration vary depending on this setting.
  - If **Socket** is selected for **Connection type**:
    - a. For **IP Protocol**, select **TCP** or **UDP**. The default is **TCP**.
    - b. For **Port**, enter or select an appropriate port. The default is port **502**.
  - If **Serial** is selected for **Connection type**:
    - a. For **Serial port**, select the appropriate serial port on the EX15 device.
5. For **Packet mode**, select **RTU** or **RAW** (if **Connection type** is set to **Socket**) or **ASCII** (if **Connection type** is set to **Serial**) for the type of packet that will be used by this connection. The default is **RTU**.
6. For **Packet idle gap**, type the maximum allowable time between bytes in a packet. Allowed values are between 10 milliseconds and one second, and take the format **number{ms|s}**.  
For example, to set **Packet idle gap** to 20 milliseconds, enter **20ms**.
7. If **Connection type** is set to **Socket**, for **Inactivity timeout**, type the amount of time to wait before disconnecting the socket when it has become inactive. Allowed values are any number of minutes or seconds up to a maximum of 15 minutes, and take the format **number{m|s}**.  
For example, to set **Inactivity timeout** to ten minutes, enter **10m** or **600s**.
8. (Optional) If **Connection type** is set to **Serial**, click **Half duplex** to enable half duplex (two wire) mode.
9. (Optional) If **Connection type** is set to **Socket**, click to expand **Access control list**:
  - To limit access to specified IPv4 addresses and networks:
    - a. Click **IPv4 Addresses**.
    - b. For **Add Address**, click **+**.
    - c. For **Address**, enter the IPv4 address or network that can access the device's web administration service. Allowed values are:
      - A single IP address or host name.
      - A network designation in CIDR notation, for example, 192.168.1.0/24.
      - **any**: No limit to IPv4 addresses that can access the web administration service.
    - d. Click **+** again to list additional IP addresses or networks.

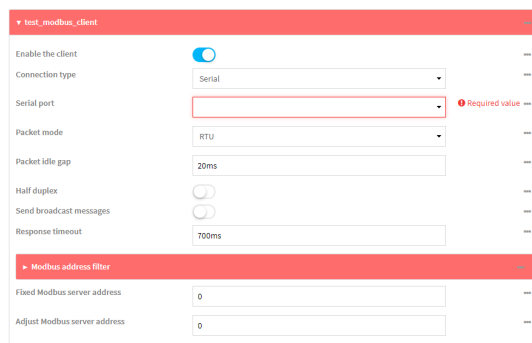
- To limit access to specified IPv6 addresses and networks:
    - a. Click **IPv6 Addresses**.
    - b. For **Add Address**, click **+**.
    - c. For **Address**, enter the IPv6 address or network that can access the device's web administration service. Allowed values are:
      - A single IP address or host name.
      - A network designation in CIDR notation, for example, 2001:db8::/48.
      - **any**: No limit to IPv6 addresses that can access the web administration service.
    - d. Click **+** again to list additional IP addresses or networks.
  - To limit access to hosts connected through a specified interface on the EX15 device:
    - a. Click **Interfaces**.
    - b. For **Add Interface**, click **+**.
    - c. For **Interface**, select the appropriate interface from the dropdown.
    - d. Click **+** again to allow access through additional interfaces.
  - To limit access based on firewall zones:
    - a. Click **Zones**.
    - b. For **Add Zone**, click **+**.
    - c. For **Zone**, select the appropriate firewall zone from the dropdown.  
See [Firewall configuration](#) for information about firewall zones.
    - d. Click **+** again to allow access through additional firewall zones.
10. Repeat these steps to configure additional servers.

## Configure clients

1. Click to expand **Clients**.
2. For **Add Modbus client**, type a name for the client and click **+**.



The new Modbus gateway client configuration is displayed.



3. The new Modbus gateway client is enabled by default. Toggle off **Enable the client** to disable.
4. For **Connection type**, select **Socket** or **Serial**. Available options in the gateway server configuration vary depending on this setting.
  - If **Socket** is selected for **Connection type**:
    - a. For **IP Protocol**, select **TCP** or **UDP**. The default is **TCP**.
    - b. For **Port**, enter or select an appropriate port. The default is port **502**.
    - c. For **Remote host**, type the hostname or IP address of the remote host on which the Modbus server is running.
  - If **Serial** is selected for **Connection type**:
    - a. For **Serial port**, select the appropriate serial port on the EX15 device.
5. For **Packet mode**, select **RTU** or **RAW** (if **Connection type** is set to **Socket**) or **ASCII** (if **Connection type** is set to **Serial**) for the type of packet that will be used by this connection. The default is **RTU**.
6. For **Packet idle gap**, type the maximum allowable time between bytes in a packet. Allowed values are between 10 milliseconds and one second, and take the format **number{ms|s}**.  
For example, to set **Packet idle gap** to 20 milliseconds, enter **20ms**.
7. If **Connection type** is set to **Socket**, for **Inactivity timeout**, type the amount of time to wait before disconnecting the socket when it has become inactive.  
Allowed values are any number of minutes or seconds up to a maximum of 15 minutes, and take the format **number{m|s}**.  
For example, to set **Inactivity timeout** to ten minutes, enter **10m** or **600s**.
8. (Optional) If **Connection type** is set to **Serial**, click **Half duplex** to enable half duplex (two wire) mode.
9. (Optional) If **Connection type** is set to **Socket**, click to expand **Access control list**:
  - To limit access to specified IPv4 addresses and networks:
    - a. Click **IPv4 Addresses**.
    - b. For **Add Address**, click **+**.
    - c. For **Address**, enter the IPv4 address or network that can access the device's web administration service. Allowed values are:
      - A single IP address or host name.
      - A network designation in CIDR notation, for example, 192.168.1.0/24.
      - **any**: No limit to IPv4 addresses that can access the web administration service.
    - d. Click **+** again to list additional IP addresses or networks.
  - To limit access to specified IPv6 addresses and networks:
    - a. Click **IPv6 Addresses**.
    - b. For **Add Address**, click **+**.
    - c. For **Address**, enter the IPv6 address or network that can access the device's web administration service. Allowed values are:
      - A single IP address or host name.
      - A network designation in CIDR notation, for example, 2001:db8::/48.

- **any**: No limit to IPv6 addresses that can access the web administration service.
- d. Click **+** again to list additional IP addresses or networks.
    - To limit access to hosts connected through a specified interface on the EX15 device:
      - a. Click **Interfaces**.
      - b. For **Add Interface**, click **+**.
      - c. For **Interface**, select the appropriate interface from the dropdown.
      - d. Click **+** again to allow access through additional interfaces.
    - To limit access based on firewall zones:
      - a. Click **Zones**.
      - b. For **Add Zone**, click **+**.
      - c. For **Zone**, select the appropriate firewall zone from the dropdown.  
See [Firewall configuration](#) for information about firewall zones.
      - d. Click **+** again to allow access through additional firewall zones.
  10. (Optional) Enable **Send broadcast messages** to configure the gateway to send broadcast messages to this client.
  11. For **Response timeout**, type the maximum time to wait for a response to a message.  
Allowed values are between 1 millisecond and 700 milliseconds, and take the format **numberms**.  
For example, to set **Response timeout** to 100 milliseconds, enter **100ms**. The default is **700ms**.
  12. Click to expand **Modbus address filter**.  
This filter is used by the gateway to determine if a message should be forwarded to a destination device. If the Modbus address in the message matches one or more of the filters, the message is forwarded. If it does not match the filters, the message is not forwarded.
  13. For **Address or address range**, type a Modbus address or range of addresses. Allowed values are **1** through **255** or a hyphen-separated range.  
For example, to have this client filter for incoming messages that contain the Modbus address of 10, type **10**. To filter for all messages with addresses in the range of 20 to 30, type **20-30**.  
To add additional address filters for this client, click **+**.

The screenshot shows a configuration window titled 'Modbus address filter'. It contains a table with two rows of filters. The first row has the value '10' in the 'Address or address range' field. The second row has the value '20-30' in the same field. At the bottom right of the table, there is a '+' button with a green arrow pointing to it. Below the button, the text 'Add Address or address range' is visible.

14. For **Fixed Modbus server address**, if request messages handled by this client should always be forwarded to a specific device, type the device's Modbus address. Leave at the default setting of **0** to allow messages that match the **Modbus address filter** to be forwarded to devices based on the Modbus address in the message.
15. For **Adjust Modbus server address**, type a value to adjust the Modbus server address downward by the specified value prior to delivering the message. Allowed values are **0** through **255**. Leave at the default setting of **0** to not adjust the server address.  
If a packet contains a Modbus server address above the amount entered here, the address will be adjusted downward by this amount before the packet is delivered. This allows you to configure clients on the gateway that will forward messages to remote devices with the same

Modbus address on different buses. For example, if there are two devices on two different buses that have the same Modbus address of 10, you can create two clients on the gateway:

- Client one:

- **Modbus address filter** set to **10**.

This will configure the gateway to deliver all messages that have the Modbus server address of 10 to this device.

- Client two:

- **Modbus address filter** set to **20**.
  - **Adjust Modbus server address** set to **10**.

This will configure the gateway to deliver all messages that have the Modbus server address address of 20 to the device with address 10.

16. Repeat these steps to configure additional clients.

17. Click **Apply** to save the configuration and apply the change.



## Command line

1. Log into the EX15 command line as a user with full Admin access rights.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.

2. At the command line, type **config** to enter configuration mode:

```
> config
(config)>
```

3. Enable the Modbus gateway:

```
(config)> service modbus_gateway enable true
(config)>
```

4. Configure servers:

a. Add a server:

```
(config)> add service modbus_gateway server name
(config service modbus_gateway server name)>
```

where *name* is a name for the server, for example:

```
(config)> add service modbus_gateway server test_modbus_server
(config service modbus_gateway server test_modbus_server)>
```

The Modbus server is enabled by default. To disable:

```
(config service modbus_gateway server test_modbus_server)> enable false
(config service modbus_gateway server test_modbus_server)>
```

- b. Set the connection type:

---

```
(config service modbus_gateway server test_modbus_server)> connection_
type type
(config service modbus_gateway server test_modbus_server)>
```

---

where *type* is either **socket** or **serial**. The default is **socket**.

- If **connection\_type** is set to **socket**:

- i. Set the IP protocol:

---

```
(config service modbus_gateway server test_modbus_server)>
socket protocol value
(config service modbus_gateway server test_modbus_server)>
```

---

where *value* is either **tcp** or **udp**.

- ii. Set the port:

---

```
(config service modbus_gateway server test_modbus_server)>
socket port
(config service modbus_gateway server test_modbus_server)>
```

---

where *port* is an integer between **1** and **65535**. The default is **502**.

- iii. Set the packet mode:

---

```
(config service modbus_gateway server test_modbus_server)>
socket packet_mode value
(config service modbus_gateway server test_modbus_server)>
```

---

where *value* is either **rtu** or **raw**. The default is **rtu**.

- iv. Set the maximum allowable time between bytes in a packet:

---

```
(config service modbus_gateway server test_modbus_server)>
socket idle_gap value
(config service modbus_gateway server test_modbus_server)>
```

---

where *value* is any number between 10 milliseconds and one second, and take the format **number{ms|s}**.

For example, to set *idle\_gap* to 20 milliseconds, enter **20ms**.

- v. Set the amount of time to wait before disconnecting the socket when it has become inactive:

---

```
(config service modbus_gateway server test_modbus_server)>
inactivity_timeout value
(config service modbus_gateway server test_modbus_server)>
```

---

where *value* is any number of minutes or seconds up to a maximum of 15 minutes, and takes the format **number{m|s}**.

For example, to set **inactivity\_timeout** to ten minutes, enter either **10m** or **600s**:

---

```
(config service modbus_gateway server test_modbus_server)>
inactivity_timeout 600s
(config service modbus_gateway server test_modbus_server)>
```

---

■ If **connection\_type** is set to **serial**:

i. Set the serial port:

i. Use the **?** to determine available serial ports:

---

```
(config service modbus_gateway server test_modbus_server)>
... serial port ?
```

Serial

Additional Configuration

-----

|       |        |
|-------|--------|
| port1 | Port 1 |
|-------|--------|

---

```
(config service modbus_gateway server test_modbus_server)>
```

---

ii. Set the port:

---

```
(config service modbus_gateway server test_modbus_server)>
serial port
(config service modbus_gateway server test_modbus_server)>
```

---

ii. Set the packet mode:

---

```
(config service modbus_gateway server test_modbus_server)>
serial packet_mode value
(config service modbus_gateway server test_modbus_server)>
```

---

where *value* is either **rtu** or **ascii**. The default is **rtu**.

iii. Set the maximum allowable time between bytes in a packet:

---

```
(config service modbus_gateway server test_modbus_server)>
serial idle_gap value
(config service modbus_gateway server test_modbus_server)>
```

---

where *value* is any number between 10 milliseconds and one second, and take the format **number{ms|s}**.

For example, to set *idle\_gap* to one second, enter **1000ms** or **1s**.

iv. (Optional) Enable half-duplex (two wire) mode:

---

```
(config service modbus_gateway server test_modbus_server)>
serial half_duplex true
(config service modbus_gateway server test_modbus_server)>
```

---

c. Repeat the above instructions for additional servers.



## 5. Configure clients:

- a. Type ... to return to the root of the configuration:

---

```
(config)> add service modbus_gateway server test_modbus_server)> ...
(config)>
```

---

- b. Add a client:

---

```
(config)> add service modbus_gateway client name
(config service modbus_gateway client name)>
```

---

where *name* is a name for the client, for example:

---

```
(config)> add service modbus_gateway client test_modbus_client
(config service modbus_gateway client test_modbus_client)>
```

---

The Modbus client is enabled by default. To disable:

---

```
(config service modbus_gateway client test_modbus_client)> enable false
(config service modbus_gateway client test_modbus_client)>
```

---

- c. Set the connection type:

---

```
(config service modbus_gateway client test_modbus_client)> connection_
type type
(config service modbus_gateway client test_modbus_client)>
```

---

where *type* is either **socket** or **serial**. The default is **socket**.

- If **connection\_type** is set to **socket**:

- i. Set the IP protocol:

---

```
(config service modbus_gateway client test_modbus_client)>
socket protocol value
(config service modbus_gateway client test_modbus_client)>
```

---

where *value* is either **tcp** or **udp**.

- ii. Set the port:

---

```
(config service modbus_gateway client test_modbus_client)>
socket port
(config service modbus_gateway client test_modbus_client)>
```

---

where *port* is an integer between **1** and **65535**. The default is **502**.

- iii. Set the packet mode:

---

```
(config service modbus_gateway client test_modbus_client)>
socket packet_mode value
(config service modbus_gateway client test_modbus_client)>
```

---

where *value* is either **rtu** or **ascii**. The default is **rtu**.

- iv. Set the maximum allowable time between bytes in a packet:

---

```
(config service modbus_gateway client test_modbus_client)>
socket idle_gap value
(config service modbus_gateway client test_modbus_client)>
```

---

where *value* is any number between 10 milliseconds and one second, and take the format **number{ms|s}**.

For example, to set *idle\_gap* to 20 milliseconds, enter **20ms**.

- v. Set the amount of time to wait before disconnecting the socket when it has become inactive:

---

```
(config service modbus_gateway client test_modbus_client)>
inactivity_timeout value
(config service modbus_gateway client test_modbus_client)>
```

---

where *value* is any number of minutes or seconds up to a maximum of 15 minutes, and takes the format **number{m|s}**.

For example, to set **inactivity\_timeout** to ten minutes, enter either **10m** or **600s**:

---

```
(config service modbus_gateway client test_modbus_client)>
inactivity_timeout 600s
(config service modbus_gateway client test_modbus_client)>
```

---

- vi. Set the hostname or IP address of the remote host on which the Modbus server is running:

---

```
(config service modbus_gateway client test_modbus_client)>
remote_host ip_address|hostname
(config service modbus_gateway client test_modbus_client)>
```

---

■ If **connection\_type** is set to **serial**:

- i. Set the serial port:

- i. Use the **?** to determine available serial ports:

---

```
(config service modbus_gateway client test_modbus_client)>
... serial port ?
```

Serial

Additional Configuration

-----

port1

Port 1

---

```
(config service modbus_gateway client test_modbus_client)>
```

---

## ii. Set the port:

---

```
(config service modbus_gateway client test_modbus_client)>
serial port
(config service modbus_gateway client test_modbus_client)>
```

---

## ii. Set the packet mode:

---

```
(config service modbus_gateway client test_modbus_client)>
serial packet_mode value
(config service modbus_gateway client test_modbus_client)>
```

---

where *value* is either **rtu** or **ascii**. The default is **rtu**.

## iii. Set the maximum allowable time between bytes in a packet:

---

```
(config service modbus_gateway client test_modbus_client)>
serial idle_gap value
(config service modbus_gateway client test_modbus_client)>
```

---

where *value* is any number between 10 milliseconds and one second, and take the format **number{ms|s}**.

For example, to set *idle\_gap* to one second, enter **1000ms** or **1s**.

## iv. (Optional) Enable half-duplex (two wire) mode:

---

```
(config service modbus_gateway client test_modbus_client)>
serial half_duplex true
(config service modbus_gateway client test_modbus_client)>
```

---

## d. (Optional) Enable the gateway to send broadcast messages to this client:

---

```
(config service modbus_gateway client test_modbus_client)> broadcast
true
(config service modbus_gateway client test_modbus_client)>
```

---

## e. Set the maximum time to wait for a response to a message:

---

```
(config service modbus_gateway client test_modbus_client)> response_
timeout value
(config service modbus_gateway client test_modbus_client)>
```

---

Allowed values are between 1 millisecond and 700 milliseconds, and take the format **numberms**.

For example, to set *response\_timeout* to 100 milliseconds:

---

```
(config service modbus_gateway client test_modbus_client)> response_
timeout 100ms
(config service modbus_gateway client test_modbus_client)>
```

---

The default is **700ms**.

## f. Configure the address filter:

This filter is used by the gateway to determine if a message should be forwarded to a destination device. If the Modbus address in the message matches one or more of the filters, the message is forwarded. If it does not match the filters, the message is not forwarded. Allowed values are **1** through **255** or a hyphen-separated range.

For example:

- To have this client filter for incoming messages that contain the Modbus address of 10, set the index **0** entry to **10**:

---

```
(config service modbus_gateway client test_modbus_client)> filter
0 10
(config service modbus_gateway client test_modbus_client)>
```

---

- To filter for all messages with addresses in the range of 20 to 30, set the index **0** entry to **20-30**:

---

```
(config service modbus_gateway client test_modbus_client)> filter
0 20-30
(config service modbus_gateway client test_modbus_client)>
```

---

To add additional filters, increment the index number. For example, to add an additional filter for addresses in the range of 50-100:

---

```
(config service modbus_gateway client test_modbus_client)> filter 1 50-
100
(config service modbus_gateway client test_modbus_client)>
```

---

g. If request messages handled by this client should always be forwarded to a specific device, use **fixed\_server\_address** to set the device's Modbus address:

---

```
(config service modbus_gateway client test_modbus_client)> fixed_server_
address value
(config service modbus_gateway client test_modbus_client)>
```

---

Leave at the default setting of **0** to allow messages that match the Modbus address filter to be forwarded to devices based on the Modbus address in the message.

h. To adjust the Modbus server address downward by the specified value prior to delivering the message, use **adjust\_server\_address**:

---

```
(config service modbus_gateway client test_modbus_client)> adjust_
server_address value
(config service modbus_gateway client test_modbus_client)>
```

---

where *value* is an integer from **0** to **255**. Leave at the default setting of **0** to not adjust the server address.

If a packet contains a Modbus server address above the amount entered here, the address will be adjusted downward by this amount before the packet is delivered. This allows you to configure clients on the gateway that will forward messages to remote devices with the same Modbus address on different buses. For example, if there are two devices on two

different buses that have the same Modbus address of 10, you can create two clients on the gateway:

- Client one:

- **filter** set to **10**.

This will configure the gateway to deliver all messages that have the Modbus server address of 10 to this device.

- Client two:

- **filter** set to **20**.
  - **adjust\_server\_address** set to **10**.

This will configure the gateway to deliver all messages that have the Modbus server address address of 20 to the device with address 10.

i. Repeat the above instructions for additional clients.

6. Save the configuration and apply the change:

---

```
(config)> save
Configuration saved.
>
```

---

7. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Show Modbus gateway status and statistics

You can view status and statistics about location information from either the WebUI or the command line.

### WebUI

1. Log into the EX15 WebUI as a user with Admin access.
2. On the menu, select **Status > Modbus Gateway**.

The **Modbus Gateway** page appears.

Statistics related to the Modbus gateway server are displayed. If the message **Server connections not available** is displayed, this indicates that there are no connected clients.

- To view information about Modbus gateway clients, click **Clients**.
- To view statistics that are common to both the clients and server, click **Common Statistics**.
- To view configuration details about the gateway, click the  (configuration) icon in the upper right of the gateway's status pane.

### Command line

1. Log into the EX15 command line as a user with Admin access.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.

2. Use the `show modbus-gateway` command at the system prompt:

---

```
> show modbus-gateway
```

| Server Connection | IP Address  | Port  | Uptime |
|-------------------|-------------|-------|--------|
| modbus_socket     | 10.45.1.139 | 49570 | 6      |
| modbus_socket     | 10.45.1.139 | 49568 | 13     |

| Client               | Uptime |
|----------------------|--------|
| modbus_socket_41     | 0      |
| modbus_socket_21     | 0      |
| modbus_serial_client | 428    |

```
>
```

---

If the message **Server connections not available** is displayed, this indicates that there are no connected clients.

3. Use the `show modbus-gateway verbose` command at the system prompt to display more information:

---

```
> show modbus-gateway verbose
```

| Client               | Uptime |
|----------------------|--------|
| modbus_socket_41     | 0      |
| modbus_socket_21     | 0      |
| modbus_serial_client | 506    |

Common Statistics

---

```
Configuration Updates : 1
Client Configuration Failure : 0
Server Configuration Failure : 0
Configuration Load Failure : 0
Incoming Connections : 4
Internal Error : 0
Resource Shortages : 0
```

Servers

---

```
modbus_socket
```

---

```
Client Lookup Errors : 0
Incoming Connections : 4
Packet Errors : 0
RX Broadcasts : 0
RX Requests : 12
TX Exceptions : 0
```

---

---

```

TX Responses : 12

Clients

modbus_socket_41

Address Translation Errors : 0
Connection Errors : 0
Packet Errors : 0
RX Responses : 4
RX Timeouts : 0
TX Broadcasts : 0
TX Requests : 4

modbus_socket_21

Address Translation Errors : 0
Connection Errors : 0
Packet Errors : 0
RX Responses : 4
RX Timeouts : 0
TX Broadcasts : 0
TX Requests : 4

modbus_serial_client

Address Translation Errors : 0
Connection Errors : 0
Packet Errors : 0
RX Responses : 4
RX Timeouts : 0
TX Broadcasts : 0
TX Requests : 4

>

```

---

4. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## System time

By default, the EX15 device synchronizes the system time by periodically connecting to the Digi NTP server, **time.devicecloud.com**. In this mode, the device queries the time server based on following events and schedule:

- At boot time.
- Once a day.

The default configuration has the system time zone set to UTC. No additional configuration is required for the system time if the default configuration is sufficient. However, you can change the default time zone and the default NTP server, as well as configuring additional NTP servers. If multiple servers are configured, a number of time samples are obtained from each of the servers and a subset of the NTP clock filter and selection algorithms are applied to select the best of these. See [Configure the system time](#) for details about changing the default configuration.

The EX15 device can also be configured to use Network Time Protocol (NTP). In this configuration, the device serves as an NTP server, providing NTP services to downstream devices. See [Network Time Protocol](#) for more information about NTP server support.

## Configure the system time

This procedure is optional.

The EX15 device's default system time configuration uses the Digi NTP server, **time.devicecloud.com**, and has the time zone set to **UTC**. You can change the default NTP server and the default time zone, as well as configuring additional NTP servers.

### Required Configuration Items

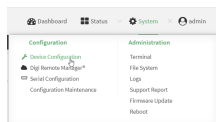
- The time zone for the EX15 device.
- At least one upstream NTP server for synchronization.

### Additional Configuration Options

- Additional upstream NTP servers.

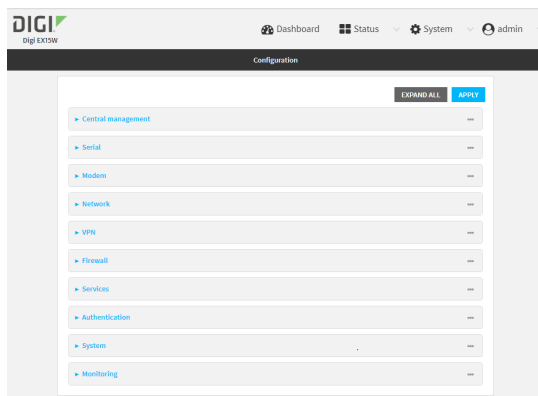
## WebUI

1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.





3. Click **System > Time**
4. (Optional) For **Timezone**, select either **UTC** or select the location nearest to your current location to set the timezone for your EX15 device. The default is **UTC**.
5. (Optional) Add upstream NTP servers that the device will use to synchronize its time. The default setting is **time.devicecloud.com**.
  - To change the default value of the NTP server:
    - a. Click **NTP servers**.
    - b. For **Server**, type a new server name.
  - To add an NTP server:
    - a. Click **NTP servers**.
    - b. For **Add Server**, click **+**.
    - c. For **Server**, enter the hostname of the upstream NTP server that the device will use to synchronize its time.
    - d. Click **+** to add additional NTP servers. If multiple servers are included, servers are tried in the order listed until one succeeds.

**Note** This list is synchronized with the list of servers included with NTP server configuration, and changes made to one will be reflected in the other. See [Configure the device as an NTP server](#) for more information about NTP server configuration.

6. Click **Apply** to save the configuration and apply the change.



## Command line

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.

2. At the command line, type **config** to enter configuration mode:

---

```
> config
(config)>
```

---

3. (Optional) Set the timezone for the location of your EX15 device. The default is **UTC**.

---

```
(config)> system time timezone value
(config)>
```

---

Where *value* is the timezone using the format specified with the following command:

---

```
(config)> system time timezone ?
```

---

Timezone: The timezone for the location of this device. This is used to adjust the time for log

messages. It also affects actions that occur at a specific time of day.

Format:

Africa/Abidjan

Africa/Accra

Africa/Addis\_Ababa

...

---

```
(config)>
```

---

4. (Optional) Add an upstream NTP server that the device will use to synchronize its time to the appropriate location in the list of NTP servers. The default setting is **time.devicecloud.com**.

- To delete the default NTP server, **time.devicecloud.com**:

---

```
(config)> del service ntp server 0
```

---

- To add the NTP server to the beginning of the list, use the index value of **0** to indicate that it should be added as the first server:

---

```
(config)> add service ntp server 0 time.server.com
(config)>
```

---

- To add the NTP server to the end of the list, use the index keyword **end**:

---

```
(config)> add service ntp server end time.server.com
(config)>
```

---

- To add the NTP server in another location in the list, use an index value to indicate the appropriate position. For example:

---

```
(config)> add service ntp server 1 time.server.com
(config)>
```

---

---

**Note** This list is synchronized with the list of servers included with NTP server configuration, and changes made to one will be reflected in the other. See [Configure the device as an NTP server](#) for more information about NTP server configuration.

---

5. Save the configuration and apply the change:

---

```
(config)> save
Configuration saved.
>
```

---

6. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Network Time Protocol

Network Time Protocol (NTP) enables devices connected on local and worldwide networks to synchronize their internal software and hardware clocks to the same time source. The EX15 device can be configured as an NTP server, allowing downstream hosts that are attached to the device's Local Area Networks to synchronize with the device.

When the device is configured as an NTP server, it also functions as an NTP client. The NTP client will be consistently synchronized with one or more upstream NTP servers, which means that NTP packets are transferred every few seconds. A minimum of one upstream NTP server is required. Additional NTP servers can be configured. If multiple servers are configured, a number of time samples are obtained from each of the servers and a subset of the NTP clock filter and selection algorithms are applied to select the best of these.

See [Configure the device as an NTP server](#) for information about configuring your device as an NTP server.

## Configure the device as an NTP server

### *Required Configuration Items*

- Enable the NTP service.
- At least one upstream NTP server for synchronization. The default setting is the Digi NTP server, **time.devicecloud.com**.

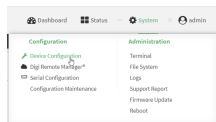
### *Additional Configuration Options*

- Additional upstream NTP servers.
- Access control list to limit downstream access to the EX15 device's NTP service.
- The time zone setting, if the default setting of UTC is not appropriate.

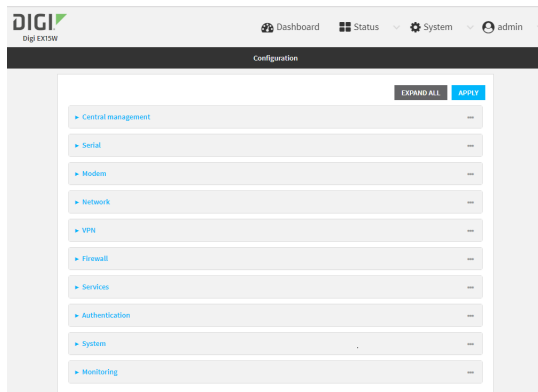
To configure the EX15 device's NTP service:



1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.



3. Click **Services > NTP**.
4. Enable the EX15 device's NTP service by clicking **Enable**.
5. (Optional) Configure the access control list to limit downstream access to the EX15 device's NTP service.
  - To limit access to specified IPv4 addresses and networks:
    - a. Click **IPv4 Addresses**.
    - b. For **Add Address**, click **+**.
    - c. For **Address**, enter the IPv4 address or network that can access the device's NTP service. Allowed values are:
      - A single IP address or host name.
      - A network designation in CIDR notation, for example, 192.168.1.0/24.
      - **any**: No limit to IPv4 addresses that can access the NTP service.
    - d. Click **+** again to list additional IP addresses or networks.
  - To limit access to specified IPv6 addresses and networks:
    - a. Click **IPv6 Addresses**.
    - b. For **Add Address**, click **+**.
    - c. For **Address**, enter the IPv6 address or network that can access the device's NTP service. Allowed values are:
      - A single IP address or host name.
      - A network designation in CIDR notation, for example, 2001:db8::/48.
      - **any**: No limit to IPv6 addresses that can access the NTP service.
    - d. Click **+** again to list additional IP addresses or networks.

- To limit access to hosts connected through a specified interface on the EX15 device:
  - a. Click **Interfaces**.
  - b. For **Add Interface**, click **+**.
  - c. For **Interface**, select the appropriate interface from the dropdown.
  - d. Click **+** again to allow access through additional interfaces.
- To limit access based on firewall zones:
  - a. Click **Zones**.
  - b. For **Add Zone**, click **+**.
  - c. For **Zone**, select the appropriate firewall zone from the dropdown.  
See [Firewall configuration](#) for information about firewall zones.
  - d. Click **+** again to allow access through additional firewall zones.

---

**Note** By default, the access control list for the NTP service is empty, which means that all downstream hosts connected to the EX15 device can use the NTP service.

---

6. (Optional) Add upstream NTP servers that the device will use to synchronize its time. The default setting is **time.devicecloud.com**.
  - To change the default value of the NTP server:
    - a. Click **NTP servers**.
    - b. For **Server**, type a new server name.
  - To add an NTP server:
    - a. Click **NTP servers**.
    - b. For **Add Server**, click **+**.
    - c. For **Server**, enter the hostname of the upstream NTP server that the device will use to synchronize its time.
    - d. Click **+** to add additional NTP servers. If multiple servers are included, servers are tried in the order listed until one succeeds.

---

**Note** This list is synchronized with the list of servers included with NTP client configuration, and changes made to one will be reflected in the other. See [Configure the system time](#) for more information about NTP client configuration.

---

7. (Optional) Configure the system time zone. The default is **UTC**.
  - a. Click **System > Time**
  - b. Select the **Timezone** for the location of your EX15 device.
8. Click **Apply** to save the configuration and apply the change.



## Command line

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.

2. At the command line, type **config** to enter configuration mode:

---

```
> config
(config)>
```

---

3. Enable the NTP service:

---

```
(config)> service ntp enable true
(config)>
```

---

4. (Optional) Add an upstream NTP server that the device will use to synchronize its time to the appropriate location in the list of NTP servers. The default setting is **time.devicecloud.com**.

- To delete the default NTP server, **time.devicecloud.com**:

---

```
(config)> del service ntp server 0
```

---

- To add the NTP server to the beginning of the list, use the index value of **0** to indicate that it should be added as the first server:

---

```
(config)> add service ntp server 0 time.server.com
(config)>
```

---

- To add the NTP server to the end of the list, use the index keyword **end**:

---

```
(config)> add service ntp server end time.server.com
(config)>
```

---

- To add the NTP server in another location in the list, use an index value to indicate the appropriate position. For example:

---

```
(config)> add service ntp server 1 time.server.com
(config)>
```

---

---

**Note** This list is synchronized with the list of servers included with NTP client configuration, and changes made to one will be reflected in the other. See [Configure the system time](#) for more information about NTP client configuration.

---

5. (Optional) Configure the access control list to limit downstream access to the EX15 device's NTP service.

- To limit access to specified IPv4 addresses and networks:

---

```
(config)> add service ntp acl address end value
(config)>
```

---

Where *value* can be:

- A single IP address or host name.
- A network designation in CIDR notation, for example, 192.168.1.0/24.
- **any**: No limit to IPv4 addresses that can access the NTP server agent.

Repeat this step to list additional IP addresses or networks.

- To limit access to specified IPv6 addresses and networks:

---

```
(config)> add service ntp acl address6 end value
(config)>
```

---

Where *value* can be:

- A single IP address or host name.
- A network designation in CIDR notation, for example, 2001:db8::/48.
- **any**: No limit to IPv6 addresses that can access the NTP server agent.

Repeat this step to list additional IP addresses or networks.

- To limit access to hosts connected through a specified interface on the EX15 device:

---

```
(config)> add service ntp acl interface end value
(config)>
```

---

Where *value* is an interface defined on your device.

Display a list of available interfaces:

Use **... network interface ?** to display interface information:

Repeat this step to list additional interfaces.

- To limit access based on firewall zones:

---

```
(config)> add service ntp acl zone end value
```

---

Where *value* is a firewall zone defined on your device, or the **any** keyword.

Display a list of available firewall zones:

Type **... firewall zone ?** at the config prompt:

---

```
(config)> ... firewall zone ?
```

Zones: A list of groups of network interfaces that can be referred to by packet filtering rules and access control lists.

Additional Configuration

---

```
any
dynamic_routes
edge
external
internal
ipsec
loopback
setup
```

---

---

```
(config)>
```

---

Repeat this step to list additional firewall zones.

---

**Note** By default, the access control list for the NTP service is empty, which means that all downstream hosts connected to the EX15 device can use the NTP service.

---

6. (Optional) Set the timezone for the location of your EX15 device. The default is **UTC**.

---

```
(config)> system time timezone value
(config)>
```

---

Where *value* is the timezone using the format specified with the following command:

---

```
(config)> system time timezone ?
```

---

Timezone: The timezone for the location of this device. This is used to adjust the time for log

messages. It also affects actions that occur at a specific time of day.

Format:

```
Africa/Abidjan
Africa/Accra
Africa/Addis_Ababa
...
```

---

```
(config)>
```

---

7. Save the configuration and apply the change:

---

```
(config)> save
Configuration saved.
>
```

---

8. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.



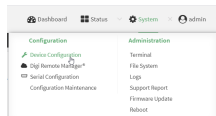
## Configure a multicast route

Multicast routing allows a device to transmit data to a single multicast address, which is then distributed to a group of devices that are configured to be members of that group.

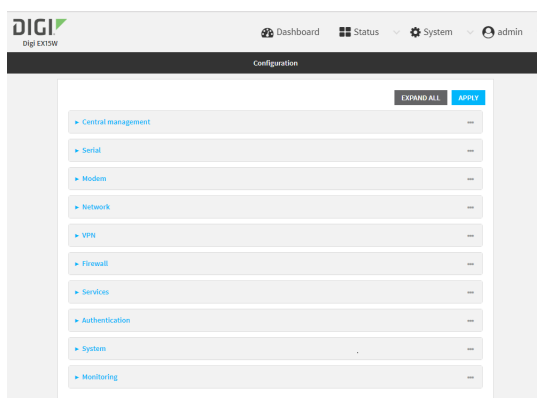
To configure a multicast route:

### WebUI

1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.



3. Click **Services > Multicast**.
4. For **Add Multicast route**, type a name for the route and click **+**.
5. The new route is enabled by default. To disable, uncheck **Enable**.
6. Type the **Source address** for the route. This must be a multicast IP address between 224.0.0.1 and 239.255.255.255.
7. Type the **Source port**. Ensure the port is not used by another protocol.
8. Select a **Source interface** where multicast packets will arrive.
9. Select a **Destination interface** that the EX15 device will use to send multicast packets.
10. Click **Apply** to save the configuration and apply the change.



### Command line

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.

2. At the command line, type **config** to enter configuration mode:

---

```
> config
(config)>
```

---

3. Add the multicast route. For example, to add a route named **test**:

---

```
(config)> add service multicast test
(config service multicast test)>
```

---

4. The multicast route is enabled by default. If it has been disabled, enable the route:

---

```
(config service multicast test)> enable true
(config service multicast test)>
```

---

5. Set the source address for the route. This must be a multicast IP address between 224.0.0.1 and 239.255.255.255.

---

```
(config service multicast test)> dst ip-address
(config service multicast test)>
```

---

6. Set the source port for the route. Ensure the port is not used by another protocol.

---

```
(config service multicast test)> port port
(config service multicast test)>
```

---

7. Set the source interface for the route where multicast packets will arrive:

- a. Use the **?** to determine available interfaces:

---

```
(config service multicast test)>src_interface ?
```

---

Source interface: Where the multicast packets will arrive. IP routes do not have an effect in the incoming stream.

Format:

```
/network/interface/defaultip
/network/interface/defaultlinklocal
/network/interface/lan
/network/interface/loopback
/network/interface/modem
/network/interface/wan
```

Current value:

---

```
(config service multicast test)> src_interface
```

---

- b. Set the interface. For example:

---

```
(config service multicast test)> src_interface /network/interface/wan
(config service multicast test)>
```

---

8. Set the destination interface that the EX15 device will use to send mutlicast packets.

---

```
(config service multicast test)> interface interface
(config service multicast test)>
```

---

- a. Use the **?** to determine available interfaces:

---

```
(config service multicast test)>interface ?
```

Destination interface: Which interface to send the multicast packets.

Format:

```
/network/interface/defaultip
/network/interface/defaultlinklocal
/network/interface/lan
/network/interface/loopback
/network/interface/modem
/network/interface/wan
```

Current value:

---

```
(config service multicast test)> interface
```

---

- b. Set the interface. For example:

---

```
(config service multicast test)> interface /network/interface/wan
(config service multicast test)>
```

---

9. Save the configuration and apply the change:

---

```
(config)> save
Configuration saved.
>
```

---

10. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Ethernet network bonding

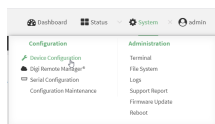
The EX15 device supports bonding mode for the Ethernet network. This allows you to configure the device so that Ethernet ports share one IP address. When both ports are being used, they act as one Ethernet network port.

### Required configuration items

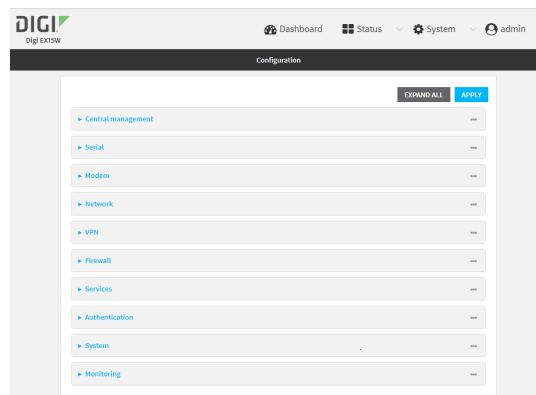
- Enable Ethernet bonding.
- The mode, either:
  - Active-backup. Provides fault tolerance.
  - Round-robin. Provides load balancing as well as fault tolerance.
- The Ethernet devices in the bonded pool.

### WebUI

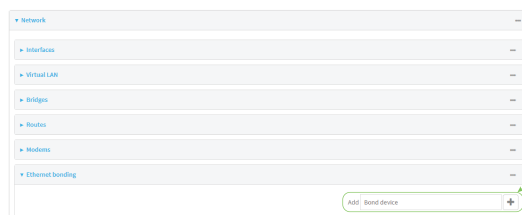
1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.

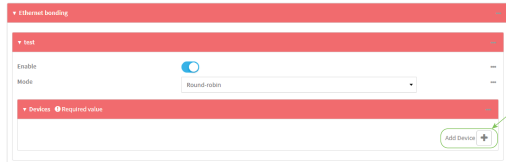


3. Click **Network > Ethernet bonding**.
4. For **Add Bond device**, click **+**



The bond device is enabled by default. To disable, click to toggle off **Enable**.

5. For **Mode**, selected either:
  - **Active-backup**: Transmits data on only one of the bonded devices at a time. When the active device fails, the next available device in the list is chosen. This mode provides for fault tolerance.
  - **Round-robin**: Alternates between bonded devices to provide load balancing as well as fault tolerance.
6. Click to expand **Devices**.
7. Add Ethernet devices:
  - a. For **Add device**, click **+**



- b. For **Device**, select an Ethernet device to participate in the bond pool.
  - c. Repeat for each appropriate Ethernet device.
8. Click **Apply** to save the configuration and apply the change.



## Command line

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the command line, type **config** to enter configuration mode:

```
> config
(config)>
```

3. Add a network bond:

```
(config)> add network bond name
(config network bond name)>
```

The new network bond is enabled by default. To disable:

```
(config network bond name)> enable false
(config network bond name)>
```

4. Set the mode:

```
(config network bond name)> mode value
(config network bond name)>
```

where value is either:

- **active-backup**: Transmits data on only one of the bonded devices at a time. When the active device fails, the next available device in the list is chosen. This mode provides for fault tolerance.
- **round-robin**: Alternates between bonded devices to provide load balancing as well as fault tolerance.

5. Add Ethernet devices:

- a. Use the **?** to determine available devices:

```
(config network bond name)> ... network device ?
```

```
Additional Configuration
```

```

```

```
lan
loopback
wan
```

```
(config network bond name)>
```

- b. Add a device:

```
(config network bond name)> add device /network/device/lan
(config network bond name)>
```

- c. Repeat to add additional devices.

6. Save the configuration and apply the change:

```
(config)> save
Configuration saved.
>
```

7. Type **exit** to exit the Admin CLI.

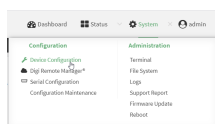
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Enable service discovery (mDNS)

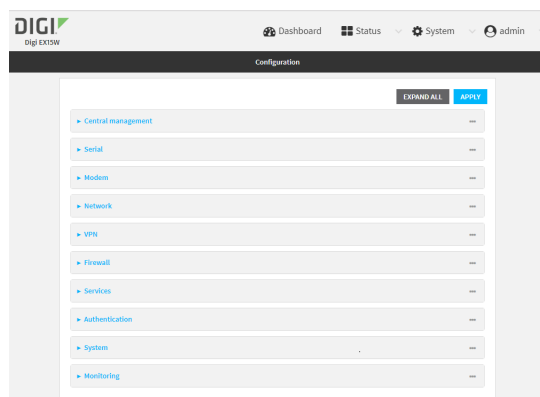
Multicast DNS mDNS is a protocol that resolves host names in small networks that do not have a DNS server. You can enable the EX15 device to use mDNS.

### WebUI

1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.



3. Click **Services > Service Discovery (mDNS)**.
4. **Enable** the mDNS service.
5. Click **Access control list** to configure access control:
  - To limit access to specified IPv4 addresses and networks:
    - a. Click **IPv4 Addresses**.
    - b. For **Add Address**, click **+**.
    - c. For **Address**, enter the IPv4 address or network that can access the device's mDNS service. Allowed values are:
      - A single IP address or host name.
      - A network designation in CIDR notation, for example, 192.168.1.0/24.
      - **any**: No limit to IPv4 addresses that can access the mDNS service.
    - d. Click **+** again to list additional IP addresses or networks.
  - To limit access to specified IPv6 addresses and networks:
    - a. Click **IPv6 Addresses**.
    - b. For **Add Address**, click **+**.
    - c. For **Address**, enter the IPv6 address or network that can access the device's mDNS service. Allowed values are:
      - A single IP address or host name.
      - A network designation in CIDR notation, for example, 2001:db8::/48.
      - **any**: No limit to IPv6 addresses that can access the mDNS service.
    - d. Click **+** again to list additional IP addresses or networks.
  - To limit access to hosts connected through a specified interface on the EX15 device:
    - a. Click **Interfaces**.
    - b. For **Add Interface**, click **+**.
    - c. For **Interface**, select the appropriate interface from the dropdown.
    - d. Click **+** again to allow access through additional interfaces.
  - To limit access based on firewall zones:
    - a. Click **Zones**.
    - b. For **Add Zone**, click **+**.

- c. For **Zone**, select the appropriate firewall zone from the dropdown.  
See [Firewall configuration](#) for information about firewall zones.
  - d. Click **+** again to allow access through additional firewall zones.
6. Click **Apply** to save the configuration and apply the change.



## Command line

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the command line, type **config** to enter configuration mode:

```
> config
(config)>
```

3. Enable the mDNS service:

```
(config)> service mdns enable true
(config)>
```

4. Configure access control:

- To limit access to specified IPv4 addresses and networks:

```
(config)> add service mdns acl address end value
(config)>
```

Where *value* can be:

- A single IP address or host name.
- A network designation in CIDR notation, for example, 192.168.1.0/24.
- **any**: No limit to IPv4 addresses that can access the mDNS service.

Repeat this step to list additional IP addresses or networks.

- To limit access to specified IPv6 addresses and networks:

```
(config)> add service mdns acl address6 end value
(config)>
```

Where *value* can be:

- A single IP address or host name.
- A network designation in CIDR notation, for example, 2001:db8::/48.
- **any**: No limit to IPv6 addresses that can access the mDNS service.

Repeat this step to list additional IP addresses or networks.



- To limit access to hosts connected through a specified interface on the EX15 device:

---

```
(config)> add service mdns acl interface end value
(config)>
```

---

Where *value* is an interface defined on your device.

Display a list of available interfaces:

Use ... **network interface ?** to display interface information:

Repeat this step to list additional interfaces.

- To limit access based on firewall zones:

---

```
(config)> add service mdns acl zone end value
```

---

Where *value* is a firewall zone defined on your device, or the **any** keyword.

Display a list of available firewall zones:

Type ... **firewall zone ?** at the config prompt:

---

```
(config)> ... firewall zone ?
```

---

Zones: A list of groups of network interfaces that can be referred to by packet filtering rules and access control lists.

Additional Configuration

-----

```
any
dynamic_routes
edge
external
internal
ipsec
loopback
setup
```

```
(config)>
```

---

Repeat this step to list additional firewall zones.

5. Save the configuration and apply the change:

---

```
(config)> save
Configuration saved.
>
```

---

6. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Use the iPerf service

Your EX15 device includes an iPerf3 server that you can use to test the performance of your network.

iPerf3 is a command-line tool that measures the maximum network throughput an interface can handle. This is useful when diagnosing network speed issues, to determine, for example, whether a cellular connection is providing expected throughput.

The EX15 implementation of iPerf3 supports testing with both TCP and UDP.

---

**Note** Using iPerf clients that are at a version earlier than iPerf3 to connect to the EX15 device's iPerf3 server may result in unpredictable results. As a result, Digi recommends using an iPerf client at version 3 or newer to connect to the EX15 device's iPerf3 server.

---

### **Required configuration items**

- Enable the iPerf server on the EX15 device.
- An iPerf3 client installed on a remote host. iPerf3 software can be downloaded at <https://iperf.fr/iperf-download.php>.

### **Additional configuration Items**

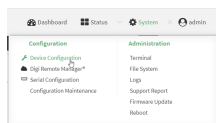
- The port that the EX15 device's iPerf server will use to listen for incoming connections.
- The access control list for the iPerf server.

When the iPerf server is enabled, the EX15 device will automatically configure its firewall rules to allow incoming connections on the configured listening port. You can restrict access by configuring the access control list for the iPerf server.

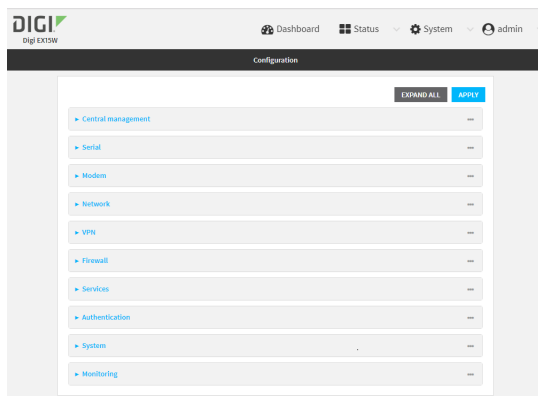
To enable the iPerf3 server:

## WebUI

1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.



3. Click **Services > iPerf**.
4. Click **Enable**.
5. (Optional) For **iPerf Server Port**, type the appropriate port number for the iPerf server listening port.
6. (Optional) Click to expand **Access control list** to restrict access to the iPerf server:
  - To limit access to specified IPv4 addresses and networks:
    - a. Click **IPv4 Addresses**.
    - b. For **Add Address**, click **+**.
    - c. For **Address**, enter the IPv4 address or network that can access the device's iPerf service. Allowed values are:
      - A single IP address or host name.
      - A network designation in CIDR notation, for example, 192.168.1.0/24.
      - **any**: No limit to IPv4 addresses that can access the iPerf service.
    - d. Click **+** again to list additional IP addresses or networks.
  - To limit access to specified IPv6 addresses and networks:
    - a. Click **IPv6 Addresses**.
    - b. For **Add Address**, click **+**.
    - c. For **Address**, enter the IPv6 address or network that can access the device's iPerf service. Allowed values are:

- A single IP address or host name.
  - A network designation in CIDR notation, for example, 2001:db8::/48.
  - **any**: No limit to IPv6 addresses that can access the iperf service.
- d. Click **+** again to list additional IP addresses or networks.
- To limit access to hosts connected through a specified interface on the EX15 device:
    - a. Click **Interfaces**.
    - b. For **Add Interface**, click **+**.
    - c. For **Interface**, select the appropriate interface from the dropdown.
    - d. Click **+** again to allow access through additional interfaces.
  - To limit access based on firewall zones:
    - a. Click **Zones**.
    - b. For **Add Zone**, click **+**.
    - c. For **Zone**, select the appropriate firewall zone from the dropdown.  
See [Firewall configuration](#) for information about firewall zones.
    - d. Click **+** again to allow access through additional firewall zones.
7. Click **Apply** to save the configuration and apply the change.



## Command line

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the command line, type **config** to enter configuration mode:
 

```
> config
(config)>
```
3. Enable the iPerf server:
 

```
(config)> service iperf enable true
(config)>
```
4. (Optional) Set the port number for the iPerf server listening port. The default is 5201.
 

```
(config)> service iperf port port_number
(config)>
```
5. (Optional) Set the access control list to restrict access to the iPerf server:
  - To limit access to specified IPv4 addresses and networks:
 

```
(config)> add service iperf acl address end value
(config)>
```

Where *value* can be:

- A single IP address or host name.
- A network designation in CIDR notation, for example, 192.168.1.0/24.
- **any**: No limit to IPv4 addresses that can access the service-type.

Repeat this step to list additional IP addresses or networks.

- To limit access to specified IPv6 addresses and networks:

---

```
(config)> add service iperf acl address6 end value
(config)>
```

---

Where *value* can be:

- A single IP address or host name.
- A network designation in CIDR notation, for example, 2001:db8::/48.
- **any**: No limit to IPv6 addresses that can access the service-type.

Repeat this step to list additional IP addresses or networks.

- To limit access to hosts connected through a specified interface on the EX15 device:

---

```
(config)> add service iperf acl interface end value
(config)>
```

---

Where *value* is an interface defined on your device.

Display a list of available interfaces:

Use ... **network interface ?** to display interface information:

Repeat this step to list additional interfaces.

- To limit access based on firewall zones:

---

```
(config)> add service iperf acl zone end value
```

---

Where *value* is a firewall zone defined on your device, or the **any** keyword.

Display a list of available firewall zones:

Type ... **firewall zone ?** at the config prompt:

---

```
(config)> ... firewall zone ?
```

---

Zones: A list of groups of network interfaces that can be referred to by packet filtering rules and access control lists.

Additional Configuration

```

any
dynamic_routes
edge
external

```

---

---

```

internal
ipsec
loopback
setup

```

---

```
(config)>
```

---

Repeat this step to list additional firewall zones.

6. Save the configuration and apply the change:

---

```

(config)> save
Configuration saved.
>

```

---

7. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Example performance test using iPerf3

On a remote host with iPerf3 installed, enter the following command:

---

```
$ iperf3 -c device_ip
```

---

where *device\_ip* is the IP address of the EX15 device. For example:

---

```

$ iperf3 -c 192.168.2.1
Connecting to host 192.168.2.1, port 5201
[4] local 192.168.3.100 port 54934 connected to 192.168.1.1 port 5201
[ID] Interval Transfer Bandwidth Retr Cwnd
[4] 0.00-1.00 sec 26.7 MBytes 224 Mbits/sec 8 2.68 MBytes
[4] 1.00-2.00 sec 28.4 MBytes 238 Mbits/sec 29 1.39 MBytes
[4] 2.00-3.00 sec 29.8 MBytes 250 Mbits/sec 0 1.46 MBytes
[4] 3.00-4.00 sec 31.2 MBytes 262 Mbits/sec 0 1.52 MBytes
[4] 4.00-5.00 sec 32.1 MBytes 269 Mbits/sec 0 1.56 MBytes
[4] 5.00-6.00 sec 32.5 MBytes 273 Mbits/sec 0 1.58 MBytes
[4] 6.00-7.00 sec 33.9 MBytes 284 Mbits/sec 0 1.60 MBytes
[4] 7.00-8.00 sec 33.7 MBytes 282 Mbits/sec 0 1.60 MBytes
[4] 8.00-9.00 sec 33.5 MBytes 281 Mbits/sec 0 1.60 MBytes
[4] 9.00-10.00 sec 33.2 MBytes 279 Mbits/sec 0 1.60 MBytes
- - - - -
[ID] Interval Transfer Bandwidth Retr
[4] 0.00-10.00 sec 315 MBytes 264 Mbits/sec 37
[4] 0.00-10.00 sec 313 MBytes 262 Mbits/sec
 sender
 receiver

iperf Done.
$

```

---

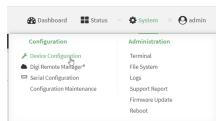
## Configure the ping responder service

Your EX15 device's ping responder service replies to ICMP and ICMPv6 echo requests. The service is enabled by default. You can disable the service, or you can configure the service to use an access control list to limit the service to specified IP address, interfaces, and/or zones.

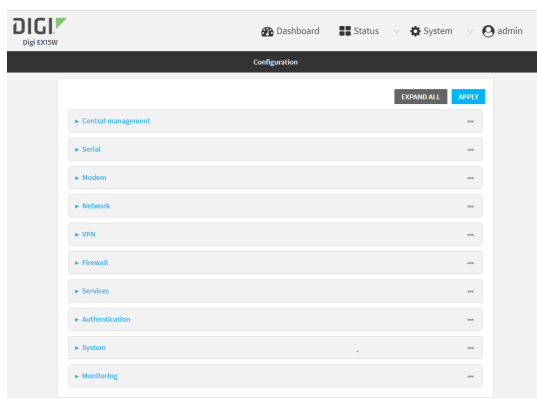
To enable the iPerf3 server:

## WebUI

1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.



3. Click **Services > Ping responder**.

The ping responder service is enabled by default. Click **Enable** to disable all ping responses.

4. Click to expand **Access control list** to restrict ping responses to specified IP address, interfaces, and/or zones:
  - To limit access to specified IPv4 addresses and networks:
    - a. Click **IPv4 Addresses**.
    - b. For **Add Address**, click **+**.
    - c. For **Address**, enter the IPv4 address or network that can access the device's ping responder. Allowed values are:
      - A single IP address or host name.
      - A network designation in CIDR notation, for example, 192.168.1.0/24.
      - **any**: No limit to IPv4 addresses that can access the ping responder.
    - d. Click **+** again to list additional IP addresses or networks.
  - To limit access to specified IPv6 addresses and networks:
    - a. Click **IPv6 Addresses**.
    - b. For **Add Address**, click **+**.
    - c. For **Address**, enter the IPv6 address or network that can access the device's ping responder. Allowed values are:
      - A single IP address or host name.
      - A network designation in CIDR notation, for example, 2001:db8::/48.

- **any**: No limit to IPv6 addresses that can access the ping responder.
- d. Click **+** again to list additional IP addresses or networks.
  - To limit access to hosts connected through a specified interface on the EX15 device:
    - a. Click **Interfaces**.
    - b. For **Add Interface**, click **+**.
    - c. For **Interface**, select the appropriate interface from the dropdown.
    - d. Click **+** again to allow access through additional interfaces.
  - To limit access based on firewall zones:
    - a. Click **Zones**.
    - b. For **Add Zone**, click **+**.
    - c. For **Zone**, select the appropriate firewall zone from the dropdown.  
See [Firewall configuration](#) for information about firewall zones.
    - d. Click **+** again to allow access through additional firewall zones.
- 5. Click **Apply** to save the configuration and apply the change.



## Command line

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the command line, type **config** to enter configuration mode:

```
> config
(config)>
```

3. Enable the iPerf server:

```
(config)> service iperf enable true
(config)>
```

4. (Optional) Set the port number for the iPerf server listening port. The default is 5201.

```
(config)> service iperf port port_number
(config)>
```

5. (Optional) Set the access control list to restrict access to the iPerf server:

- To limit access to specified IPv4 addresses and networks:

```
(config)> add service iperf acl address end value
(config)>
```

Where *value* can be:



- A single IP address or host name.
- A network designation in CIDR notation, for example, 192.168.1.0/24.
- **any**: No limit to IPv4 addresses that can access the service-type.

Repeat this step to list additional IP addresses or networks.

- To limit access to specified IPv6 addresses and networks:

---

```
(config)> add service iperf acl address6 end value
(config)>
```

---

Where *value* can be:

- A single IP address or host name.
- A network designation in CIDR notation, for example, 2001:db8::/48.
- **any**: No limit to IPv6 addresses that can access the service-type.

Repeat this step to list additional IP addresses or networks.

- To limit access to hosts connected through a specified interface on the EX15 device:

---

```
(config)> add service iperf acl interface end value
(config)>
```

---

Where *value* is an interface defined on your device.

Display a list of available interfaces:

Use ... **network interface ?** to display interface information:

Repeat this step to list additional interfaces.

- To limit access based on firewall zones:

---

```
(config)> add service iperf acl zone end value
```

---

Where *value* is a firewall zone defined on your device, or the **any** keyword.

Display a list of available firewall zones:

Type ... **firewall zone ?** at the config prompt:

---

```
(config)> ... firewall zone ?
```

Zones: A list of groups of network interfaces that can be referred to by packet filtering rules and access control lists.

Additional Configuration

---

```
any
dynamic_routes
edge
external
internal
ipsec
```

---

---

```

loopback
setup

```

```

(config)>

```

---

Repeat this step to list additional firewall zones.

6. Save the configuration and apply the change:

---

```

(config)> save
Configuration saved.
>

```

---

7. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Example performance test using iPerf3

On a remote host with Iperf3 installed, enter the following command:

---

```

$ iperf3 -c device_ip

```

---

where *device\_ip* is the IP address of the EX15 device. For example:

---

```

$ iperf3 -c 192.168.2.1
Connecting to host 192.168.2.1, port 5201
[4] local 192.168.3.100 port 54934 connected to 192.168.1.1 port 5201
[ID] Interval Transfer Bandwidth Retr Cwnd
[4] 0.00-1.00 sec 26.7 MBytes 224 Mbits/sec 8 2.68 MBytes
[4] 1.00-2.00 sec 28.4 MBytes 238 Mbits/sec 29 1.39 MBytes
[4] 2.00-3.00 sec 29.8 MBytes 250 Mbits/sec 0 1.46 MBytes
[4] 3.00-4.00 sec 31.2 MBytes 262 Mbits/sec 0 1.52 MBytes
[4] 4.00-5.00 sec 32.1 MBytes 269 Mbits/sec 0 1.56 MBytes
[4] 5.00-6.00 sec 32.5 MBytes 273 Mbits/sec 0 1.58 MBytes
[4] 6.00-7.00 sec 33.9 MBytes 284 Mbits/sec 0 1.60 MBytes
[4] 7.00-8.00 sec 33.7 MBytes 282 Mbits/sec 0 1.60 MBytes
[4] 8.00-9.00 sec 33.5 MBytes 281 Mbits/sec 0 1.60 MBytes
[4] 9.00-10.00 sec 33.2 MBytes 279 Mbits/sec 0 1.60 MBytes
- - - - -
[ID] Interval Transfer Bandwidth Retr
[4] 0.00-10.00 sec 315 MBytes 264 Mbits/sec 37
[4] 0.00-10.00 sec 313 MBytes 262 Mbits/sec
 sender
 receiver

iperf Done.
$

```

---

## Applications

---

The EX15 supports Python 3.6 and provides you with the ability to run Python applications on the device interactively or from a file. You can also specify Python applications and other scripts to be run each time the device system restarts, at specific intervals, or at a specified time.

This chapter contains the following topics:

|                                                           |     |
|-----------------------------------------------------------|-----|
| Configure applications to run automatically .....         | 512 |
| Run a Python application at the shell prompt .....        | 518 |
| Start an interactive Python session .....                 | 520 |
| Digidevice module .....                                   | 522 |
| Use Python to access serial ports .....                   | 548 |
| Use the Paho MQTT python library .....                    | 549 |
| Use the local REST API to configure the EX15 device ..... | 552 |
| Stop a script that is currently running .....             | 556 |
| Show script information .....                             | 556 |

## Configure applications to run automatically

You can configure an application to run automatically when the system restarts, at specific intervals, or at a specified time. By default, scripts execute in a "sandbox," which restricts access to the file system and available commands that can be used by the script.

### Required configuration items

- Upload or create the Python application.
- Enable the Python application to be run automatically.
- Select whether the application should run:
  - When the device boots.
  - At a specified time.
  - At a specified interval.
  - During system maintenance.

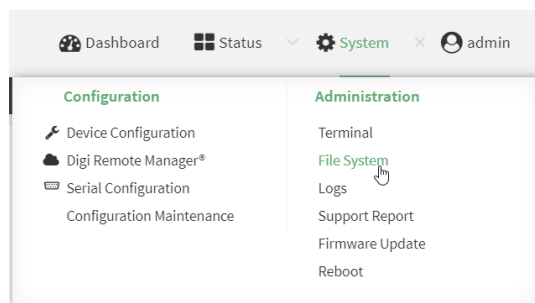
### Additional configuration items

- A label used to identify the application.
- The action to take if the Python application finishes. The actions that can be taken are:
  - None.
  - Restart the script.
  - Reboot the device.
- The arguments for the Python application.
- Whether to write the application output and errors to the system log.
- The memory available to be used by the application.
- Whether the script should run one time only.

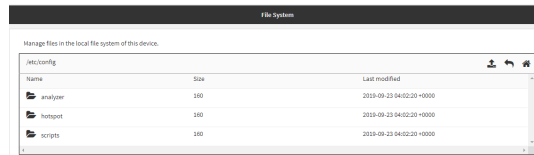
## Task one: Upload the application

### WebUI

1. Log into the EX15 WebUI as a user with Admin access.
2. On the menu, click **System**. Under **Administration**, click **File System**.



The **File System** page appears.



3. Highlight the **scripts** directory and click to open the directory.
4. Click (upload).
5. Browse to the location of the script on your local machine. Select the file and click **Open** to upload the file.

The uploaded file is uploaded to the **/etc/config/scripts** directory.

## Command line

1. Log into the EX15 command line as a user with Admin access.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the command line, use the **scp** command to upload the Python application script to the EX15 device:

---

```
> scp host hostname-or-ip user username remote remote-path local local-path
to local
```

---

where:

- **hostname-or-ip** is the hostname or ip address of the remote host.
- **username** is the name of the user on the remote host.
- **remote-path** is the path and filename of the file on the remote host that will be copied to the EX15 device.
- **local-path** is the location on the EX15 device where the copied file will be placed.

For example:

To upload a Python application from a remote host with an IP address of 192.168.4.1 to the **/etc/config/scripts** directory on the EX15 device, issue the following command:

---

```
> scp host 192.168.4.1 user admin remote /home/admin/bin/test.py local
/etc/config/scripts/ to local
admin@192.168.4.1's password: adminpwd
test.py 100% 36MB 11.1MB/s 00:03
>
```

---

3. Type **exit** to exit the Admin CLI.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

---

**Note** You can also create Python applications by using the **vi** command when logged in with shell access.

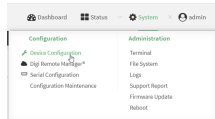
---

## Task two: Configure the application to run automatically

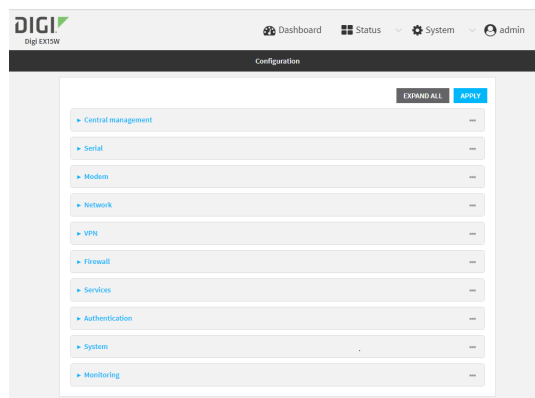
**Note** This feature does not provide syntax or error checking. Certain commands can render the device inoperable. Use with care.

### WebUI

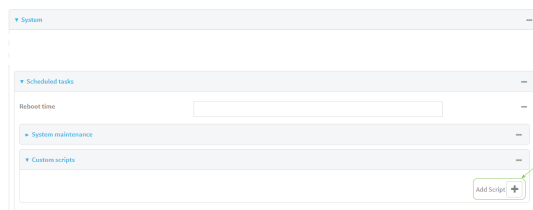
1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



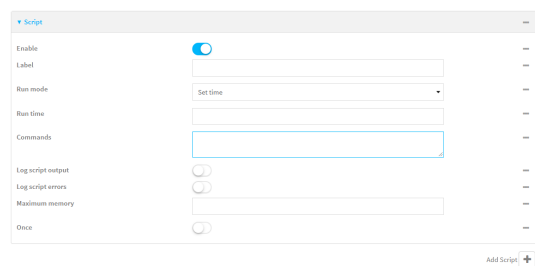
The **Configuration** window is displayed.



3. Click **System** > **Scheduled tasks** > **Custom scripts**.
4. For **Add Script**, click **+**.



The schedule script configuration window is displayed.



Scheduled scripts are enabled by default. To disable, click **Enable** to toggle off.

5. (Optional) For **Label**, provide a label for the script.
6. For **Run mode**, select the mode that will be used to run the script. Available options are:
  - **On boot**: The script will run once each time the device boots.
    - If **On boot** is selected, select the action that will be taken when the script completes in **Exit action**. Available options are:
      - **None**: Action taken when the script exits.
      - **Restart script**: Runs the script repeatedly.
      - **Reboot**: The device will reboot when the script completes.
  - **Interval**: The script will start running at the specified interval, within 30 seconds after the configuration change is saved.
    - If **Interval** is selected, in **Interval**, type the interval.  
 Allowed values are any number of weeks, days, hours, minutes, or seconds, and take the format *number*{w|d|h|m|s}.  
 For example, to set **Interval** to ten minutes, enter **10m** or **600s**.
    - Click to enable **Run single** to run only a single instance of the script at a time.  
 If **Run single** is not selected, a new instance of the script will be started at every interval, regardless of whether the script is still running from a previous interval.
  - **Set time**: Runs the script at a specified time of the day.
    - If **Set Time** is selected, specify the time that the script should run in **Run time**, using the format *HH:MM*.
  - **During system maintenance**: The script will run during the system maintenance time window.
7. For **Commands**, enter the commands that will execute the script.  
 If the script begins with **#!**, then the script will be invoked in the location specified by the path for the script command. Otherwise, the default shell will be used (equivalent to **#!/bin/sh**).
8. Script logging options:
  - a. Click to enable **Log script output** to log the script's output to the system log.
  - b. Click to enable **Log script errors** to log script errors to the system log.
 If neither option is selected, only the script's exit code is written to the system log.
9. For **Maximum memory**, enter the maximum amount of memory available to be used by the script and its subprocesses, using the format *number*{b|bytes|KB|k|MB|MB|M|GB|G|TB|T}.
10. Click to enable **Once** to configure the script to run only once at the specified time.  
 If **Once** is enabled, rebooting the device will cause the script to not run again. The only way to re-run the script is to:
  - Remove the script from the device and add it again.
  - Make a change to the script.
  - Uncheck **Once**.
11. **Sandbox** is enabled by default, which restricts access to the file system and available commands that can be used by the script. This option protects the script from accidentally destroying the system it is running on.
12. Click **Apply** to save the configuration and apply the change.



## Command line

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the command line, type **config** to enter configuration mode:

```
> config
(config)>
```

3. Add a script:

```
(config)> add system schedule script end
(config system schedule script 0)>
```

Scheduled scripts are enabled by default. To disable:

```
(config system schedule script 0)> enable false
(config system schedule script 0)>
```

4. (Optional) Provide a label for the script.

```
(config system schedule script 0)> label value
(config system schedule script 0)>
```

where *value* is any string. if spaces are used, enclose *value* within double quotes.

5. Set the mode that will be used to run the script:

```
(config system schedule script 0)> when mode
(config system schedule script 0)>
```

where *mode* is one of the following:

- **boot**: The script will run once each time the device boots.
  - If **boot** is selected, set the action that will be taken when the script completes:

```
(config system schedule script 0)> exit_action action
(config system schedule script 0)>
```

where *action* is one of the following:

- **none**: Action taken when the script exits.
- **restart**: Runs the script repeatedly.
- **reboot**: The device will reboot when the script completes.
- **interval**: The script will start running at the specified interval, within 30 seconds after the configuration change is saved. If **interval** is selected:



- Set the interval:

---

```
(config system schedule script 0)> on_interval value
(config system schedule script 0)>
```

---

where *value* is any number of weeks, days, hours, minutes, or seconds, and takes the format **number{w|d|h|m|s}**.

For example, to set **on\_interval** to ten minutes, enter either **10m** or **600s**:

---

```
(config system schedule script 0)> on_interval 600s
(config system schedule script 0)>
```

---

- (Optional) Configure the script to run only a single instance at a time:

---

```
(config system schedule script 0)> once true
(config system schedule script 0)>
```

---

If **once** is set to **false**, a new instance of the script will be started at every interval, regardless of whether the script is still running from a previous interval.

- **set\_time**: Runs the script at a specified time of the day.

- If **set\_time** is set, set the time that the script should run, using the format *HH:MM*:

---

```
(config system schedule script 0)> run_time HH:MM
(config system schedule script 0)>
```

---

- **maintenance\_time**: The script will run during the system maintenance time window.

#### 6. Set the commands that will execute the script:

---

```
(config system schedule script 0)> commands filename
(config system schedule script 0)>
```

---

where *filename* is the path and filename of the script, and any related command line information.

If the script begins with **#!**, then the script will be invoked in the location specified by the path for the script command. Otherwise, the default shell will be used (equivalent to **#!/bin/sh**).

#### 7. Script logging options:

- To log the script's output to the system log:

---

```
(config system schedule script 0)> syslog_stdout true
(config system schedule script 0)>
```

---

- To log script errors to the system log:

---

```
(config system schedule script 0)> syslog_stderr true
(config system schedule script 0)>
```

---

If **syslog\_stdout** and **syslog\_stderr** are not enabled, only the script's exit code is written to the system log.

8. Set the maximum amount of memory available to be used by the script and its subprocesses:

---

```
(config system schedule script 0)> max_memory value
(config system schedule script 0)>
```

---

where *value* uses the syntax **number{b|bytes|KB|k|MB|MB|M|GB|G|TB|T}**.

9. To run the script only once at the specified time:

---

```
(config system schedule script 0)> once true
(config system schedule script 0)>
```

---

If **once** is enabled, rebooting the device will cause the script to run again. The only way to re-run the script is to:

- Remove the script from the device and add it again.
- Make a change to the script.
- Disable **once**.

10. **Sandbox** is enabled by default. This option protects the script from accidentally destroying the system it is running on.

---

```
(config system schedule script 0)> sandbox true
(config system schedule script 0)>
```

---

11. Save the configuration and apply the change:

---

```
(config)> save
Configuration saved.
>
```

---

12. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Run a Python application at the shell prompt

Python applications can be run from a file at the shell prompt. The Python application will run until it completes, displaying output and prompting for additional user input if needed. To interrupt the application, enter **CTRL-C**.

---

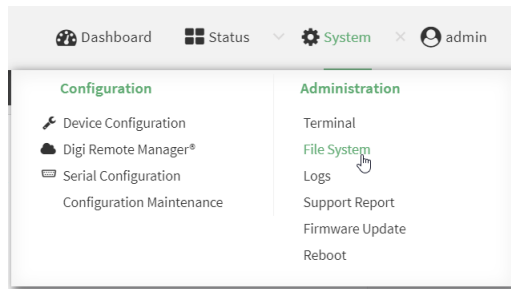
**Note** Python applications cannot be run from the Admin CLI. You must access the device shell in order to run Python applications from the command line. See [Authentication groups](#) for information about configuring authentication groups that include shell access.

---

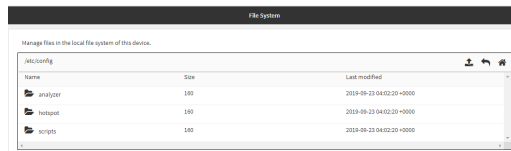
1. Upload the Python application to the EX15 device:



- Log into the EX15 WebUI as a user with Admin access.
- On the menu, click **System**. Under **Administration**, click **File System**.



The **File System** page appears.



- Highlight the **scripts** directory and click to open the directory.
- Click (upload).
- Browse to the location of the script on your local machine. Select the file and click **Open** to upload the file.

The uploaded file is uploaded to the **/etc/config/scripts** directory.

## Command line

- Log into the EX15 command line as a user with Admin access.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
- At the command line, use the **scp** command to upload the Python application script to the EX15 device:

```
> scp host hostname-or-ip user username remote remote-path local local-path to local
```

where:

- *hostname-or-ip* is the hostname or ip address of the remote host.
- *username* is the name of the user on the remote host.
- *remote-path* is the path and filename of the file on the remote host that will be copied to the EX15 device.
- *local-path* is the location on the EX15 device where the copied file will be placed.

For example:

To upload a Python application from a remote host with an IP address of 192.168.4.1 to the **/etc/config/scripts** directory on the EX15 device, issue the following command:

---

```
> scp host 192.168.4.1 user admin remote /home/admin/bin/test.py local
/etc/config/scripts/ to local
admin@192.168.4.1's password: adminpwd
test.py 100% 36MB 11.1MB/s 00:03
>
```

---

- c. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

---

**Note** You can also create Python applications by using the **vi** command when logged in with shell access.

---

2. Log into the EX15 command line as a user with shell access.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **shell** to access the device shell.

3. Use the **python** command to run the Python application. In the following example, the Python application, **test.py**, takes 3 parameters: **120**, **ports** and **storage**:

---

```
python /etc/config/scripts/test.py 120 ports storage
```

---

## Start an interactive Python session

Use the **python** command without specifying any parameters to start an interactive Python session. The Python session operates interactively using REPL (Read Evaluate Print Loop) to allow you to write Python code on the command line.

---

**Note** The Python interactive session is not available from the Admin CLI. You must access the device shell in order to run Python applications from the command line. See [Authentication groups](#) for information about configuring authentication groups that include shell access.

---

1. Log into the EX15 command line as a user with shell access.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **shell** to access the device shell.

2. At the shell prompt, use the **python** command with no parameters to enter an interactive Python session:

---

```
python
Python 3.6.12 (default, Jan 11 2021, 10:25:21)
[GCC 8.3.0] on linux
Type "help", "copyright", "credits" or "license" for more information.
>>>
```

---

3. Type Python commands at the Python prompt. For example, to view help for the digidevice module, type:

---

```
>>> help("digidevice")
Help on package digidevice:
```

---

---

NAME

digidevice - Digi device python extensions

## DESCRIPTION

This module includes various extensions that allow Python to interact with additional features offered by the device.

...

---

4. Use **Ctrl-D** to exit the Python session. You can also exit the session using **exit()** or **quit()**.

## Digidevice module

The Python **digidevice** module provides platform-specific extensions that allow you to interact with the device's configuration and interfaces. The following submodules are included with the **digidevice** module:

This section contains the following topics:

|                                                                                   |     |
|-----------------------------------------------------------------------------------|-----|
| Use digidevice.cli to execute CLI commands .....                                  | 523 |
| Use digidevice.datapoint to upload custom datapoints to Digi Remote Manager ..... | 524 |
| Use digidevice.config for device configuration .....                              | 526 |
| Use Python to respond to Digi Remote Manager SCI requests .....                   | 529 |
| Use digidevice runtime to access the runtime database .....                       | 537 |
| Use Python to upload the device name to Digi Remote Manager .....                 | 539 |
| Use Python to access the device location data .....                               | 541 |
| Use Python to send and receive SMS messages .....                                 | 545 |

## Use digidevice.cli to execute CLI commands

Use the **digidevice.cli** Python module to issue CLI commands from Python to retrieve status and statistical information about the device.

For example, to display the system status and statistics by using an interactive Python session, use the **show system** command with the **cli** module:

1. Log into the EX15 command line as a user with shell access.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **shell** to access the device shell.

2. At the shell prompt, use the **python** command with no parameters to enter an interactive Python session:

---

```
python
Python 3.6.12 (default, Jan 11 2021, 10:25:21)
[GCC 8.3.0] on linux
Type "help", "copyright", "credits" or "license" for more information.
>>>
```

---

3. Import the **cli** submodule:

---

```
>>> from digidevice import cli
>>>
```

---

4. Execute a CLI command using the **cli.execute(command)** function. For example, to print the system status and statistics to stdout using the **show system** command:

---

```
>>> response = cli.execute("show system")
>>>
>>> print (response)
```

|                       |                                           |
|-----------------------|-------------------------------------------|
| Model                 | : Digi EX15                               |
| Serial Number         | : EX15-000065                             |
| SKU                   | : EX15                                    |
| Hostname              | : EX15                                    |
| MAC                   | : DF:DD:E2:AE:21:18                       |
| Hardware Version      | : 50001947-01 1P                          |
| Firmware Version      | : 21.2.39.67                              |
| Alt. Firmware Version | : 21.2.39.67                              |
| Bootloader Version    | : 19.7.23.0-15f936e0ed                    |
| Current Time          | : Fri, 26 Feb 2021 8:04:23 +0000          |
| CPU                   | : 1.4%                                    |
| Uptime                | : 6 days, 6 hours, 21 minutes, 57 seconds |
| (541317s)             |                                           |
| Temperature           | : 40C                                     |

```
>>>
```

---

5. Use **Ctrl-D** to exit the Python session. You can also exit the session using **exit()** or **quit()**.

## Help for using Python to execute EX15 CLI commands

Get help executing a CLI command from Python by accessing help for **cli.execute**:

1. Log into the EX15 command line as a user with shell access.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **shell** to access the device shell.
2. At the shell prompt, use the **python** command with no parameters to enter an interactive Python session:

---

```
python
Python 3.6.12 (default, Jan 11 2021, 10:25:21)
[GCC 8.3.0] on linux
Type "help", "copyright", "credits" or "license" for more information.
>>>
```

---

3. Import the **cli** submodule:

---

```
>>> from digidevice import cli
>>>
```

---

4. Use the help command with **cli.execute**:

---

```
>>> help(cli.execute)
Help on function execute in module digidevice.cli:

execute(command, timeout=5)
Execute a CLI command with the timeout specified returning the results.
...
```

---

5. Use **Ctrl-D** to exit the Python session. You can also exit the session using **exit()** or **quit()**.

## Use digidevice.datapoint to upload custom datapoints to Digi Remote Manager

Use the **datapoint** Python module to upload custom datapoints to Digi Remote Manager.

The following characteristics can be defined for a datapoint:

- Stream ID
- Value
- (Optional) Data type
  - integer
  - long
  - float
  - double
  - string
  - binary
- Units (optional)
- Timestamp (optional)



- Location (optional)
  - Tuple of latitude, longitude and altitude
- Description (optional)
- Quality (optional)
  - An integer describing the quality of the data point

For example, to use an interactive Python session to upload datapoints related to velocity, temperature, and the state of the emergency door:

1. Log into the EX15 command line as a user with shell access.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **shell** to access the device shell.
2. At the shell prompt, use the **python** command with no parameters to enter an interactive Python session:

---

```
python
Python 3.6.12 (default, Jan 11 2021, 10:25:21)
[GCC 8.3.0] on linux
Type "help", "copyright", "credits" or "license" for more information.
>>>
```

---

3. Import the **datapoint** submodule and other necessary modules:

---

```
>>> from digidevice import datapoint
>>> import time
>>>
```

---

4. Upload the datapoints to Remote Manager:

---

```
>>> datapoint.upload("Velocity", 69, units="mph")
>>> datapoint.upload("Temperature", 24, geo_location=(54.409469, -1.718836,
129))
>>> datapoint.upload("Emergency_Door", "closed", timestamp=time.time())
```

---

5. Use **Ctrl-D** to exit the Python session. You can also exit the session using **exit()** or **quit()**.

Once the datapoints have been uploaded to Remote Manager, they can be viewed via Remote Manager or accessed using Web Services calls. See the [Digi Remote Manager Programmers Guide](#) for more information on web services and datapoints.

### ***Help for using Python to upload custom datapoints to Remote Manager***

Get help for uploading datapoints to your Digi Remote Manager account by accessing help for **datapoint.upload**:

1. Log into the EX15 command line as a user with shell access.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **shell** to access the device shell.
2. At the shell prompt, use the **python** command with no parameters to enter an interactive Python session:

---

```
python
Python 3.6.12 (default, Jan 11 2021, 10:25:21)
[GCC 8.3.0] on linux
Type "help", "copyright", "credits" or "license" for more information.
>>>
```

---

3. Import the **datapoint** submodule and other necessary modules:

---

```
>>> from digidevice import datapoint
>>>
```

---

4. Use the help command with **datapoint.upload**:

---

```
>>> help(datapoint.upload)
Help on function upload in module digidevice.datapoint:

upload(stream_id:str, data, *, description:str=None, timestamp:float=None,
units:str=None,
geo_location:Tuple[float, float, float]=None, quality:int=None,
data_type:digidevice.datapoint.DataType=None, timeout:float=None)
...
```

---

5. Use **Ctrl-D** to exit the Python session. You can also exit the session using **exit()** or **quit()**.

## Use digidevice.config for device configuration

Use the **config** Python module to access and modify the device configuration.

### Read the device configuration

1. Log into the EX15 command line as a user with shell access.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **shell** to access the device shell.
2. At the shell prompt, use the **python** command with no parameters to enter an interactive Python session:

---

```
python
Python 3.6.12 (default, Jan 11 2021, 10:25:21)
[GCC 8.3.0] on linux
Type "help", "copyright", "credits" or "license" for more information.
>>>
```

---

3. Import the **config** submodule:

---

```
>>> from digidevice import config
>>>
```

---

4. Use **config.load()** and the **get()** method to return the device's configuration:
  - a. Return the entire configuration:

---

```
>>> cfg = config.load()
>>> print(cfg)
```

---

This returns the device configuration:

---

```
...
network.interface.lan1.device=/network/bridge/lan1
network.interface.lan1.enable=true
network.interface.lan1.ipv4.address=192.168.2.1/24
network.interface.lan1.ipv4.connection_monitor.attempts=3
...
```

---

- b. Print a list of available interfaces:

---

```
>>> cfg = config.load()
>>> interfaces = cfg.get("network.interface")
>>> print(interfaces.keys())
```

---

This returns the following:

---

```
['defaultip', 'defaultlinklocal', 'lan1', 'loopback', 'wan1', 'wwan1',
'wwan2']
```

---

- c. Print the IPv4 address of the LAN interface:

---

```
>>> cfg = config.load()
>>> print(interfaces.get("lan.ipv4.address"))
```

---

Which returns:

---

```
192.168.2.1/24
```

---

### **Modify the device configuration**

Use the **set()** and **commit()** methods to modify the device configuration:

1. Log into the EX15 command line as a user with shell access.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **shell** to access the device shell.
2. At the shell prompt, use the **python** command with no parameters to enter an interactive Python session:

---

```
python
Python 3.6.12 (default, Jan 11 2021, 10:25:21)
[GCC 8.3.0] on linux
Type "help", "copyright", "credits" or "license" for more information.
>>>
```

---

3. Import the **config** submodule:

---

```
>>> from digidevice import config
>>>
```

---

4. Use **config.load(writable=True)** to enable write mode for the configuration:

---

```
>>> cfg = config.load(writable=True)
>>>
```

---

5. Use the **set()** method to make changes to the configuration:

---

```
>>> cfg.set("system.name", "New-Name")
>>>
```

---

6. Use the **commit()** method to save the changes:

---

```
>>> cfg.commit()
True
>>>
```

---

7. Use the **get()** method to verify the change:

---

```
>>> print(cfg.get("system.name"))
New-Name
>>>
```

---

### ***Help for using Python to read and modify device configuration***

Get help for reading and modifying the device configuration by accessing help for **digidevice.config**:

1. Log into the EX15 command line as a user with shell access.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **shell** to access the device shell.
2. At the shell prompt, use the **python** command with no parameters to enter an interactive Python session:

---

```
python
Python 3.6.12 (default, Jan 11 2021, 10:25:21)
[GCC 8.3.0] on linux
Type "help", "copyright", "credits" or "license" for more information.
>>>
```

---

3. Import the **config** submodule:

---

```
>>> from digidevice import config
>>>
```

---

4. Use the help command with **config**:

---

```
>>> help(config)
Help on module acl.config in acl:

NAME
acl.config - Python interface to ACL configuration (libconfig).
...
```

---

5. Use **Ctrl-D** to exit the Python session. You can also exit the session using **exit()** or **quit()**.

## Use Python to respond to Digi Remote Manager SCI requests

The **device\_request** Python module allows you to interact with Digi Remote Manager by using Remote Manager's Server Command Interface (SCI), a web service that allows users to access information and perform commands that relate to their devices.

Use Remote Manager's SCI interface to create SCI requests that are sent to your EX15 device, and use the **device\_request** module to send responses to those requests to Remote Manager.

See the [Digi Remote Manager Programmers Guide](#) for more information on SCI.

### **Task one: Use the `device_request` module on your EX15 device to create a response**

1. Log into the EX15 command line as a user with shell access.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **shell** to access the device shell.
2. At the shell prompt, use the **python** command with no parameters to enter an interactive Python session:

---

```
python
Python 3.6.12 (default, Jan 11 2021, 10:25:21)
[GCC 8.3.0] on linux
Type "help", "copyright", "credits" or "license" for more information.
>>>
```

---

3. Import the **device\_request** module:

---

```
>>> from digidevice import device_request
>>>
```

---

4. Create a function to handle the request from Remote Manager:

---

```
>>> def handler(target, request):
 print ("received request %s for target %s" % (request, target))
 return "OK"
>>>
```

---

5. Register a callback function that will be called when the device receives a SCI request from Remote Manager:

---

```
>>> device_request.register("myTarget", handler)
>>>
```

---

**Note** Leave the interactive Python session active while completing task two, below. Once you have completed task two, exit the interactive session by using **Ctrl-D**. You can also exit the session using **exit()** or **quit()**.

### **Task two: Create and send an SCI request from Digi Remote Manager**

The second step in using the **device\_request** module is to create an SCI request that Remote Manager will forward to the device. For example, you can create in SCI request a the Remote Manager API explorer:

1. In Remote Manager, click **Documentation > API Explorer**.
2. Select the device to use as the SCI target:
  - a. Click **SCI Targets**.
  - b. Click **Add Targets**.
  - c. Enter or select the device ID of the device.
  - d. Click **Add**.
  - e. Click **OK**.
3. Click **Examples > SCI > Data Service > Send Request**.

Code similar to the following will be displayed in the HTTP message body text box:

---

```
<sci_request version="1.0">
 <data_service>
 <targets>
 <device id="00000000-00000000-0000FFFF-A83CF6A3"/>
 </targets>
 <requests>
 <device_request target_name="myTarget">
 my payload string
 </device_request>
 </requests>
 </data_service>
</sci_request>
```

---

**Note** The value of the **target\_name** parameter in the **device\_request** element must correspond to the **target** parameter of the **device\_request.register** function in the Python script. In this example, the two are the same.

---

4. Click **Send**.

Once that the request has been sent to the device, the handler on the device is executed.

- On the device, you will receive the following output:

---

```
>>> received request
 my payload string
 for target myTarget
>>>
```

---

- In Remote Manager, you will receive a response similar to the following:

---

```
<sci_reply version="1.0">
 <data_service>
 <device id="00000000-00000000-0000FFFF-A83CF6A3"/>
 <requests>
 <device_request target_name="myTarget" status="0">OK</device_
request>
 </requests>
 </device>
</data_service>
</sci_request>
```

---

**Example: Use digidevice.cli with digidevice.device\_request**

In this example, we will use the **digidevice.cli** module in conjunction with the **digidevice.device\_request** module to return information about multiple devices to Remote Manager.

1. Create a Python application, called `showsystem.py`, that uses the **digidevice.cli** module to create a response containing information about device and the **device\_request** module to respond with this information to a request from Remote Manager:

---

```
from digidevice import device_request
from digidevice import cli
import time

def handler(target, request):
 return cli.execute("show system verbose")

def status_cb(error_code, error_description):
 if error_code != 0:
 print("error handling showSystem device request: %s" % error_
description)

device_request.register("showSystem", handler, status_callback = status_cb)

Do not let the process finish so that it handles device requests
while True:
 time.sleep(10)
```

---

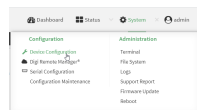
2. Upload the `showsystem.py` application to the `/etc/config/scripts` directory on two or more Digi devices. In this example, we will upload it to two devices, and use the same request in Remote Manager to query both devices.

See [Configure applications to run automatically](#) for information about uploading Python applications to your device. You can also create the script on the device by using the **vi** command when logged in with shell access.

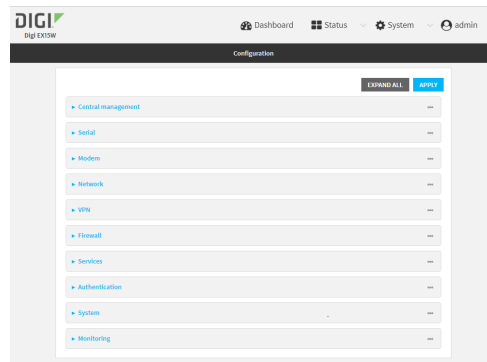
3. For both devices:
  - a. Configure the device to automatically run the `showsystem.py` application on reboot, and to restart the application if it crashes. This can be done from either the WebUI or the command line:

## WebUI

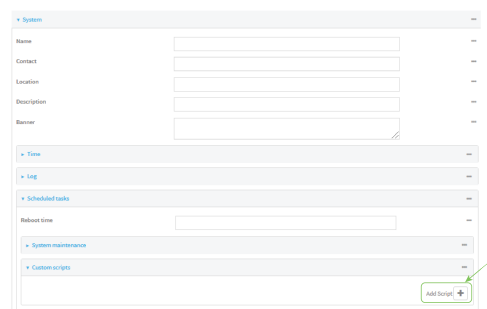
- i. Log into the EX15 WebUI as a user with full Admin access rights.
- ii. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



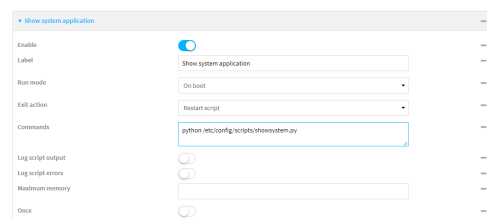
The **Configuration** window is displayed.



- iii. Click **System > Scheduled tasks > Custom scripts**.
- iv. Click **+** to add a custom script.



- v. For **Label**, type **Show system application**.
- vi. For **Run mode**, select **On boot**.
- vii. For **Exit action**, select **Restart script**.
- viii. For **Commands**, type `python /etc/config/scripts/showsystem.py`.



- ix. Click **Apply** to save the configuration and apply the change.



## Command line



- i. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.

- ii. At the command line, type **config** to enter configuration mode:

---

```
> config
(config)>
```

---

- iii. Add an application entry:

---

```
(config)> add system schedule script end
(config system schedule script 0)>
```

---

Scheduled scripts are enabled by default. To disable:

---

```
(config system schedule script 0)> enable false
(config system schedule script 0)>
```

---

- iv. Provide a label for the script:

---

```
(config system schedule script 0)> label "Show system application"
```

---

- v. Configure the application to run automatically when the device reboots:

---

```
(config system schedule script 0)> when boot
(config system schedule script 0)>
```

---

- vi. Configure the application to restart if it crashes:

---

```
(config system schedule script 0)> exit_action restart
(config system schedule script 0)>
```

---

- vii. Set the command that will execute the application:

---

```
(config system schedule script 0)> commands "python
/etc/config/scripts/showsystem.py"
(config system schedule script 0)>
```

---

- viii. Save the configuration and apply the change:

---

```
(config)> save
Configuration saved.
>
```

---

- b. Run the showsystem.py application. You can run the application by either rebooting the device, or by running it from the shell prompt.

- To reboot the device:

- i. From the WebUI:

- i. From the main menu, click **System**.
- ii. Click **Reboot**.

- i. From the command line, at the Admin CLI prompt, type:

---

```
> reboot
```

---

- To run the application from the shell prompt:

- i. Log into the EX15 command line as a user with shell access.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **shell** to access the device shell.

- ii. Type the following at the shell prompt:

---

```
python /etc/config/scripts/showsystem.py &
#
```

---

- iii. Exit the shell:

---

```
exit
```

---

4. In Remote Manager, click **Documentation > API Explorer**.

5. Select the devices to use as the SCI target:

- a. Click **SCI Targets**.
- b. Click **Add Targets**.
- c. Enter or select the device ID of one of the devices.
- d. Click **Add**.
- e. Enter or select the device ID of the second device and click **Add**.
- f. Click **OK**.

6. Click **Examples > SCI > Data Service > Send Request**.

Code similar to the following will be displayed in the HTTP message body text box:

---

```
<sci_request version="1.0">
 <data_service>
 <targets>
 <device id="00000000-00000000-0000FFFF-A83CF6A3"/>
 <device id="00000000-00000000-0000FFFF-485740BC"/>
 </targets>
 <requests>
 <device_request target_name="myTarget">
 my payload string
 </device_request>
 </requests>
 </data_service>
</sci_request>
```

---

7. For the **device\_request** element, replace the value of **target\_name** with **showSystem**. This matches the **target** parameter of the **device\_request.register** function in the showsystem.py application.

---

```
<device_request target_name="showSystem">
```

---

8. Click **Send**.

You should receive a response similar to the following:

---

```

<sci_reply version="1.0">
 <data_service>
 <device id="00000000-00000000-0000FFFF-A83CF6A3"/>
 <requests>
 <device_request target_name="showSystem" status="0">Model
 : Digi EX15
 Serial Number : EX15-000068
 Hostname : EX15
 MAC : 00:40:D0:13:35:36

 Hardware Version : 50001959-01 A
 Firmware Version : 21.2.39.67
 Bootloader Version : 1
 Firmware Build Date : Fri, 26 Feb 2021 8:04:23
 Schema Version : 461

 Timezone : UTC
 Current Time : Fri, 26 Feb 2021 8:04:23
 CPU : 1.1
 Uptime : 1 day, 21 hours, 49 minutes, 47
seconds (164987s)
 Temperature : 39C

 Contact : Jane Smith

 Disk

 Load Average : 0.10, 0.05, 0.00
 RAM Usage : 85.176MB/250.484MB(34%)
 Disk /etc/config Usage : 0.068MB/13.416MB(1%)
 Disk /opt Usage : 47.724MB/5309.752MB(1%)
 Disk /overlay Usage : MB/MB(%)
 Disk /tmp Usage : 0.004MB/40.96MB(0%)
 Disk /var Usage : 0.820MB/32.768MB(3%)</device_request>
 </requests>
 </device>
 <device id="00000000-00000000-0000FFFF-485740BC"/>
 <requests>
 <device_request target_name="showSystem" status="0">Model
 : Digi EX15
 Serial Number : EX15-000023
 Hostname : EX15
 MAC : 00:40:D0:26:79:1C

 Hardware Version : 50001959-01 A
 Firmware Version : 21.2.39.67
 Bootloader Version : 1
 Firmware Build Date : Fri, 26 Feb 2021 8:04:23
 Schema Version : 461

 Timezone : UTC
 Current Time : Fri, 26 Feb 2021 8:04:23
 CPU : 1.1
 Uptime : 4 day, 13 hours, 43 minutes, 22
seconds (395002s)
 Temperature : 37C

```

---

---

```

Contact : Omar Ahmad
Disk

Load Average : 0.10, 0.05, 0.00
RAM Usage : 85.176MB/250.484MB (34%)
Disk /etc/config Usage : 0.068MB/13.416MB (1%)
Disk /opt Usage : 47.724MB/5309.752MB (1%)
Disk /overlay Usage : MB/MB (%)
Disk /tmp Usage : 0.004MB/40.96MB (0%)
Disk /var Usage : 0.820MB/32.768MB (3%)</device_request>
</requests>
</device>
</data_service>
</sci_request>

```

---

### Help for using Python to respond to Digi Remote Manager SCI requests

Get help for respond to Digi Remote Manager Server Command Interface (SCI) requests by accessing help for **digidevice.device\_request**:

1. Log into the EX15 command line as a user with shell access.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **shell** to access the device shell.
2. At the shell prompt, use the **python** command with no parameters to enter an interactive Python session:

---

```

python
Python 3.6.12 (default, Jan 11 2021, 10:25:21)
[GCC 8.3.0] on linux
Type "help", "copyright", "credits" or "license" for more information.
>>>

```

---

3. Import the **device\_request** submodule:

---

```

>>> from digidevice import device_request
>>>

```

---

4. Use the help command with **device\_request**:

---

```

>>> help(device_request)
Help on module digidevice.device_request in digidevice:

NAME
digidevice.device_request - APIs for registering device request handlers
...

```

---

You can also use the help command with available **device\_request** functions:

- Use the help command with **device\_request.register**:

---

```

>>> help(device_request.register)
Help on function register in module digidevice.device_request:

register(target:str, response_callback:Callable[[str, str], str],

```

---

---

```
status_callback:Callable[[int, str], NoneType]=None, xml_
encoding:str='UTF-8')
...
```

---

- Use the help command with **device\_request.unregister**:

---

```
>>> help(device_request.unregister)
Help on function unregister in module digidevice.device_request:

unregister(target:str) -> bool
...
```

---

5. Use **Ctrl-D** to exit the Python session. You can also exit the session using **exit()** or **quit()**.

## Use digidevice runtime to access the runtime database

Use the **runt** submodule to access and modify the device runtime database.

### Read from the runtime database

Use the **keys()** and **get()** methods to read the device configuration:

1. Log into the EX15 command line as a user with shell access.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **shell** to access the device shell.
2. At the shell prompt, use the **python** command with no parameters to enter an interactive Python session:

---

```
python
Python 3.6.12 (default, Jan 11 2021, 10:25:21)
[GCC 8.3.0] on linux
Type "help", "copyright", "credits" or "license" for more information.
>>>
```

---

3. Import the **runt** submodule:

---

```
>>> from digidevice import runt
>>>
```

---

4. Use the **start()** method to open the runtime database:

---

```
>>> runt.start()
>>>
```

---

5. Use the **keys()** method to display available keys in the runtime database, and use the **get()** method to print information from the runtime database:
  - a. Print available keys:

---

```
>>> print(runt.keys(""))
```

---

This returns available keys:

---

```
['advanced', 'drm', 'firmware', 'location', 'manufacture', 'metrics',
'mm', 'network', 'pam', 'serial', 'system']
```

---

- b. Print available keys for the system key:

---

```
>>> print(runt.keys("system"))
```

---

This will return the following:

---

```
['boot_count', 'chassis', 'cpu_temp', 'cpu_usage', 'disk', 'load_avg',
'local_time', 'mac', 'mcu', 'model', 'ram', 'serial', 'uptime']
```

---

- c. Use the **get()** method to print the device's MAC address:

---

```
>>> print(runt.get("system.mac"))
```

---

This will return the MAC address of the device.

6. Use the **stop()** method to close the runtime database:
7. Use **Ctrl-D** to exit the Python session. You can also exit the session using **exit()** or **quit()**.

### **Modify the runtime database**

Use the **set()** method to modify the runtime database:

1. Log into the EX15 command line as a user with shell access.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **shell** to access the device shell.
2. At the shell prompt, use the **python** command with no parameters to enter an interactive Python session:

---

```
python
Python 3.6.12 (default, Jan 11 2021, 10:25:21)
[GCC 8.3.0] on linux
Type "help", "copyright", "credits" or "license" for more information.
>>>
```

---

3. Import the **runt** submodule:

---

```
>>> from digidevice import runt
>>>
```

---

4. Use **start()** method to open the runtime database:

---

```
>>> runt.start()
>>>
```

---

5. Use the **set()** method to make changes to the runtime database:

---

```
>>> runt.set("my-variable", "my-value")
>>>
```

---

6. Use the **get()** method to verify the change:

---

```
>>> print(runt.get("my-variable"))
my-variable
>>>
```

---

7. Close the runtime database:

---

```
>>> runt.stop()
>>>
```

---

8. Use **Ctrl-D** to exit the Python session. You can also exit the session using **exit()** or **quit()**.

### **Help for using Python to access the runtime database**

Get help for reading and modifying the device runtime database by accessing help for **digidevice.runt**:

1. Log into the EX15 command line as a user with shell access.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **shell** to access the device shell.
2. At the shell prompt, use the **python** command with no parameters to enter an interactive Python session:

---

```
python
Python 3.6.12 (default, Jan 11 2021, 10:25:21)
[GCC 8.3.0] on linux
Type "help", "copyright", "credits" or "license" for more information.
>>>
```

---

3. Import the **runt** submodule:

---

```
>>> from digidevice import runt
>>>
```

---

4. Use the help command with **runt**:

---

```
>>> help(runt)

Help on module acl.runt in digidevice:

NAME
acl.runt - Python interface to ACL runtime database (runttd).
...
```

---

5. Use **Ctrl-D** to exit the Python session. You can also exit the session using **exit()** or **quit()**.

### **Use Python to upload the device name to Digi Remote Manager**

The **name** submodule can be used to upload a custom name for your device to Digi Remote Manager. When you use the **name** submodule to upload a custom device name to Remote Manager, the following issues apply:

- If the name is being used by to another device in your Remote Manager account, the name will be removed from the previous device and added to the new device.
- If Remote Manager is configured to apply a profile to a device based on the device name, changing the name of the device may cause Remote Manager to automatically push a profile onto the device.

Together, these two features allow you to swap one device for another by using the **name** submodule to change the device name, while guaranteeing that the new device will have the same configuration as the previous one.

---

**Note** Because causing a profile to be automatically pushed from Remote Manager may change the behavior of the device, including overwriting existing usernames and passwords, the **name** submodule should be used with caution. As a result, support for this functionality is disabled by default on Remote Manager.

---

### ***Enable support on Digi Remote Manager for uploading custom device names***

1. In Remote Manager, click **API Explorer**.
2. For the HTTP method, select **PUT**.
3. For **Enter and API or select an example**, type **/ws/v1/settings/inventory/AllowDeviceToSetOwnNameEnabled**.
4. In the HTTP message body text box, type the following:

---

```
{
 "name" : "AllowDeviceToSetOwnNameEnabled",
 "value" : "true"
}
```

---

5. Click **Send**.

### ***Upload a custom name***

1. Log into the EX15 command line as a user with shell access.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **shell** to access the device shell.
2. At the shell prompt, use the **python** command with no parameters to enter an interactive Python session:

---

```
python
Python 3.6.12 (default, Jan 11 2021, 10:25:21)
[GCC 8.3.0] on linux
Type "help", "copyright", "credits" or "license" for more information.
>>>
```

---

3. Import the **name** submodule:

---

```
>>> from digidevice import name
```

---

4. Upload the name to Remote Manager:

---

```
>>> name.upload("my_name")
```

---



5. Use **Ctrl-D** to exit the Python session. You can also exit the session using **exit()** or **quit()**.

### **Help for uploading the device name to Digi Remote Manager**

Get help for uploading the device name to Digi Remote Manager by accessing help for **digidevice.name**:

1. Log into the EX15 command line as a user with shell access.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **shell** to access the device shell.
2. At the shell prompt, use the **python** command with no parameters to enter an interactive Python session:

---

```
python
Python 3.6.12 (default, Jan 11 2021, 10:25:21)
[GCC 8.3.0] on linux
Type "help", "copyright", "credits" or "license" for more information.
>>>
```

---

3. Import the **name** submodule:

---

```
>>> from digidevice import name
>>>
```

---

4. Use the help command with **name**:

---

```
>>> help(name)

Help on module digidevice.name in digidevice:

NAME
digidevice.name - API for uploading name from the device
...
```

---

5. Use **Ctrl-D** to exit the Python session. You can also exit the session using **exit()** or **quit()**.

## **Use Python to access the device location data**

The **location** submodule enables access to the location data for the EX15 device.

The module takes a snapshot of location data stored in the runt database. The location data snapshot can be subsequently updated by using the update method.

### **Determine if the device's location**

1. Log into the EX15 command line as a user with shell access.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **shell** to access the device shell.
2. At the shell prompt, use the **python** command with no parameters to enter an interactive Python session:

---

```
python
Python 3.6.12 (default, Jan 11 2021, 10:25:21)
[GCC 8.3.0] on linux
Type "help", "copyright", "credits" or "license" for more information.
>>>
```

---

3. Import the **location** submodule:

---

```
>>> from digidevice import location
```

---

4. Use the **valid\_fix** object to determine if the device has a valid fix:

---

```
>>> loc = location.Location()
>>> loc.valid_fix
True
>>>
```

---

5. Use the **position** object to return the device's position:

---

```
>>> loc.position
(44.926195299999998, -93.397084499999999, 292.39999399999999)
>>>
```

---

The coordinates are returned in the following order:

*latitude, longitude, altitude*

*altitude* is in meters.

6. You can also return only one of the coordinate positions:

- Use the **latitude** object to return the latitude:

---

```
>>> loc.latitude
44.926195299999998
>>>
```

---

- Use the **longitude** object to return the longitude:

---

```
>>> loc.longitude
-93.397084499999999
>>>
```

---

- Use the **altitude** object to return the altitude, in meters:

---

```
>>> loc.altitude
292.39999399999999
>>>
```

---

7. Use **Ctrl-D** to exit the Python session. You can also exit the session using **exit()** or **quit()**.

### **Update the location data**

The **location** submodule takes a snapshot of the current location and stores it in the runtime database. You can update this snapshot:

1. Log into the EX15 command line as a user with shell access.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **shell** to access the device shell.
2. At the shell prompt, use the **python** command with no parameters to enter an interactive Python session:

---

```
python
Python 3.6.12 (default, Jan 11 2021, 10:25:21)
[GCC 8.3.0] on linux
Type "help", "copyright", "credits" or "license" for more information.
>>>
```

---

3. Import the **location** submodule:

---

```
>>> from digidevice import location
```

---

4. Update the location object with the latest location data:

---

```
>>> loc = location.Location()
>>> loc.position
>>> (44.926195299999998, -93.397084499999999, 292.39999399999999)
>>> loc.update()
>>> loc.position
44.926231, -93.397923, 289.439229
>>>
```

---

5. Use **Ctrl-D** to exit the Python session. You can also exit the session using **exit()** or **quit()**.

### ***Output location data in json format***

The **location** submodule takes a snapshot of the current location and stores it in the runtime database. You can update this snapshot

1. Log into the EX15 command line as a user with shell access.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **shell** to access the device shell.
2. At the shell prompt, use the **python** command with no parameters to enter an interactive Python session:

---

```
python
Python 3.6.12 (default, Jan 11 2021, 10:25:21)
[GCC 8.3.0] on linux
Type "help", "copyright", "credits" or "license" for more information.
>>>
```

---

3. Import the **json** submodule:

---

```
>>> import json
```

---

4. Import the **location** submodule:

---

```
>>> from digidevice import location
```

---

5. Print the location data in json format:

---

```
>>> geojson_data = location.Location().geojson
>>> print(json.dumps(geojson_data, indent=4))
{
 "type": "Feature",
 "geometry": {
 "type": "Point",
 "coordinates": [
 44.926195299999998,
 -93.397084499999999,
 273.200012000000002
]
 },
 "properties": {
 "direction": "None",
 "horizontal_velocity": "0.0",
 "latitude.deg_min_sec": "44° 54' 45.586\" N",
 "longitude.deg_min_sec": "93° 33' 52.334\" W",
 "num_satellites": "12",
 "quality": "Standard GNSS (2D/3D)",
 "selected_source_idx": "0",
 "source": "USB (/dev/ttyACM0)",
 "source_idx.0.altitude": "273.200012",
 "source_idx.0.direction": "None",
 "source_idx.0.horizontal_velocity": "0.195489",
 "source_idx.0.label": "usb",
 "source_idx.0.latitude": "44.902662",
 "source_idx.0.latitude.deg_min_sec": "44° 55' 45.065\" N",
 "source_idx.0.longitude": "-93.560648",
 "source_idx.0.longitude.deg_min_sec": "93° 16' 52.966\" W",
 "source_idx.0.num_satellites": "12",
 "source_idx.0.quality": "Standard GNSS (2D/3D)",
 "source_idx.0.utc_date_time": "Feb-26-2021 8:04:23",
 "source_idx.0.vertical_velocity": "0.0",
 "source_idx.1.label": "gnss",
 "source_idx.1.quality": "No Fix / Invalid",
 "state": "Enabled, signal",
 "utc_date_time": "Feb-26-2021 8:04:23",
 "vertical_velocity": "0.0"
 }
}
>>>
```

---

6. Use **Ctrl-D** to exit the Python session. You can also exit the session using **exit()** or **quit()**.

### ***Help for the digidevice location module***

Get help for the digidevice location module:

1. Log into the EX15 command line as a user with shell access.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **shell** to access the device shell.

- At the shell prompt, use the **python** command with no parameters to enter an interactive Python session:

```
python
Python 3.6.12 (default, Jan 11 2021, 10:25:21)
[GCC 8.3.0] on linux
Type "help", "copyright", "credits" or "license" for more information.
>>>
```

- Import the **location** submodule:

```
>>> from digidevice import location
>>>
```

- Use the help command with **location**:

```
>>> help(location)
Help on module digidevice.location in digidevice:

NAME
digidevice.location - digidevice.location - API for accessing location data
...
```

- Use **Ctrl-D** to exit the Python session. You can also exit the session using **exit()** or **quit()**.

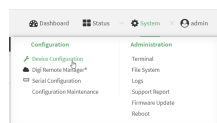
## Use Python to send and receive SMS messages

You can create Python scripts that send and receive SMS message in tandem with the Digi Remote Manager or Digi aView by using the `digidevice.sms` module. To use a script to send or receive SMS messages, you must also enable the ability to schedule SMS scripting.

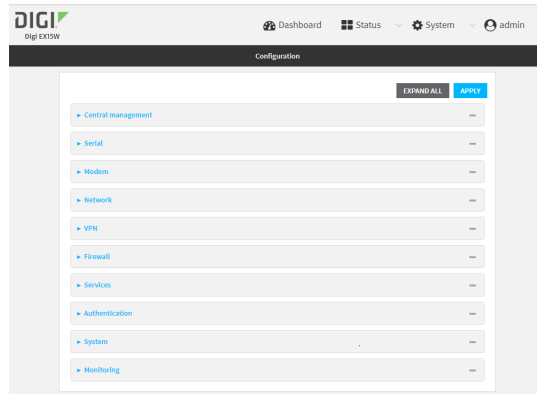
### Enable the ability to schedule SMS scripting

#### WebUI

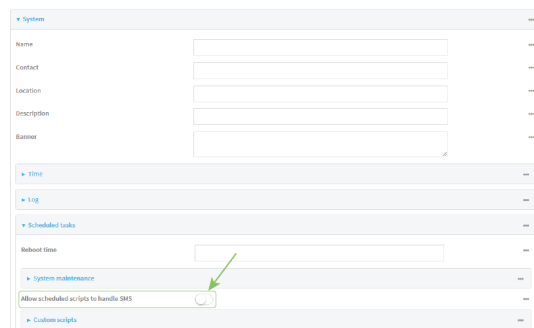
- Log into the EX15 WebUI as a user with full Admin access rights.
- On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.



3. Click **System** > **Scheduled tasks**.
4. Click to enable **Allow scheduled scripts to handle SMS**.



5. Click **Apply** to save the configuration and apply the change.



## Command line

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the command line, type **config** to enter configuration mode:

```
> config
(config)>
```

3. At the config prompt, type:

```
(config)> system schedule sms_script_handling true
(config)>
```

4. Save the configuration and apply the change:

---

```
(config)> save
Configuration saved.
>
```

---

5. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

See [Configure applications to run automatically](#) for more information about scheduling scripts.

### **Example digidevice.sms code**

The following example code receives an SMS message and sends a response:

---

```
#!/usr/bin/python

DIGI SPECIFICALLY DISCLAIMS ANY WARRANTIES, INCLUDING, BUT NOT LIMITED
TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A
PARTICULAR PURPOSE. THE SOFTWARE AND ACCOMPANYING DOCUMENTATION, IF ANY,
PROVIDED HEREUNDER IS PROVIDED "AS IS" AND WITHOUT WARRANTY OF ANY KIND.
DIGI HAS NO OBLIGATION TO PROVIDE MAINTENANCE, SUPPORT, UPDATES,
ENHANCEMENTS, OR MODIFICATIONS.
#
IN NO EVENT SHALL DIGI BE LIABLE TO ANY PARTY FOR DIRECT, INDIRECT,
SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES, INCLUDING LOST PROFITS,
ARISING OUT OF THE USE OF THIS SOFTWARE AND ITS DOCUMENTATION, EVEN IF
DIGI HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES.
"""
NOTE: This code allows SMS messages to be sent and received and should be
reviewed before implementing. If you allow SMS incoming messages to modify or run
commands on the device, all incoming messages should be encrypted and validated
prior to execution.
"""
import os
import threading
import sys
from digidevice.sms import Callback, send
COND = threading.Condition()

def sms_test_callback(sms, condtion):
 print(f"SMS message from {sms['from']} received")
 print(sms)
 condition.acquire()
 condition.notify()
 condition.release()

def send_sms(destination, msg):
 print("sending SMS message", msg)
 if len(destination) > 10:
 destination = "1" + destination
 send(destination, msg)

if __name__ == '__main__':
 if len(sys.argv) > 1:
 dest = sys.argv[1]
 else:
```

---

---

```

 dest = '15005550006'
 my_callback = Callback(sms_test_callback, COND)
 send_sms("+" + dest, 'Hello World!')
 print("Please send an SMS message now.")
 print("Execution halted until a message is received or 60 seconds have
passed.")
 # acquire the semaphore and wait until a callback occurs
 COND.acquire()
 try:
 COND.wait(60.0)
 except Exception as err:
 print("exception occurred while waiting")
 print(err)
 COND.release()
 my_callback.unregister_callback()

```

---

## Use Python to access serial ports

You can use the Python **serial** module to access serial ports on your EX15 device that are configured to be in Application mode. See [Configure the serial port](#) for information about configuring a serial port in Application mode.

To use Python to access serial ports:

1. Log into the EX15 command line as a user with shell access.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **shell** to access the device shell.
2. Determine the path to the serial port:

---

```

ls /dev/serial/
by-id by-path by-usb port1
#

```

---

3. At the shell prompt, use the **python** command with no parameters to enter an interactive Python session:

---

```

python
Python 3.6.12 (default, Jan 11 2021, 10:25:21)
[GCC 8.3.0] on linux
Type "help", "copyright", "credits" or "license" for more information.
>>>

```

---

4. Import the **serial** module:

---

```

>>> import serial
>>>

```

---

5. You can now perform operations on the serial port. For example, to write a message to the serial port:

---

```

>>> s = serial.Serial("/dev/serial/port1", 115200)
>>> s.write(b"Hello from serial port")
26
>>>

```

---



6. Use **Ctrl-D** to exit the Python session. You can also exit the session using **exit()** or **quit()**.

## Use the Paho MQTT python library

Your EX15 device includes support for the Paho MQTT python library. MQTT is a lightweight messaging protocol used to communicate with various applications including cloud-based applications such as Amazon Web Services and Microsoft Azure. The following is example code that reads some data from updates the device firmware, then publishes information about DHCP clients and system information to the MQTT server.

```

"""
MQTT client example:
- Reporting some device metrics from runt
- Reporting DHCP clients
- Firmware update feature (simple implementation, read TODO in cmd_fwupdate)
"""

import sys
import time
import paho.mqtt.client as mqtt
import json
from acl import runt, config
from http import HTTPStatus
import urllib.request
import tempfile
import os
from digidevice import cli

POLL_TIME = 60

def cmd_reboot(params):
 print("Rebooting unit...")
 try:
 cli.execute("reboot", 10)
 except:
 print("Failed to run 'reboot' command")
 return HTTPStatus.INTERNAL_SERVER_ERROR

return HTTPStatus.OK

def cmd_fwupdate(params):
 try:
 fw_uri = params["uri"]
 except:
 print("Firmware file URI not passed")
 return HTTPStatus.BAD_REQUEST

 print("Request to update firmware with URI: {}".format(fw_uri))

 try:
 fd, fname = tempfile.mkstemp()
 os.close(fd)
 try:
 urllib.request.urlretrieve(fw_uri, fname)
 except:
 print("Failed to download FW file from URI {}".format(fw_uri))
 return HTTPStatus.NOT_FOUND

```

---

```

 try:
 ret = cli.execute("system firmware update file " + fname, 60)
 except:
 print("Failed to run firmware update command")
 return HTTPStatus.INTERNAL_SERVER_ERROR

 if not "Firmware update completed" in ret:
 print("Failed to update firmware")
 return HTTPStatus.INTERNAL_SERVER_ERROR
 finally:
 os.remove(fname)

 print("Firmware update finished")

 return HTTPStatus.OK

CMD_HANDLERS = {
 "reboot": cmd_reboot,
 "fw-update": cmd_fwupdate
}

def send_cmd_reply(client, cmd_path, cid, cmd, status):
 if not status or not cid:
 return

 if cmd_path.startswith(PREFIX_CMD):
 path = cmd_path[len(PREFIX_CMD):]
 else:
 print("Invalid command path ({}), cannot send reply".format(cmd_path))
 return

 reply = {
 "cmd": cmd,
 "status": status
 }

 client.publish(PREFIX_RSP + path + "/" + cid, json.dumps(reply, separators=
(' ', ':')))

def on_connect(client, userdata, flags, rc):
 print("Connected to MQTT server")
 client.subscribe(PREFIX_CMD + "/system")

def on_message(client, userdata, msg):
 """ Supporting only a single topic for now, no need for filters
 Expects the following message format:
 {
 "cid": "<client-id>",
 "cmd": "<command>",
 "params": {
 <optional_parameters>
 }
 }

 Supported commands:
 - "fw-update"
 params:
 - "uri": "<firmware_file_URL>"

```

---

```

- "reboot"
 params:
 """

try:
 m = json.loads(msg.payload)
 cid = m["cid"]
 cmd = m["cmd"]
 try:
 payload = m["params"]
 except:
 payload = None
except:
 print("Invalid command format: {}".format(msg.payload))
 if not cid:
 # Return if client-ID not passed
 return None
 send_cmd_reply(client, msg.topic, cid, cmd, HTTPStatus.BAD_REQUEST)

try:
 status = CMD_HANDLERS[cmd](payload)
except:
 print("Invalid command: {}".format(cmd))
 status = HTTPStatus.NOT_IMPLEMENTED

send_cmd_reply(client, msg.topic, cid, cmd, status)

def publish_dhcp_leases():
 leases = []
 try:
 with open('/etc/config/dhcp.leases', 'r') as f:
 for line in f:
 elems = line.split()
 if len(elems) != 5:
 continue
 leases.append({"mac": elems[1], "ip": elems[2], "host": elems
[3]})
 if leases:
 client.publish(PREFIX_EVENT + "/leases", json.dumps(leases,
separators=(',', ':')))
 except:
 print("Failed to open DHCP leases file")

def publish_system():
 avg1, avg5, avg15 = runt.get("system.load_avg").split(' ')
 ram_used = runt.get("system.ram.per")
 disk_opt = runt.get("system.disk./opt.per")
 disk_config = runt.get("system.disk./etc/config.per")

 msg = json.dumps({
 "load_avg": {
 "1min": avg1,
 "5min": avg5,
 "15min": avg15
 },
 "disk_usage": {
 "/opt": disk_opt,
 "/etc/config": disk_config,
 "ram": ram_used

```

---

```

 }
})

client.publish(PREFIX_EVENT + "/system", json.dumps(msg))

runt.start()
serial = runt.get("system.serial")

PREFIX = "router/" + serial
PREFIX_EVENT = "event/" + PREFIX
PREFIX_CMD = "cmd/" + PREFIX
PREFIX_RSP = "rsp/" + PREFIX

client = mqtt.Client()
client.on_connect = on_connect
client.on_message = on_message

try:
 client.connect("192.168.1.100", 1883, 60)
 client.loop_start()
except:
 print("Failed to connect to MQTT server")
 sys.exit(1)

while True:
 publish_dhcp_leases()
 publish_system()
 time.sleep(POLL_TIME)

```

---

## Use the local REST API to configure the EX15 device

Your EX15 device includes a REST API that can be used to return information about the device's configuration and to make modifications to the configuration. You can view the REST API specification from your web browser by opening the URL:

**<https://ip-address/cgi-bin/config.cgi>**

For example:

**<https://192.168.210.1/cgi-bin/config.cgi>**

## Use the GET method to return device configuration information

To return device configuration, issue the **GET** method. For example, using **curl**:

```
$ curl -k -u admin https://ip-address/cgi-bin/config.cgi/value/path -X GET
```

---

where:

- *ip-address* is the IP address of the EX15 device.
- *path* is the path location in the configuration for the information being returned.

To determine allowed values for *path* from the Admin CLI:

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.

2. At the command line, type **config** to enter configuration mode:

---

```
> config
(config)>
```

---

3. At the config prompt, type **?** (question mark):

---

```
(config)> ?
auth Authentication
cloud Central management
firewall Firewall
monitoring Monitoring
network Network
serial Serial
service Services
system System
vpn VPN

(config)>
```

---

The allowed values for *path* are listed in the first (left) column.

4. To determine further allowed path location values by using the **?** (question mark) with the path name:

---

```
(config> service ?

Services

Additional Configuration

dns DNS
iperf IPerf
location Location
mdns Service Discovery (mDNS)
modbus_gateway Modbus Gateway
multicast Multicast
ntp NTP
ping Ping responder
snmp SNMP
ssh SSH
telnet Telnet
web_admin Web administration

(config)> service
```

---

For example, to use **curl** to return the ssh configuration:

---

```
$ curl -k -u admin https://192.168.210.1/cgi-bin/config.cgi/value/service/ssh -X
GET
Enter host password for user 'admin':
{
 ok": true,
```

---

---

```

 "result": {
 "type": "object",
 "path": "service.ssh"
 },
 "collapsed": {
 "acl.zone.0": "internal"
 },
 "acl.zone.1": "edge"
 },
 "acl.zone.2": "ipsec"
},
"acl.zone.3": "setup"
},
"enable": "true"
},
"key": ""
},
"mdns.enable": "true"
},
"mdns.name": ""
},
"mdns.type": "_ssh._tcp."
},
"port": "22"
},
"protocol.0": "tcp"
 }
}
$

```

---

You can also use the **GET** method to return the configuration parameters associated with an item:

---

```

curl -k -u admin https://192.168.210.1/cgi-bin/config.cgi/keys/service/ssh -X GET
Enter host password for user 'admin':
{ "ok": true, "result": ["acl", "enable", "key", "mdns", "port", "protocol"] }
$

```

---

## Use the POST method to modify device configuration parameters and add items to a list array

To modify configuration parameters, use the **POST** method with the **path** and **value** parameters.

---

```

$ curl -k -u admin "https://ip-address/cgi-bin/config.cgi/value?path=path&value=new_value" -X POST

```

---

where:

- *path* is the path to the configuration parameter, in dot notation (for example, **ssh.service.enable**).
- *new\_value* is the new value for the parameter.

For example, to disable the ssh service using **curl**:

---

```

$ curl -k -u admin "https://192.168.210.1/cgi-bin/config.cgi/value?path=service.ssh.enable&value=false" -X POST
Enter host password for user 'admin':

```

---

---

```
{ "ok": true }
$
```

---

To add items to a list array, use the **POST** method with the **path** and **append** parameters. For example, to add the external firewall zone to the ssh service:

---

```
$ curl -k -u admin "https://192.168.210.1/cgi-bin/config.cgi/value?path=service.ssh.acl.zone&append=true&value=external" -X POST
Enter host password for user 'admin':
{ "ok": true, "result": "service.ssh.acl.zone.4" }
$
```

---

## Use the DELETE method to remove items from a list array

To remove items from a list array, use the **DELETE** method. For example, using **curl**:

---

```
$ curl -k -u admin "https://192.168.210.1/cgi-bin/config.cgi/value?path=path"
```

---

where *path* is the path to the list item, including the list number, in dot notation (for example, **service.ssh.acl.zone.4**).

For example, to remove the external firewall zone to the ssh service:

1. Use the **GET** method to determine the SSH service's list number for the external zone:

---

```
$ curl -k -u admin "https://192.168.210.1/cgi-bin/config.cgi/value/service/ssh/acl/zone" -X GET
{
 "ok": true,
 "result": {
 "type": "array",
 "path": "service.ssh.acl.zone"
 },
 "collapsed": {
 "0": "internal",
 "1": "edge",
 "2": "ipsec",
 "3": "setup",
 "4": "external"
 }
}
```

---

2. Use the **DELETE** method to remove the external zone (list item 4).

---

```
$ curl -k -u admin https://192.168.210.1/cgi-bin/config.cgi/value?path=service.ssh.acl.zone.4 -X DELETE
Enter host password for user 'admin':
{ "ok": true }
$
```

---

## Stop a script that is currently running

You can stop a script that is currently running by using the `system script stop name` command.

### Command line

1. Log into the EX15 command line as a user with Admin access.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. Determine the name of scripts that are currently running:

```
)> system script stop
0 script1
1 script2
>
```

3. Stop the appropriate script:

```
)> system script stop script1
>
```

4. Save the configuration and apply the change:

```
(config)> save
Configuration saved.
>
```

5. Type **exit** to exit the Admin CLI.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

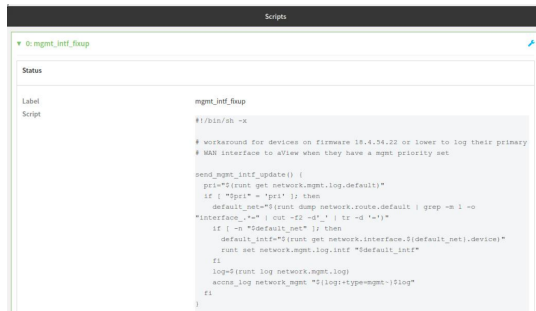
## Show script information

You can view status and statistics about location information from either the WebUI or the command line.

### WebUI

1. Log into the EX15 WebUI as a user with Admin access.
2. At the **Status** page, click **Scripts**.  
The **Scripts** page displays:





## Command line

1. Log into the EX15 command line as a user with Admin access.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.

2. Use the **show scripts** command at the system prompt:

```
> show scripts
```

| Index | Label           | Script                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Enabled | Status | Run time |
|-------|-----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|--------|----------|
| 0     | mgmt_intf_fixup | #!/bin/sh -x<br>send_mgmt_intf_update() {<br>pri="\$(run get network.mgmt.log.default)"<br>if [ "\$pri" = 'pri' ]; then<br>default_net="\$(run dump network.route.default   grep -m 1 -o<br>"interface_.*"   cut -f2 -d'_'   tr -d '=')"<br>if [ -n "\$default_net" ]; then<br>default_intf="\$(run get network.interface.\${default_net}.device)"<br>run set network.mgmt.log.intf "\$default_intf"<br>fi<br>log=\$(run log network.mgmt.log)<br>accns_log network_mgmt "\${log:+type=mgmt~}\$log"<br>fi<br>} |         |        |          |
| ...   |                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |         |        |          |

3. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## User authentication

---

This chapter contains the following topics:

|                                                                       |     |
|-----------------------------------------------------------------------|-----|
| EX15 user authentication .....                                        | 559 |
| User authentication methods .....                                     | 559 |
| Authentication groups .....                                           | 567 |
| Local users .....                                                     | 577 |
| Terminal Access Controller Access-Control System Plus (TACACS+) ..... | 590 |
| Remote Authentication Dial-In User Service (RADIUS) .....             | 596 |
| LDAP .....                                                            | 601 |
| Disable shell access .....                                            | 609 |
| Set the idle timeout for EX15 users .....                             | 611 |
| Example user configuration .....                                      | 613 |

## EX15 user authentication

User authentication on the EX15 has the following features and default configuration:

| Feature             | Description                                                                                                                                                                                                                                                                                                      | Default configuration                                                                                                                                                     |
|---------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Idle timeout</b> | Determines how long a user session can be idle before the system automatically disconnects.                                                                                                                                                                                                                      | ■ 10 minutes.                                                                                                                                                             |
| <b>Allow shell</b>  | <p>If disabled, prevents all authentication prohibits access to the shell prompt for all authentication groups. This does not prevent access to the Admin CLI.</p> <hr/> <p><b>Note</b> If shell access is disabled, re-enabling it will erase the device's configuration and perform a factory reset.</p> <hr/> | ■ Enabled.                                                                                                                                                                |
| <b>Methods</b>      | Determines how users are authenticated for access: <b>local users</b> , <b>TACACS+</b> , or <b>RADIUS</b> .                                                                                                                                                                                                      | ■ <b>local users</b> .                                                                                                                                                    |
| <b>Groups</b>       | Associates access permissions for a group. . You can modify the released groups and create additional groups as needed for your site. A user can be assigned to more than one group.                                                                                                                             | <p>■ <b>admin</b>: Provides the logged-in user with administrative and shell access.</p> <p>■ <b>serial</b>: Provides the logged-in user with access to serial ports.</p> |
| <b>Users</b>        | Defines local users for the EX15.                                                                                                                                                                                                                                                                                | ■ <b>admin</b> : Belongs to both the <b>admin</b> and <b>serial</b> groups.                                                                                               |
| <b>TACACS+</b>      | Configures support for TACACS+ (Terminal Access Controller Access-Control System Plus) servers and users.                                                                                                                                                                                                        | ■ Not configured.                                                                                                                                                         |
| <b>RADIUS</b>       | Configures support for RADIUS (Remote Authentication Dial-In User Service) servers and users.                                                                                                                                                                                                                    | ■ Not configured.                                                                                                                                                         |
| <b>LDAP</b>         | Configures support for LDAP (Lightweight Directory Access Protocol) servers and users.                                                                                                                                                                                                                           | ■ Not configured.                                                                                                                                                         |

## User authentication methods

Authentication methods determine how users of the EX15 device are authenticated. Available authentication methods are:

- **Local users:** Users are authenticated on the local device.
- **RADIUS:** Users are authenticated by using a remote RADIUS server for authentication.  
See [Remote Authentication Dial-In User Service \(RADIUS\)](#) for information about configuring RADIUS authentication.
- **TACACS+:** Users are authenticated by using a remote TACACS+ server for authentication.  
See [Terminal Access Controller Access-Control System Plus \(TACACS+\)](#) for information about configuring TACACS+ authentication.
- **LDAP:** Users are authenticated by using a remote LDAP server for authentication.  
See [LDAP](#) for information about configuring LDAP authentication.

# Add a new authentication method

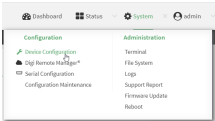
## Required configuration items

- The types of authentication method to be used:

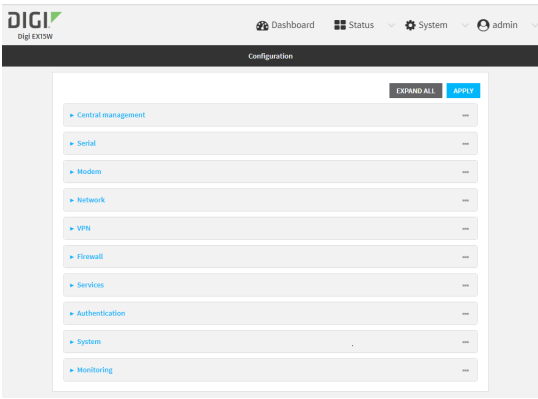
To add an authentication method:

### WebUI

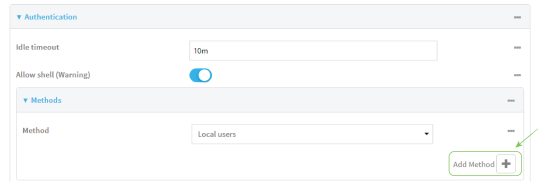
1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



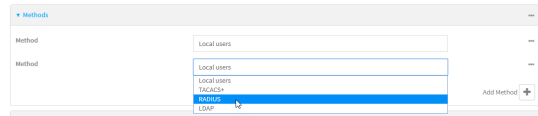
The **Configuration** window is displayed.



3. Click **Authentication > Methods**.
4. For **Add Method**, click **+**.



5. Select the appropriate authentication type for the new method from the **Method** drop-down.



**Note** Authentication methods are attempted in the order they are listed until the first successful authentication result is returned. See [Rearrange the position of authentication methods](#) for information about how to reorder the authentication methods.

6. Repeat these steps to add additional methods.
7. Click **Apply** to save the configuration and apply the change.



## Command line

Authentication methods are attempted in the order they are listed until the first successful authentication result is returned. This procedure describes how to add methods to various places in the list.

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the command line, type **config** to enter configuration mode:

```
> config
(config)>
```

3. Add the new authentication method to the appropriate location in the list:

- To determine the current list of authentication methods:

- a. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
- b. At the command line, type **config** to enter configuration mode:

```
> config
(config)>
```

- c. Use the **show auth method** command to display the current authentication methods configuration:

```
(config)> show auth method
0 local
(config)>
```

- To add the new authentication method to the beginning of the list, use the index value of **0** to indicate that it should be added as the first method:

```
(config)> add auth method 0 auth_type
(config)>
```

where *auth\_type* is one of **local**, **radius**, **tacacs+**, or **ldap**.

- To add the new authentication method to the end of the list, use the index keyword **end**:

```
(config)> add auth method end auth_type
(config)>
```

where *auth\_type* is one of **local**, **radius**, **tacacs+**, or **ldap**.

- To add the new authentication in another location in the list, use an index value to indicate the appropriate position. For example:

```
(config)> add auth method 1 auth_type
(config)>
```

where *auth\_type* is one of **local**, **radius**, **tacacs+**, or **ldap**.

- You can also use the **move** command to rearrange existing methods. See [Rearrange the position of authentication methods](#) for information about how to reorder the authentication methods.

4. Save the configuration and apply the change:

```
(config)> save
Configuration saved.
>
```

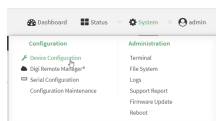
5. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

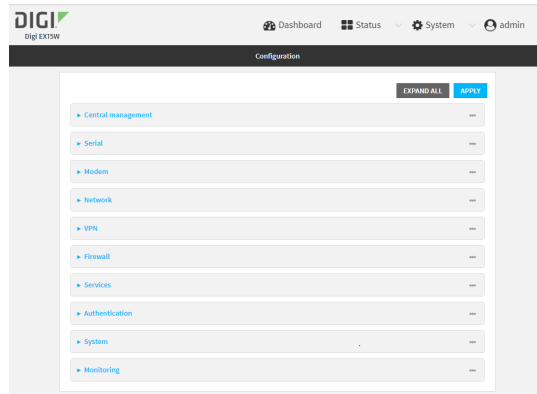
## Delete an authentication method

### WebUI

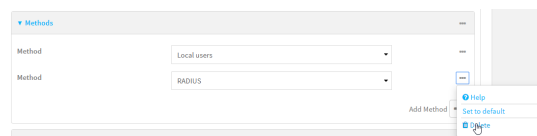
1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.



3. Click **Authentication > Methods**.
4. Click the menu icon (...) next to the method and select **Delete**.



5. Click **Apply** to save the configuration and apply the change.



## Command line

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the command line, type **config** to enter configuration mode:

```
> config
(config)>
```

3. Use the **show auth method** command to determine the index number of the authentication method to be deleted:

```
(config)> show auth method
0 local
1 radius
2 tacacs+
(config)>
```

4. Delete the appropriate authentication method:

```
(config)> del auth method n
```



Where  $n$  is index number of the authentication method to be deleted. For example, to delete the TACACS+ authentication method as displayed by the example **show** command, above:

```
(config)> del auth method 2
```

5. Save the configuration and apply the change:

```
(config)> save
Configuration saved.
>
```

6. Type **exit** to exit the Admin CLI.

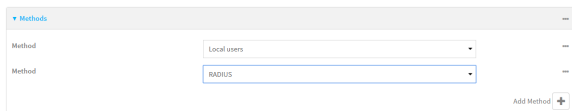
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Rearrange the position of authentication methods

### WebUI

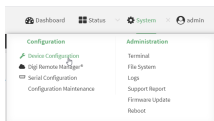
Authentication methods are reordered by changing the method type in the **Method** drop-down for each authentication method to match the appropriate order.

For example, the following configuration has **Local users** as the first method, and **RADIUS** as the second.

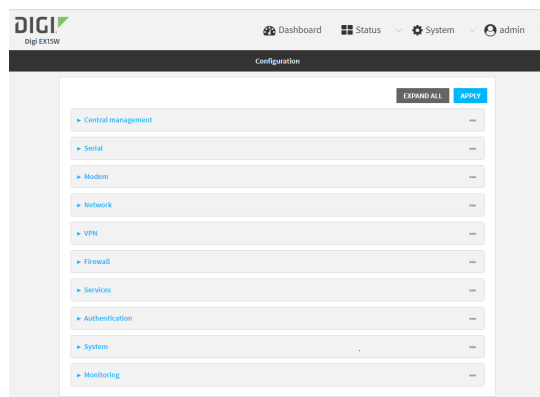


To reorder these so that **RADIUS** is first and **Local users** is second:

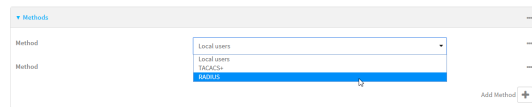
1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



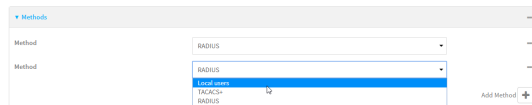
The **Configuration** window is displayed.



- Click to expand the first **Method**.
- In the **Method** drop-down, select **RADIUS**.



- Click to expand the second **Method**.
- In the **Method** drop-down, select **Local users**.



- Click **Apply** to save the configuration and apply the change.



## Command line

- Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
- At the command line, type **config** to enter configuration mode:

```
> config
(config)>
```

- Use the **show** command to display current configuration:

```
(config)> show auth method
0 local
1 radius
(config)>
```

- Use the **move** command to rearrange the methods:

```
(config)> move auth method 1 0
(config)>
```

- Use the **show** command again to verify the change:

```
(config)> show auth method
0 radius
1 local
(config)>
```

- 6. Save the configuration and apply the change:

```
(config)> save
Configuration saved.
>
```

- 7. Type **exit** to exit the Admin CLI.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Authentication groups

Authentication groups are used to assign access rights to EX15 users. Three types of access rights can be assigned:

- **Admin access:** Users with Admin access can be configured to have either:
  - The ability to manage the EX15 device by using the WebUI or the Admin CLI.
  - Read-only access to the WebUI and Admin CLI.
- **Shell access:** Users with Shell access have the ability to access the shell when logging into the EX15 via ssh, telnet, or the serial console.  
Shell access is not available if the **Allow shell** parameter has been disabled. See [Disable shell access](#) for more information about the **Allow shell** parameter.
- **Serial access:** Users with Serial access have the ability to log into the EX15 device by using the serial console.

### Preconfigured authentication groups

The EX15 device has two preconfigured authentication groups:

- The **admin** group is configured by default to have full **Admin access** and **Shell access**.  
Shell access is not available if the **Allow shell** parameter has been disabled. See [Disable shell access](#) for more information about the **Allow shell** parameter.
- The **serial** group is configured by default to have **Serial access**.

The preconfigured authentication groups cannot be deleted, but the access rights defined for the group are configurable.

This section contains the following topics:

Change the access rights for a predefined group .....568

Add an authentication group .....570

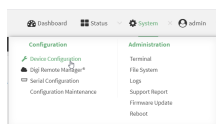
Delete an authentication group .....574

## Change the access rights for a predefined group

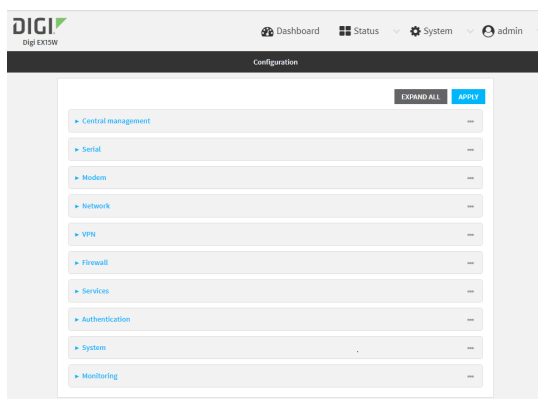
By default, two authentication groups are predefined: **admin** and **serial**. To change the access rights of the predefined groups:

### WebUI

1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.



3. Click **Authentication > Groups**.
4. Click the authentication group to be changed, either **admin** or **serial**, to expand its configuration node.
5. Click the box next to the following options, as appropriate, to enable or disable access rights for each:

#### ■ Admin access

For groups assigned Admin access, you can also determine whether the **Access level** should be **Full access** or **Read-only access**.

- **Full access** provides users of this group with the ability to manage the EX15 device by using the WebUI or the Admin CLI.
- **Read-only access** provides users of this group with read-only access to the WebUI and Admin CLI.

The default is **Full access**.

#### ■ Interactive shell access

Shell access is not available if the **Allow shell** parameter has been disabled. See [Disable shell access](#) for more information about the **Allow shell** parameter.

#### ■ Serial access

6. Click **Apply** to save the configuration and apply the change.

## Command line

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the command line, type **config** to enter configuration mode:

```
> config
(config)>
```

3. Enable or disable access rights for the group. For example:

- Admin access:

- To set the access level for Admin access of the **admin** group:

```
(config)> auth group admin acl admin level value
(config)>
```

where *value* is either:

- **full**: provides users of this group with the ability to manage the EX15 device by using the WebUI or the Admin CLI.
- **read-only**: provides users of this group with read-only access to the WebUI and Admin CLI.

The default is **full**.

- To disable Admin access for the **admin** group:

---

```
(config)> auth group admin acl admin enable false
(config)>
```

---

- Shell access:

- To enable Shell access for the **serial** group:

---

```
(config)> auth group serial acl shell enable true
(config)>
```

---

Shell access is not available if the **Allow shell** parameter has been disabled. See [Disable shell access](#) for more information about the **Allow shell** parameter.

- Serial access:

- To enable Serial access for the **admin** group:

---

```
(config)> auth group admin acl serial enable true
(config)>
```

---

4. Save the configuration and apply the change:

---

```
(config)> save
Configuration saved.
>
```

---

5. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Add an authentication group

### Required configuration items

- The access rights to be assigned to users that are assigned to this group.

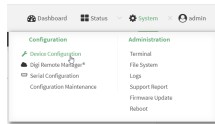
### Additional configuration items

- Access rights to OpenVPN tunnels, and the tunnels to which they have access.
- Access rights to captive portals, and the portals to which they have access.
- Access rights to query the device for Nagios monitoring.

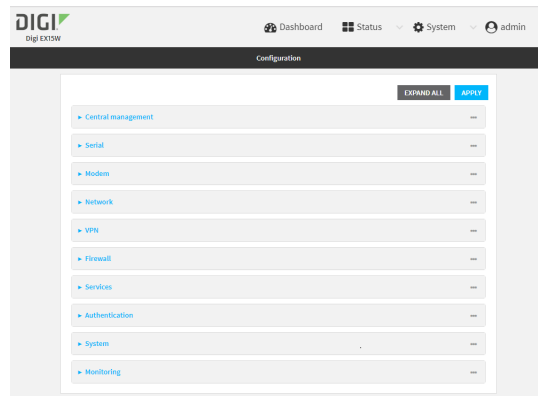
To add an authentication group:



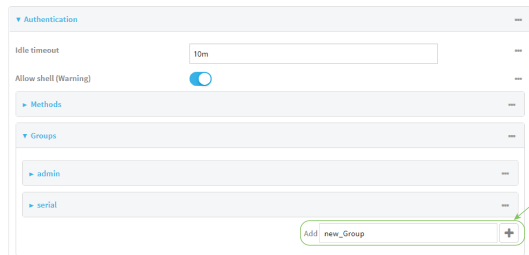
1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.



3. Click **Authentication > Groups**.
4. For **Add**, type a name for the group and click **+**.



The group configuration window is displayed.



5. Click the following options, as appropriate, to enable or disable access rights for each:

■ **Admin access**

For groups assigned Admin access, you can also determine whether the **Access level** should be **Full access** or **Read-only access**.

where *value* is either:

- **Full access full**: provides users of this group with the ability to manage the EX15 device by using the WebUI or the Admin CLI.
- **Read-only access read-only**: provides users of this group with read-only access to the WebUI and Admin CLI.

The default is **Full access full**.

#### ■ Shell access

Shell access is not available if the **Allow shell** parameter has been disabled. See [Disable shell access](#) for more information about the **Allow shell** parameter.

#### ■ Serial access

- (Optional) Configure OpenVPN access. See for further information.
- (Optional) Configure captive portal access:
  - Enable captive portal access rights for users of this group by checking the box next to **Captive portal access**.
  - Click **Captive portals** to expand the **Captive portal** node.
  - For **Add Captive portal**, click **+**.
  - In the **Captive portal** dropdown, select a captive portal to which users of this group will have access.
  - Click **+** again to add additional captive portals.
- (Optional) Enable users that belong to this group to query the device for Nagios monitoring by checking the box next to **Nagios access**.
- (Optional) Enable users that belong to this group to access the Bluetooth scanning service by checking the box next to **Bluetooth scanner access**.
- (Optional) Enable users that belong to this group to access the Wi-Fi scanning service by checking the box next to **Wi-Fi scanner access**.
- Click **Apply** to save the configuration and apply the change.



## Command line

- Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.

- At the command line, type **config** to enter configuration mode:

```
> config
(config)>
```

- Use the **add auth group** command to add a new authentication. For example, to add a group named **test**:



---

```
(config)> add auth group test
(config auth group test)>
```

---

4. Enable access rights for the group:

■ Admin access:

---

```
(config auth group test)> acl admin enable true
(config)>
```

---

■ Set the access level for Admin access:

---

```
(config)> auth group admin acl admin level value
(config)>
```

---

where *value* is either:

- **full**: provides users of this group with the ability to manage the EX15 device by using the WebUI or the Admin CLI.
- **read-only**: provides users of this group with read-only access to the WebUI and Admin CLI.

The default is **full**.

■ Shell access:

---

```
(config auth group test)> acl shell enable true
(config)>
```

---

Shell access is not available if the **Allow shell** parameter has been disabled. See [Disable shell access](#) for more information about the **Allow shell** parameter.

■ Serial access:

---

```
(config auth group test)> acl serial enable true
(config)>
```

---

5. (Optional) Configure captive portal access:

a. Return to the config prompt by typing three periods (...):

---

```
(config auth group test)> ...
(config)>
```

---

b. Enable captive portal access rights for users of this group:

---

```
(config)> auth group test acl portal enable true
(config)>
```

---

c. Add a captive portal to which users of this group will have access:

i. Determine available portals:

---

```
(config)> show firewall portal
portal1
 auth none
 enable true
```

---

---

```
http redirect
no interface
no message
no redirect_url
no terms
timeout 24h
no title
(config)>
```

---

ii. Add a captive portal:

---

```
(config)> add auth group test acl portal portals end portal1
(config)>
```

---

6. (Optional) Configure Nagios monitoring:

---

```
(config)> auth group test acl nagios enable true
(config)>
```

---

7. (Optional) Enable users that belong to this group to access the Bluetooth scanning service:

---

```
(config)> auth group test acl bluetooth_scanner enable true
(config)>
```

---

8. (Optional) Enable users that belong to this group to access the Wi-Fi scanning service:

---

```
(config)> auth group group test acl wifi_scanner enable true
(config)>
```

---

9. Save the configuration and apply the change:

---

```
(config)> save
Configuration saved.
>
```

---

10. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

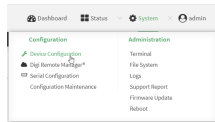
## Delete an authentication group

By default, the EX15 device has two preconfigured authentication groups: **admin** and **serial**. These groups cannot be deleted.

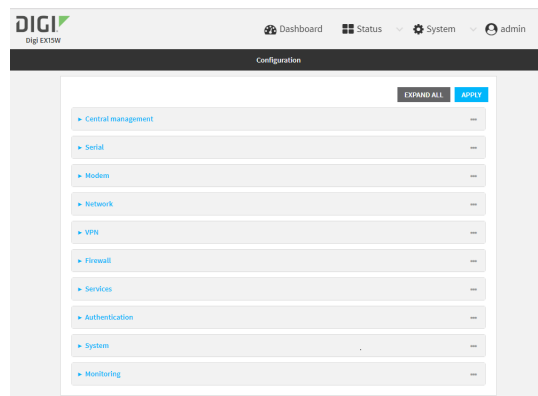
To delete an authentication group that you have created:



1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.



3. Click **Authentication > Groups**.
4. Click the menu icon (...) next to the group to be deleted and select **Delete**.



5. Click **Apply** to save the configuration and apply the change.



## Command line

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the command line, type **config** to enter configuration mode:

```
> config
(config)>
```

3. At the config prompt, type:

```
(config)> del auth group groupname
```

4. Save the configuration and apply the change:

---

```
(config)> save
Configuration saved.
>
```

---

5. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

# Local users

Local users are authenticated on the device without using an external authentication mechanism such as TACACS+ or RADIUS. Local user authentication is enabled by default, with one preconfigured default user.

## Default user

At manufacturing time, each EX15 device comes with a default user configured as follows:

- Username: **admin**.
- Password: The default password is displayed on the label on the bottom of the device.

**Note** The default password is a unique password for the device, and is the most critical security feature for the device. If you reset the device to factory defaults, you must log in using the default user and password, and you should immediately [change the password](#) to a custom password. Before deploying or mounting the EX15 device, record the default password, so you have the information available when you need it even if you cannot physically access the label on the bottom of the device.

The default **admin** user is preconfigured with both Admin and Serial access. You can configure the **admin** user account to fit with the needs of your environment.

This section contains the following topics:

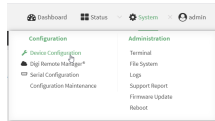
|                                      |     |
|--------------------------------------|-----|
| Change a local user's password ..... | 578 |
| Configure a local user .....         | 580 |
| Delete a local user .....            | 587 |

## Change a local user's password

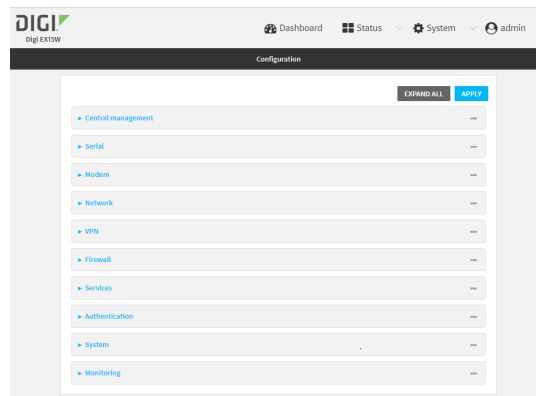
To change a user's password:

### WebUI

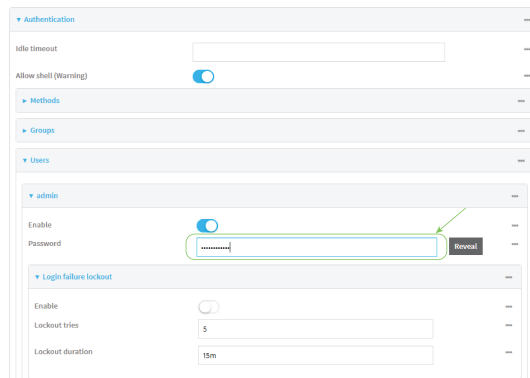
1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



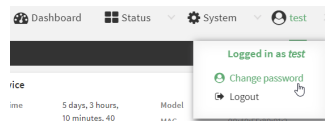
The **Configuration** window is displayed.



3. Click **Authentication > Users**.
4. Click the username to expand the user's configuration node.
5. For **Password**, enter the new password. The password must be at least ten characters long and must contain at least one uppercase letter, one lowercase letter, one number, and one special character.



You can also change the password for the active user by clicking the user name in the menu bar:



The active user must have full Admin access rights to be able to change the password.

6. Click **Apply** to save the configuration and apply the change.



 **Command line**

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.

2. At the command line, type **config** to enter configuration mode:

---

```
> config
(config)>
```

---

3. At the config prompt, type:

---

```
(config)> auth user username password pwd
```

---

Where:

- *username* is the name of the user.
- *pwd* is the new password for the user. The password must be at least ten characters long and must contain at least one uppercase letter, one lowercase letter, one number, and one special character.

4. Save the configuration and apply the change:

---

```
(config)> save
Configuration saved.
>
```

---

5. Type **exit** to exit the Admin CLI.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Configure a local user

### Required configuration items

- A username.
- A password. The password must be at least ten characters long and must contain at least one uppercase letter, one lowercase letter, one number, and one special character. For security reasons, passwords are stored in hash form. There is no way to get or display passwords in clear-text form, although prior to saving the configuration, the password can be shown by clicking **Reveal**.
- The authentication group or groups from which the user will inherit access rights. See [Authentication groups](#) for information about configuring groups.

### Additional configuration items

- The number of unsuccessful login attempts before the user is locked out of the system.
- The amount of time that the user is locked out of the system after the specified number of unsuccessful login attempts.
- An optional public ssh key, to authenticate the user when using passwordless SSH login.

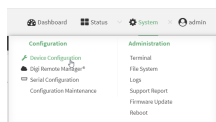


- Two-factor authentication information for user login over SSH, telnet, and the serial console:
  - The verification type for two-factor authentication: Either time-based or counter-based.
  - The security key.
  - Whether to allow passcode reuse (time based verification only).
  - The passcode refresh interval (time based verification only).
  - The valid code window size.
  - The login limit.
  - The login limit period.
  - One-time use eight-digit emergency scratch codes.

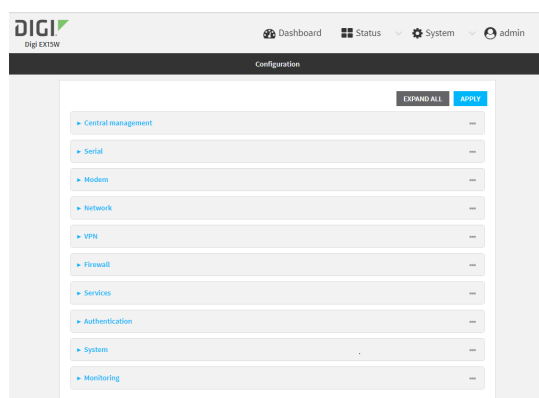
To configure a local user:

## WebUI

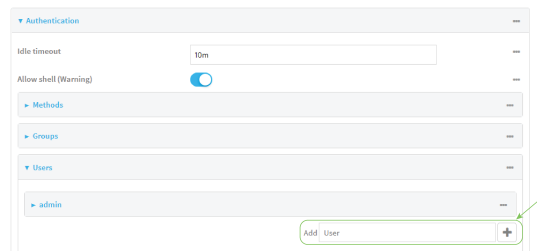
1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.



3. Click **Authentication > Users**.
4. In **Add User**, type a name for the user and click **+**.



The user configuration window is displayed.

The user is enabled by default. To disable, click to toggle off **Enable**.

5. Enter a password for the user. The password must be at least ten characters long and must contain at least one uppercase letter, one lowercase letter, one number, and one special character.
6. Click to expand **Login failure lockdown**.

The login failure lockdown feature is enabled by default. To disable, click to toggle off **Enable**.

- a. For **Lockout tries**, type the number of unsuccessful login attempts before the user is locked out of the device. The default is **5**.
- b. For **Lockout duration**, type the amount of time that the user is locked out after the number of unsuccessful login attempts defined in **Lockout tries**.

Allowed values are any number of minutes, or seconds, and take the format **number{m|s}**.

For example, to set **Lockout duration** to ten minutes, enter **10m** or **600s**.

The minimum value is 1 second, and the maximum is 15 minutes. The default is 15 minutes.

7. Add groups for the user.

Groups define user access rights. See [Authentication groups](#) for information about configuring groups.

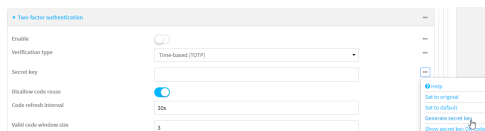
- a. Click to expand **Groups**.
- b. For **Add Group**, click **+**.

- c. For **Group**, select an appropriate group.

**Note** Every user must be configured with at least one group. You can add multiple groups to a user by clicking **Add** again and selecting the next group.

8. (Optional) Add SSH keys for the user to use passwordless SSH login:
  - a. Click **SSH keys**.
  - b. In **Add SSH key**, paste or type a public encryption key that this user can use for passwordless SSH login and click **+**.
9. (Optional) Configure two-factor authentication for SSH, telnet, and serial console login:

- a. Click **Two-factor authentication**.
- b. Check **Enable** to enable two-factor authentication for this user.
- c. Select the **Verification type**:
  - **Time-based (TOTP)**: Time-based One-Time Password (TOTP) authentication uses the current time to generate a one-time password.
  - **Counter-based (HOTP)**: HMAC-based One-Time Password (HOTP) uses a counter to validate a one-time password.
- d. Generate a **Secret key**:
  - i. Click ... next to the field label and select **Generate secret key**.



- ii. To display the QR code for the secret key, click ... next to the field label and select **Show secret key QR code**.
- iii. Copy the secret key, or scan or copy the QR code, for use with an application or mobile device to generate passcodes.

---

**Note** To copy the QR code, right-click the QR code and select your browser's save image functionality.

---

- e. For time-based verification only, select **Disallow code reuse** to prevent a code from being used more than once during the time that it is valid.
- f. For time-based verification only, in **Code refresh interval**, type the amount of time that a code will remain valid.  
 Allowed values are any number of weeks, days, hours, minutes, or seconds, and take the format **number{w|d|h|m|s}**. For example, to set **Code refresh interval** to ten minutes, enter **10m** or **600s**.
- g. In **Valid code window size**, type the allowed number of concurrently valid codes. In cases where TOTP is being used, increasing the **Valid code window size** may be necessary when the clocks used by the server and client are not synchronized.
- h. For **Login limit**, type the number of times that the user is allowed to attempt to log in during the **Login limit period**. Set **Login limit** to **0** to allow an unlimited number of login attempts during the **Login limit period**.
- i. For **Login limit period**, type the amount of time that the user is allowed to attempt to log in.  
 Allowed values are any number of weeks, days, hours, minutes, or seconds, and take the format **number{w|d|h|m|s}**. For example, to set **Login limit period** to ten minutes, enter **10m** or **600s**.
- j. Scratch codes are emergency codes that may be used once, at any time. To add a scratch code:
  - i. Click **Scratch codes**.
  - ii. For **Add Code**, click **+**.

- iii. For **Code**, enter the scratch code. The code must be eight digits, with a minimum of 10000000.
  - iv. Click **+** again to add additional scratch codes.
10. Click **Apply** to save the configuration and apply the change.



## Command line

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the command line, type **config** to enter configuration mode:

```
> config
(config)>
```

3. Add a user. For example, to create a user named **new\_user**:

```
(config)> add auth user new_user
(config auth user new_user)>
```

The user is enabled by default. To disable the user, type:

```
(config auth user new_user)> enable false
(config auth user new_user)>
```

4. Set the user's password. The password must be at least ten characters long and must contain at least one uppercase letter, one lowercase letter, one number, and one special character.

```
(config auth user new_user> password pwd
(config auth user new_user)>
```

5. Configure login failure lockout settings:

The login failure lockout feature is enabled by default. To disable:

```
(config auth user new_user> lockout enable false
(config auth user new_user)>
```

- a. Set the number of unsuccessful login attempts before the user is locked out of the device.  
where *value* is any integer. The minimum value is **1**, and the default value is **5**.
- b. Set the amount of time that the user is locked out after the number of unsuccessful login attempts defined in **lockout tries**:

```
(config auth user new_user> lockout duration value
(config auth user new_user)>
```

where *value* is any number of minutes, or seconds, and takes the format **number{m}s**.

For example, to set **duration** to ten minutes, enter either **10m** or **600s**:

---

```
(config auth user new_user)> lockout duration 600s
(config auth user new_user)>
```

---

The minimum value is 1 second, and the maximum is 15 minutes. The default is 15 minutes.

6. Add groups for the user.

Groups define user access rights. See [Authentication groups](#) for information about configuring groups.

- a. Add a group to the user. For example, to add the admin group to the user:

---

```
(config auth user new_user> add group end admin
(config auth user new_user)>
```

---

**Note** Every user must be configured with at least one group.

---

- b. (Optional) Add additional groups by repeating the add group command:

---

```
(config auth user new_user> add group end serial
(config auth user new_user)>
```

---

To remove a group from a user:

- a. Use the **show** command to determine the index number of the group to be deleted:

---

```
(config auth user new_user> show group
0 admin
1 serial
(config auth user new_user>
```

---

- b. Type the following:

---

```
(config auth user new_user)> del group n
(config auth user new_user)>
```

---

Where *n* is index number of the authentication method to be deleted. For example, to delete the serial group as displayed by the example **show** command, above:

---

```
(config auth user new_user)> del group 1
(config auth user new_user)>
```

---

7. (Optional) Add SSH keys for the user to use passwordless SSH login:

- a. Change to the user's ssh\_key node:

---

```
(config auth user new_user)> ssh_key
(config auth user new_user ssh_key)>
```

---

- b. Add the key by using the ssh\_key command and pasting or typing a public encryption key that this user can use for passwordless SSH login:

---

```
(config auth user new_user ssh_key)> ssh_key key
(config auth user new_user ssh_key)>
```

---

## 8. (Optional) Configure two-factor authentication for SSH, telnet, and serial console login:

## a. Change to the user's two-factor authentication node:

---

```
(config auth user new_user)> 2fa
(config auth user new_user 2fa)>
```

---

## b. Enable two-factor authentication for this user:

---

```
(config auth user new_user 2fa)> enable true
(config auth user new_user 2fa)>
```

---

## c. Configure the verification type. Allowed values are:

- **totp**: Time-based One-Time Password (TOTP) authentication uses the current time to generate a one-time password.
- **hotp**: HMAC-based One-Time Password (HOTP) uses a counter to validate a one-time password.

The default value is **totp**.

---

```
(config auth user new_user 2fa)> type totp
(config auth user new_user 2fa)>
```

---

## d. Add a secret key:

---

```
(config auth user new_user 2fa)> secret key
(config auth user new_user 2fa)>
```

---

This key should be used by an application or mobile device to generate passcodes.

e. For time-based verification only, enable **disallow\_reuse** to prevent a code from being used more than once during the time that it is valid.

---

```
(config auth user new_user 2fa)> disallow_reuse true
(config auth user new_user 2fa)>
```

---

## f. For time-based verification only, configure the code refresh interval. This is the amount of time that a code will remain valid.

---

```
(config auth user new_user 2fa)> refresh_interval value
(config auth user new_user 2fa)>
```

---

where *value* is any number of weeks, days, hours, minutes, or seconds, and takes the format **number{w|d|h|m|s}**.

For example, to set **refresh\_interval** to ten minutes, enter either **10m** or **600s**:

---

```
(config auth user name 2fa)> refresh_interval 600s
(config auth user name 2fa)>
```

---

The default is **30s**.

## g. Configure the valid code window size. This represents the allowed number of concurrently valid codes. In cases where TOTP is being used, increasing the valid code window size may be necessary when the clocks used by the server and client are not synchronized.

---

```
(config auth user new_user 2fa)> window_size 3
(config auth user new_user 2fa)>
```

---

- h. Configure the login limit. This represents the number of times that the user is allowed to attempt to log in during the Login limit period. Set to 0 to allow an unlimited number of login attempts during the Login limit period

---

```
(config auth user new_user 2fa)> login_limit 3
(config auth user new_user 2fa)>
```

---

- i. Configure the login limit period. This is the amount of time that the user is allowed to attempt to log in.

---

```
(config auth user new_user 2fa)> login_limit_period value
(config auth user new_user 2fa)>
```

---

where *value* is any number of weeks, days, hours, minutes, or seconds, and takes the format **number{w|d|h|m|s}**.

For example, to set **login\_limit\_period** to ten minutes, enter either **10m** or **600s**:

---

```
(config auth user name 2fa)> login_limit_period 600s
(config auth user name 2fa)>
```

---

The default is **30s**.

- j. Scratch codes are emergency codes that may be used once, at any time. To add a scratch code:

- i. Change to the user's scratch code node:

---

```
(config auth user new_user 2fa)> scratch_code
(config auth user new_user 2fa scratch_code)>
```

---

- ii. Add a scratch code:

---

```
(config auth user new_user 2fa scratch_code)> add end code
(config auth user new_user 2fa scratch_code)>
```

---

Where code is an digit number, with a minimum of 10000000.

- iii. To add additional scratch codes, use the **add end code** command again.

9. Save the configuration and apply the change:

---

```
(config auth user new 2fa scratch_code)> save
Configuration saved.
>
```

---

10. Type **exit** to exit the Admin CLI.

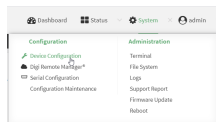
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Delete a local user

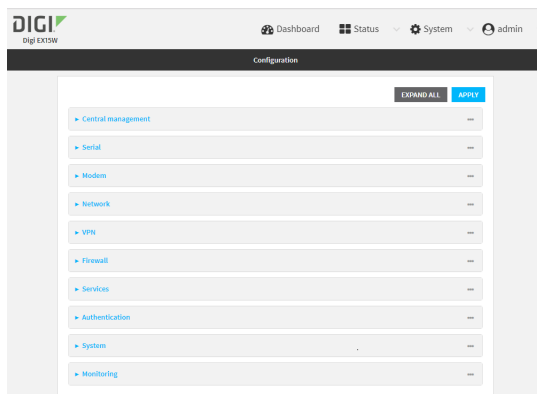
To delete a user from your EX15:



1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.



3. Click **Authentication > Users**.
4. Click the menu icon (...) next to the name of the user to be deleted and select **Delete**.



5. Click **Apply** to save the configuration and apply the change.





 **Command line**

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the command line, type **config** to enter configuration mode:  

---

```
> config
(config)>
```

---
3. At the config prompt, type:  

---

```
(config)> del auth user username
```

---
4. Save the configuration and apply the change:  

---

```
(config)> save
Configuration saved.
>
```

---
5. Type **exit** to exit the Admin CLI.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

# Terminal Access Controller Access-Control System Plus (TACACS+)

Your EX15 device supports Terminal Access Controller Access-Control System Plus (TACACS+), a networking protocol that provides centralized authentication and authorization management for users who connect to the device. With TACACS+ support, the EX15 device acts as a TACACS+ client, which sends user credentials and connection parameters to a TACACS+ server over TCP. The TACACS+ server then authenticates the TACACS+ client requests and sends back a response message to the device.

When you are using TACACS+ authentication, you can have both local users and TACACS+ users able to log in to the device. To use TACACS+ authentication, you must set up a TACACS+ server that is accessible by the EX15 device prior to configuration. The process of setting up a TACACS+ server varies by the server environment.

This section contains the following topics:

|                                                                    |     |
|--------------------------------------------------------------------|-----|
| TACACS+ user configuration .....                                   | 591 |
| TACACS+ server failover and fallback to local authentication ..... | 592 |
| Configure your EX15 device to use a TACACS+ server .....           | 592 |

## TACACS+ user configuration

When configured to use TACACS+ support, the EX15 device uses a remote TACACS+ server for user authentication (password verification) and authorization (assigning the access level of the user). Additional TACACS+ servers can be configured as backup servers for user authentication.

This section outlines how to configure a TACACS+ server to be used for user authentication on your EX15 device.

### Example TACACS+ configuration

With TACACS+, users are defined in the server configuration file. On Ubuntu, the default location and filename for the server configuration file is **/etc/tacacs+/tac\_plus.conf**.

**Note** TACACS+ configuration, including filenames and locations, may vary depending on your platform and installation. This example assumes a Ubuntu installation.

To define users:

1. Open the TACACS+ server configuration file in a text editor. For example:

```
$ sudo gedit /etc/tacacs+/tac_plus.conf
```

2. Add users to the file using the following format. This example will create two users, one with admin and serial access, and one with only serial access.

```
user = user1 {
 name = "User1 for EX15"
 pap = cleartext password1
 service = system {
 groupname = admin,serial
 }
}
user = user2 {
 name = "User2 for EX15"
 pap = cleartext password2
 service = system {
 groupname = serial
 }
}
```

The **groupname** attribute is optional. If used, the value must correspond to authentication groups configured on your EX15. Alternatively, if the user is also configured as a local user on the EX15 device and the LDAP server authenticates the user but does not return any groups, the local configuration determines the list of groups. See [Authentication groups](#) for more information about authentication groups. The **groupname** attribute can contain one group or multiple groups in a comma-separated list.

3. Save and close the file.
4. Verify that your changes did not introduce any syntax errors:

```
$ sudo tac_plus -C /etc/tacacs+/tac_plus.conf -P
```

If successful, this command will echo the configuration file to standard out. If the command encounters any syntax errors, a message similar to this will display:

---

```
Error: Unrecognised token on line 1
```

---

5. Restart the TACACS+ server:

---

```
$ sudo /etc/init.d/tacacs_plus restart
```

---

## TACACS+ server failover and fallback to local authentication

In addition to the primary TACACS+ server, you can also configure your EX15 device to use backup TACACS+ servers. Backup TACACS+ servers are used for authentication requests when the primary TACACS+ server is unavailable.

### *Falling back to local authentication*

With user authentication methods, you can configure your EX15 device to use multiple types of authentication. For example, you can configure both TACACS+ authentication and local authentication, so that local authentication can be used as a fallback mechanism if the primary and backup TACACS+ servers are unavailable. Additionally, users who are configured locally but are not configured on the TACACS+ server are still able to log into the device. Authentication methods are attempted in the order they are listed until the first successful authentication result is returned; therefore if you want to ensure that users are authenticated first through the TACACS+ server, and only authenticated locally if the TACACS+ server is unavailable or if the user is not defined on the TACACS+ server, then you should list the TACACS+ authentication method prior to the Local users authentication method.

See [User authentication methods](#) for more information about authentication methods.

If the TACACS+ servers are unavailable and the EX15 device falls back to local authentication, only users defined locally on the device are able to log in. TACACS+ users cannot log in until the TACACS+ servers are brought back online.

## Configure your EX15 device to use a TACACS+ server

This section describes how to configure a EX15 device to use a TACACS+ server for authentication and authorization.

### Required configuration items

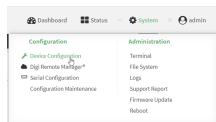
- Define the TACACS+ server IP address or domain name.
- Define the TACACS+ server shared secret.
- The group attribute configured in the TACACS+ server configuration.
- The service field configured in the TACACS+ server configuration.
- Add TACACS+ as an authentication method for your EX15 device.

### Additional configuration items

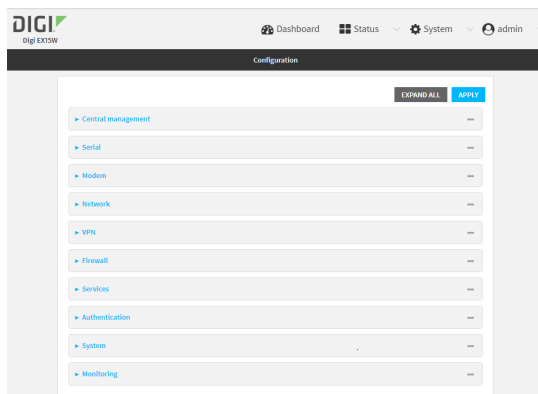
- Whether other user authentication methods should be used in addition to the TACACS+ server, or if the TACACS+ server should be considered the authoritative login method.
- The TACACS+ server port. It is configured to 49 by default.
- Add additional TACACS+ servers in case the first TACACS+ server is unavailable.



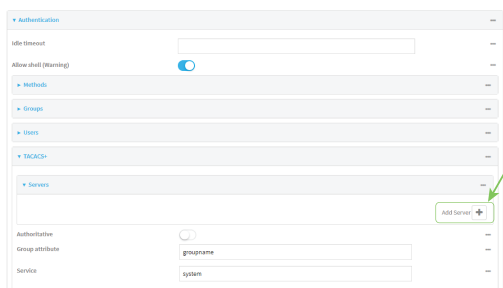
1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.



3. Click **Authentication > TACACS+ > Servers**.
4. Add TACACS+ servers:
  - a. For **Add server**, click **+**.

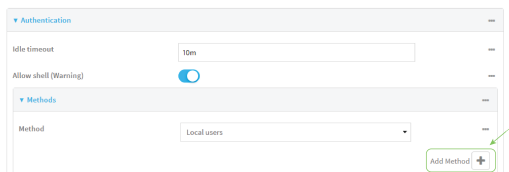


- b. For **Hostname**, type the hostname or IP address of the TACACS+ server.
  - c. (Optional) Change the default **Port** setting to the appropriate port. Normally this should be left at the default setting of port 49.
  - d. For **Secret**, type the TACACS+ server's shared secret. This is configured in the key parameter of the TACACS+ server's tac\_plus.conf file, for example:
 

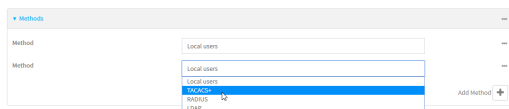
```
key = testing123
```
  - e. (Optional) Click **+** again to add additional TACACS+ servers.
5. (Optional) Enable **Authoritative** to prevent other authentication methods from being used if TACACS+ authentication fails. Other authentication methods will only be used if the TACACS+ server is unavailable.
  6. (Optional) For **Group attribute**, type the name of the attribute used in the TACACS+ server's configuration to identify the EX15 authentication group or groups that the user is a member of.

For example, in [TACACS+ user configuration](#), the group attribute in the sample tac\_plus.conf file is **groupname**, which is also the default setting in the EX15 configuration.

7. (Optional) For **Service**, type the value of the **service** attribute in the the TACACS+ server's configuration. For example, in [TACACS+ user configuration](#), the value of the **service** attribute in the sample tac\_plus.conf file is **system**, which is also the default setting in the EX15 configuration.
8. Add TACACS+ to the authentication methods:
  - a. Click **Authentication > Methods**.
  - b. For **Add method**, click **+**.



- c. Select **TACACS+** for the new method from the **Method** drop-down.



Authentication methods are attempted in the order they are listed until the first successful authentication result is returned. See [Rearrange the position of authentication methods](#) for information about rearranging the position of the methods in the list.

9. Click **Apply** to save the configuration and apply the change.



## Command line

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the command line, type **config** to enter configuration mode:

```
> config
(config)>
```

3. (Optional) Prevent other authentication methods from being used if TACACS+ authentication fails. Other authentication methods will only be used if the TACACS+ server is unavailable.

```
(config)> auth tacacs+ authoritative true
(config)>
```

4. (Optional) Configure the group\_attribute. This is the name of the attribute used in the TACACS+ server's configuration to identify the EX15 authentication group or groups that the

user is a member of. For example, in [TACACS+ user configuration](#), the group attribute in the sample tac\_plus.conf file is **groupname**, which is also the default setting for the group\_ attribute in the EX15 configuration.

---

```
(config)> auth tacacs+ group_attribute attribute-name
(config)>
```

---

5. (Optional) Configure the type of service. This is the value of the **service** attribute in the the TACACS+ server's configuration. For example, in [TACACS+ user configuration](#), the value of the **service** attribute in the sample tac\_plus.conf file is **system**, which is also the default setting in the EX15 configuration.

---

```
(config)> auth tacacs+ service service-name
(config)>
```

---

6. Add a TACACS+ server:

- a. Add the server:

---

```
(config)> add auth tacacs+ server end
(config auth tacacs+ server 0)>
```

---

- b. Enter the TACACS+ server's IP address or hostname:

---

```
(config auth tacacs+ server 0)> hostname hostname|ip-address
(config auth tacacs+ server 0)>
```

---

- c. (Optional) Change the default port setting to the appropriate port:

---

```
(config auth tacacs+ server 0)> port port
(config auth tacacs+ server 0)>
```

---

- d. (Optional) Repeat the above steps to add additional TACACS+ servers.

7. Add TACACS+ to the authentication methods. Authentication methods are attempted in the order they are listed until the first successful authentication result is returned. This example will add TACACS+ to the end of the list. See [User authentication methods](#) for information about adding methods to the beginning or middle of the list.

---

```
(config)> add auth method end tacacs+
(config)>
```

---

8. Save the configuration and apply the change:

---

```
(config)> save
Configuration saved.
>
```

---

9. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

# Remote Authentication Dial-In User Service (RADIUS)

Your EX15 device supports Remote Authentication Dial-In User Service (RADIUS), a networking protocol that provides centralized authentication and authorization management for users who connect to the device. With RADIUS support, the EX15 device acts as a RADIUS client, which sends user credentials and connection parameters to a RADIUS server over UDP. The RADIUS server then authenticates the RADIUS client requests and sends back a response message to the device.

When you are using RADIUS authentication, you can have both local users and RADIUS users able to log in to the device. To use RADIUS authentication, you must set up a RADIUS server that is accessible by the EX15 device prior to configuration. The process of setting up a RADIUS server varies by the server environment. An example of a RADIUS server is FreeRADIUS.

This section contains the following topics:

|                                                                  |     |
|------------------------------------------------------------------|-----|
| RADIUS user configuration .....                                  | 597 |
| RADIUS server failover and fallback to local configuration ..... | 597 |
| Configure your EX15 device to use a RADIUS server .....          | 598 |



## RADIUS user configuration

When configured to use RADIUS support, the EX15 device uses a remote RADIUS server for user authentication (password verification) and authorization (assigning the access level of the user). Additional RADIUS servers can be configured as backup servers for user authentication.

This section outlines how to configure a RADIUS server to be used for user authentication on your EX15 device.

### Example FreeRADIUS configuration

With FreeRADIUS, users are defined in the **users** file in your FreeRADIUS installation. To define users:

1. Open the FreeRadius user file in a text editor. For example:

```
$ sudo gedit /etc/freeradius/3.0/users
```

2. Add users to the file using the following format:

```
user1 Cleartext-Password := "user1"
 Unix-FTP-Group-Names := "admin"

user2 Cleartext-Password := "user2"
 Unix-FTP-Group-Names := "serial"
```

The **Unix-FTP-Group-Names** attribute is optional. If used, the value must correspond to authentication groups configured on your EX15. Alternatively, if the user is also configured as a local user on the EX15 device and the RADIUS server authenticates the user but does not return any groups, the local configuration determines the list of groups. See [Authentication groups](#) for more information about authentication groups. The **Unix-FTP-Group-Names** attribute can contain one group or multiple groups in a comma-separated list.

3. Save and close the file.
4. Verify that your changes did not introduce any syntax errors:

```
$ sudo freeradius -CX
```

This should return a message that completes similar to:

```
...
Configuration appears to be OK
```

5. Restart the FreeRADIUS server:

```
$ sudo /etc/init.d/freeradius restart
```

## RADIUS server failover and fallback to local configuration

In addition to the primary RADIUS server, you can also configure your EX15 device to use backup RADIUS servers. Backup RADIUS servers are used for authentication requests when the primary RADIUS server is unavailable.

### Falling back to local authentication

With user authentication methods, you can configure your EX15 device to use multiple types of authentication. For example, you can configure both RADIUS authentication and local authentication, so that local authentication can be used as a fallback mechanism if the primary and backup RADIUS

servers are unavailable. Additionally, users who are configured locally but are not configured on the RADIUS server are still able to log into the device. Authentication methods are attempted in the order they are listed until the first successful authentication result is returned; therefore if you want to ensure that users are authenticated first through the RADIUS server, and only authenticated locally if the RADIUS server is unavailable or if the user is not defined on the RADIUS server, then you should list the RADIUS authentication method prior to the Local users authentication method.

See [User authentication methods](#) for more information about authentication methods.

If the RADIUS servers are unavailable and the EX15 device falls back to local authentication, only users defined locally on the device are able to log in. RADIUS users cannot log in until the RADIUS servers are brought back online.

## Configure your EX15 device to use a RADIUS server

This section describes how to configure a EX15 device to use a RADIUS server for authentication and authorization.

### Required configuration items

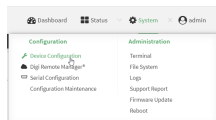
- Define the RADIUS server IP address or domain name.
- Define the RADIUS server shared secret.
- Add RADIUS as an authentication method for your EX15 device.

### Additional configuration items

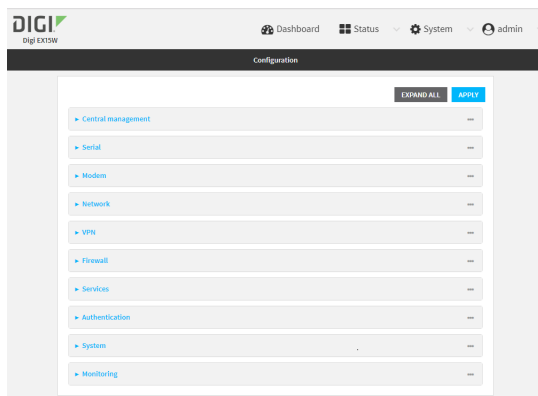
- Whether other user authentication methods should be used in addition to the RADIUS server, or if the RADIUS server should be considered the authoritative login method.
- The RADIUS server port. It is configured to 1812 by default.
- Add additional RADIUS servers in case the first RADIUS server is unavailable.
- The server NAS ID. If left blank, the default value is used:
  - If you are access the EX15 device by using the WebUI, the default value is for NAS ID is **httpd**.
  - If you are access the EX15 device by using ssh, the default value is **sshd**.
- Time in seconds before the request to the server times out. The default is 3 seconds and the maximum possible value is 60 seconds.
- Enable additional debug messages from the RADIUS client.

## WebUI

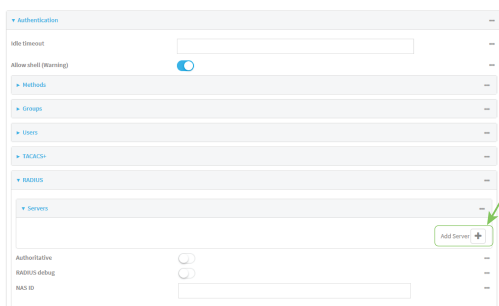
1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.



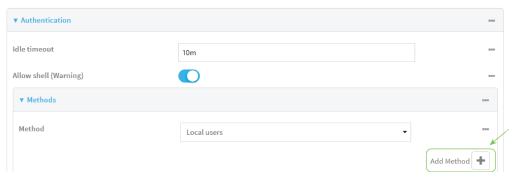
3. Click **Authentication > RADIUS > Servers**.
4. Add RADIUS servers:
  - a. For **Add server**, click **+**.



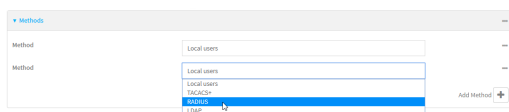
- b. For **Hostname**, type the hostname or IP address of the RADIUS server.
  - c. (Optional) Change the default **Port** setting to the appropriate port. Normally this should be left at the default setting of port 1812.
  - d. For **Secret**, type the RADIUS server's shared secret. This is configured in the secret parameter of the RADIUS server's client.conf file, for example:
 

secret=testing123
  - e. For **Timeout**, type or select the amount of time in seconds to wait for the RADIUS server to respond. Allowed value is any integer from **3** to **60**. The default value is **3**.
  - f. (Optional) Click **+** again to add additional RADIUS servers.
5. (Optional) Enable **Authoritative** to prevent other authentication methods from being used if RADIUS authentication fails. Other authentication methods will only be used if the RADIUS server is unavailable.
6. (Optional) Click **RADIUS debug** to enable additional debug messages from the RADIUS client.
7. (Optional) For **NAS ID**, type the unique identifier for this network access server (NAS). You can use the fully-qualified domain name of the NAS or any arbitrary string. If not set, the default value is used:
  - If you are accessing the EX15 device by using the WebUI, the default value is for NAS ID is **httpd**.
  - If you are accessing the EX15 device by using ssh, the default value is **sshd**.

8. Add RADIUS to the authentication methods:
  - a. Click **Authentication > Methods**.
  - b. For **Add method**, click **+**.



- c. Select **RADIUS** for the new method from the **Method** drop-down.



Authentication methods are attempted in the order they are listed until the first successful authentication result is returned. See [Rearrange the position of authentication methods](#) for information about rearranging the position of the methods in the list.

9. Click **Apply** to save the configuration and apply the change.



## Command line

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the command line, type **config** to enter configuration mode:
 

```
> config
(config)>
```
3. (Optional) Prevent other authentication methods from being used if RADIUS authentication fails. Other authentication methods will only be used if the RADIUS server is unavailable.
 

```
(config)> auth radius authoritative true
(config)>
```
4. (Optional) Enable debug messages from the RADIUS client:
 

```
(config)> auth radius debug true
(config)>
```
5. (Optional) Configure the NAS ID. This is a unique identifier for this network access server (NAS). You can use the fully-qualified domain name of the NAS or any arbitrary string. If not set, the default value is used:

- If you are accessing the EX15 device by using the WebUI, the default value is for NAS ID is **httpd**.
- If you are accessing the EX15 device by using ssh, the default value is **sshd**.

---

```
(config)> auth radius nas_id id
(config)>
```

---

6. Add a RADIUS server:

a. Add the server:

---

```
(config)> add auth radius server end
(config auth radius server 0)>
```

---

b. Enter the RADIUS server's IP address or hostname:

---

```
(config auth radius server 0)> hostname hostname|ip-address
(config auth radius server 0)>
```

---

c. (Optional) Change the default port setting to the appropriate port:

---

```
(config auth radius server 0)> port port
(config auth radius server 0)>
```

---

d. Configure the amount of time in seconds to wait for the RADIUS server to respond. Allowed value is any integer from **3** to **60**. The default value is **3**.

---

```
(config auth radius server 0)> timeout value
(config auth radius server 0)>
```

---

e. (Optional) Repeat the above steps to add additional RADIUS servers.

7. Add RADIUS to the authentication methods. Authentication methods are attempted in the order they are listed until the first successful authentication result is returned. This example will add RADIUS to the end of the list. See [User authentication methods](#) for information about adding methods to the beginning or middle of the list.

---

```
(config)> add auth method end radius
(config)>
```

---

8. Save the configuration and apply the change:

---

```
(config)> save
Configuration saved.
>
```

---

9. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## LDAP

Your EX15 device supports LDAP (Lightweight Directory Access Protocol), a protocol used for directory information services over an IP network. LDAP can be used with your EX15 device for centralized authentication and authorization management for users who connect to the device. With LDAP

support, the EX15 device acts as an LDAP client, which sends user credentials and connection parameters to an LDAP server. The LDAP server then authenticates the LDAP client requests and sends back a response message to the device.

When you are using LDAP authentication, you can have both local users and LDAP users able to log in to the device. To use LDAP authentication, you must set up a LDAP server that is accessible by the EX15 device prior to configuration. The process of setting up a LDAP server varies by the server environment.

This section contains the following topics:

|                                                                |     |
|----------------------------------------------------------------|-----|
| LDAP user configuration .....                                  | 603 |
| LDAP server failover and fallback to local configuration ..... | 604 |
| Configure your EX15 device to use an LDAP server .....         | 604 |

## LDAP user configuration

When configured to use LDAP support, the EX15 device uses a remote LDAP server for user authentication (password verification) and authorization (assigning the access level of the user). Additional LDAP servers can be configured as backup servers for user authentication.

This section outlines how to configure a LDAP server to be used for user authentication on your EX15 device.

There are several different implementations of LDAP, including Microsoft Active Directory. This section uses OpenLDAP as an example configuration. Other implementations of LDAP will have different configuration methods.

### Example OpenLDAP configuration

With OpenLDAP, users can be configured in a text file using the LDAP Data Interchange Format (LDIF). In this case, we will be using a file called **add\_user.ldif**.

1. Create the **add\_user.ldif** file in a text editor. For example:

---

```
$ gedit ./add_user.ldif
```

---

2. Add users to the file using the following format:

---

```
dn: uid=john,dc=example,dc=com
objectClass: inetOrgPerson
cn: John Smith
sn: Smith
uid: john
userPassword: password
ou: admin serial
```

---

- The value of **uid** and **userPassword** must correspond to the username and password used to log into the EX15 device.
- The **ou** attribute is optional. If used, the value must correspond to authentication groups configured on your EX15. Alternatively, if the user is also configured as a local user on the EX15 device and the LDAP server authenticates the user but does not return any groups, the local configuration determines the list of groups. See [Authentication groups](#) for more information about authentication groups.

Other attributes may be required by the user's objectClass. Any objectClass may be used as long it allows the **uid**, **userPassword**, and **ou** attributes.

3. Save and close the file.
4. Add the user to the OpenLDAP server:

---

```
$ ldapadd -x -H 'ldap:/// ' -D 'cn=admin,dc=example,dc=com' -W -f add_
user.ldif
adding new entry "uid=john,dc=example,dc=com"
```

---

5. Verify that the user has been added by performing an LDAP search:

---

```
$ ldapsearch -x -LLL -H 'ldap:/// ' -b 'dc=example,dc=com'
uid=john
dn: uid=john,dc=example,dc=com
objectClass: inetOrgPerson
```

---

---

```
cn: John Smith
sn: Smith
uid: john
ou: admin serial
```

---

## LDAP server failover and fallback to local configuration

In addition to the primary LDAP server, you can also configure your EX15 device to use backup LDAP servers. Backup LDAP servers are used for authentication requests when the primary LDAP server is unavailable.

### *Falling back to local authentication*

With user authentication methods, you can configure your EX15 device to use multiple types of authentication. For example, you can configure both LDAP authentication and local authentication, so that local authentication can be used as a fallback mechanism if the primary and backup LDAP servers are unavailable. Additionally, users who are configured locally but are not configured on the LDAP server are still able to log into the device. Authentication methods are attempted in the order they are listed until the first successful authentication result is returned; therefore if you want to ensure that users are authenticated first through the LDAP server, and only authenticated locally if the LDAP server is unavailable or if the user is not defined on the LDAP server, then you should list the LDAP authentication method prior to the Local users authentication method.

See [User authentication methods](#) for more information about authentication methods.

If the LDAP servers are unavailable and the EX15 device falls back to local authentication, only users defined locally on the device are able to log in. LDAP users cannot log in until the LDAP servers are brought back online.

## Configure your EX15 device to use an LDAP server

This section describes how to configure a EX15 device to use an LDAP server for authentication and authorization.

### Required configuration items

- Define the LDAP server IP address or domain name.
- Add LDAP as an authentication method for your EX15 device.

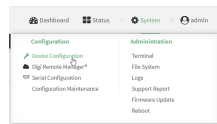
### Additional configuration items

- Whether other user authentication methods should be used in addition to the LDAP server, or if the LDAP server should be considered the authoritative login method.
- The LDAP server port. It is configured to 389 by default.
- Whether to use Transport Layer Security (TLS) when communicating with the LDAP server.
- The distinguished name (DN) and password used to communicate with the server.
- The distinguished name used to search to user base.
- The group attribute.
- The number of seconds to wait to receive a message from the server.
- Add additional LDAP servers in case the first LDAP server is unavailable.

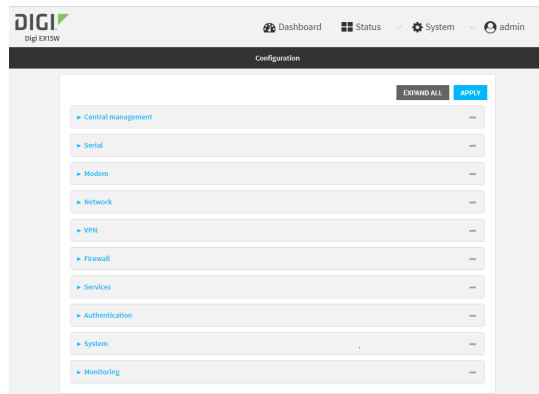




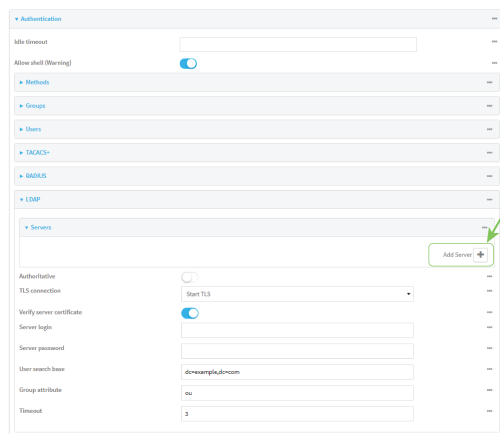
1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.

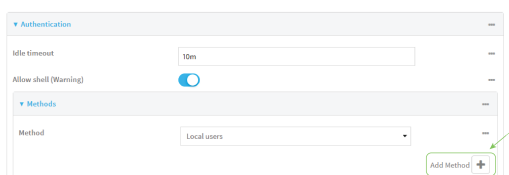


3. Click **Authentication > LDAP > Servers**.
4. Add LDAP servers:
  - a. For **Add server**, click **+**.

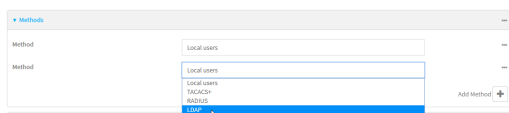


- b. For **Hostname**, type the hostname or IP address of the LDAP server.
  - c. (Optional) Change the default **Port** setting to the appropriate port. Normally this should be left at the default setting of port 389.
  - d. (Optional) Click **+** again to add additional LDAP servers.
5. (Optional) Enable **Authoritative** to prevent other authentication methods from being used if LDAP authentication fails. Other authentication methods will only be used if the LDAP server is unavailable.

6. For **TLS connection**, select the type of TLS connection used by the server:
  - **Disable TLS**: Uses a non-secure TCP connection on the LDAP standard port, 389.
  - **Enable TLS**: Uses an SSL/TLS encrypted connection on port 636.
  - **Start TLS**: Makes a non-secure TCP connection to the LDAP server on port 389, then sends a request to upgrade the connection to a secure TLS connection. This is the preferred method for LDAP.
7. If **Enable TLS** or **Start TLS** are selected for **TLS connection**:
  - Leave **Verify server certificate** at the default setting of enabled to verify the server certificate with a known Certificate Authority.
  - Disable **Verify server certificate** if the server is using a self-signed certificate.
8. (Optional) For **Server login**, type a distinguished name (DN) that is used to bind to the LDAP server and search for users, for example **cn=user,dc=example,dc=com**. Leave this field blank if the server allows anonymous connections.
9. (Optional) For **Server password**, type the password used to log into the LDAP server. Leave this field blank if the server allows anonymous connections.
10. For **User search base**, type the distinguished name (DN) on the server to search for users. This can be the root of the directory tree (for example, **dc=example,dc=com**) or a sub-tree (for example, **ou=People,dc=example,dc=com**).
11. (Optional) For **Group attribute**, type the name of the user attribute that contains the list of EX15 authentication groups that the authenticated user has access to. See [LDAP user configuration](#) for further information about the group attribute.
12. For **Timeout**, type or select the amount of time in seconds to wait for the LDAP server to respond. Allowed value is between **3** and **60** seconds.
13. Add LDAP to the authentication methods:
  - a. Click **Authentication > Methods**.
  - b. For **Add method**, click **+**.



- c. Select **LDAP** for the new method from the **Method** drop-down.



Authentication methods are attempted in the order they are listed until the first successful authentication result is returned. See [Rearrange the position of authentication methods](#) for information about rearranging the position of the methods in the list.

14. Click **Apply** to save the configuration and apply the change.



## Command line

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the command line, type **config** to enter configuration mode:

```
> config
(config)>
```

3. (Optional) Prevent other authentication methods from being used if LDAP authentication fails. Other authentication methods will only be used if the LDAP server is unavailable.

```
(config)> auth ldap authoritative true
(config)>
```

4. Set the type of TLS connection used by the LDAP server:

```
(config)> auth ldap tls value
(config)>
```

where *value* is one of:

- **off**: Uses a non-secure TCP connection on the LDAP standard port, 389.
- **on**: Uses an SSL/TLS encrypted connection on port 636.
- **start\_tls**: Makes a non-secure TCP connection to the LDAP server on port 389, then sends a request to upgrade the connection to a secure TLS connection. This is the preferred method for LDAP.

The default is **off**.

5. If **tls** is set to **on** or **start\_tls**, configure whether to verify the server certificate:

```
(config)> auth ldap verify_server_cert value
(config)>
```

where *value* is either:

- **true**: Verifies the server certificate with a known Certificate Authority.
- **false**: Does not verify the certificate. Use this option if the server is using a self-signed certificate.

The default is **true**.

6. Set the distinguished name (DN) that is used to bind to the LDAP server and search for users. Leave this option unset if the server allows anonymous connections.

```
(config)> auth ldap bind_dn dn_value
(config)>
```

For example:

---

```
(config)> auth ldap bind_dn cn=user,dc=example,dc=com
(config)>
```

---

7. Set the password used to log into the LDAP server. Leave this option unset if the server allows anonymous connections.

---

```
(config)> auth ldap bind_password password
(config)>
```

---

8. Set the distinguished name (DN) on the server to search for users. This can be the root of the directory tree (for example, **dc=example,dc=com**) or a sub-tree (for example, **ou=People,dc=example,dc=com**).

---

```
(config)> auth ldap base_dn value
(config)>
```

---

9. (Optional) Set the name of the user attribute that contains the list of EX15 authentication groups that the authenticated user has access to. See [LDAP user configuration](#) for further information about the group attribute.

---

```
(config)> auth ldap group_attribute value
(config)>
```

---

For example:

---

```
(config)> auth ldap group_attribute ou
(config)>
```

---

10. Configure the amount of time in seconds to wait for the LDAP server to respond.

---

```
(config)> auth ldap timeout value
(config)>
```

---

where *value* is any integer from **3** to **60**. The default value is **3**.

11. Add an LDAP server:

- a. Add the server:

---

```
(config)> add auth ldap server end
(config auth ldap server 0)>
```

---

- b. Enter the LDAP server's IP address or hostname:

---

```
(config auth ldap server 0)> hostname hostname|ip-address
(config auth ldap server 0)>
```

---

- c. (Optional) Change the default port setting to the appropriate port:

---

```
(config auth ldap server 0)> port port
(config auth ldap server 0)>
```

---

- d. (Optional) Repeat the above steps to add additional LDAP servers.

12. Add LDAP to the authentication methods. Authentication methods are attempted in the order they are listed until the first successful authentication result is returned. This example will add LDAP to the end of the list. See [User authentication methods](#) for information about adding methods to the beginning or middle of the list.

---

```
(config)> add auth method end ldap
(config)>
```

---

13. Save the configuration and apply the change:

---

```
(config)> save
Configuration saved.
>
```

---

14. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

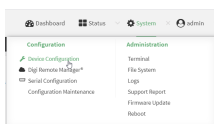
## Disable shell access

To prohibit access to the shell prompt for all authentication groups, disable the **Allow shell** parameter.. This does not prevent access to the Admin CLI.

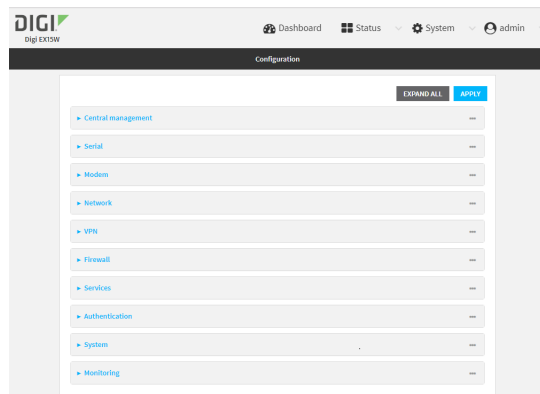
**Note** If shell access is disabled, re-enabling it will erase the device's configuration and perform a factory reset.

### WebUI

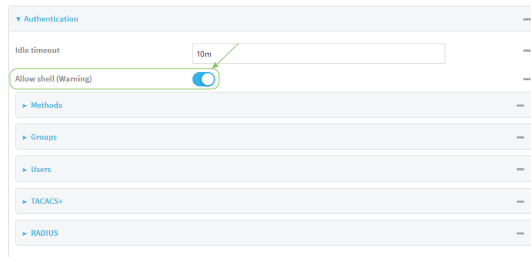
1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.



3. Click **Authentication**.
4. Click to disable **Allow shell**.



**Note** If shell access is disabled, re-enabling it will erase the device's configuration and perform a factory reset.

5. Click **Apply** to save the configuration and apply the change.



## Command line

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the command line, type **config** to enter configuration mode:

```
> config
(config)>
```

3. Set the **allow\_shell** parameter to **false**:

```
(config)> auth allow_shell false
```

**Note** If shell access is disabled, re-enabling it will erase the device's configuration and perform a factory reset.

4. Save the configuration and apply the change:

```
(config)> save
Configuration saved.
>
```

5. Type **exit** to exit the Admin CLI.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

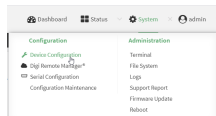
## Set the idle timeout for EX15 users

To configure the amount of time that the user's active session can be inactive before it is automatically disconnected, set the **Idle timeout** parameter.

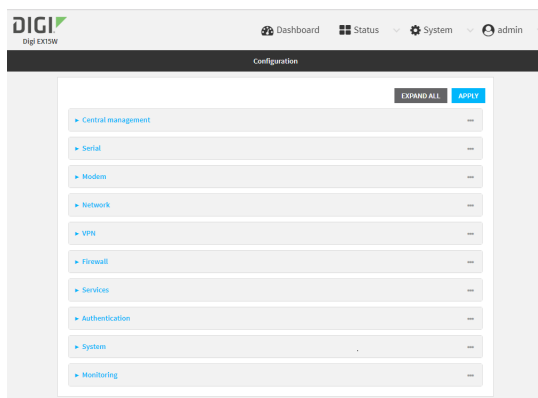
By default, the Idle timeout is set to 10 minutes.

### WebUI

1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



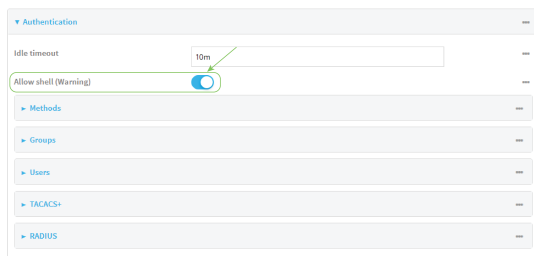
The **Configuration** window is displayed.



3. Click **Authentication**.
4. For **Idle timeout**, enter the amount of time that the active session can be idle before the user is automatically logged out.

Allowed values are any number of weeks, days, hours, minutes, or seconds, and take the format **number{w|d|h|m|s}**.

For example, to set **Idle timeout** to ten minutes, enter **10m** or **600s**.



5. Click **Apply** to save the configuration and apply the change.



## Command line

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.

2. At the command line, type **config** to enter configuration mode:

```
> config
(config)>
```

3. At the config prompt, type:

```
(config)# auth idle_timeout value
```

where *value* is any number of weeks, days, hours, minutes, or seconds, and takes the format **number{w|d|h|m|s}**.

For example, to set **idle\_timeout** to ten minutes, enter either **10m** or **600s**:

```
(config)> auth idle_timeout 600s
(config)>
```

4. Save the configuration and apply the change:

```
(config)> save
Configuration saved.
>
```

5. Type **exit** to exit the Admin CLI.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.



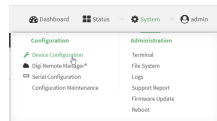
## Example user configuration

### Example 1: Administrator user with local authentication

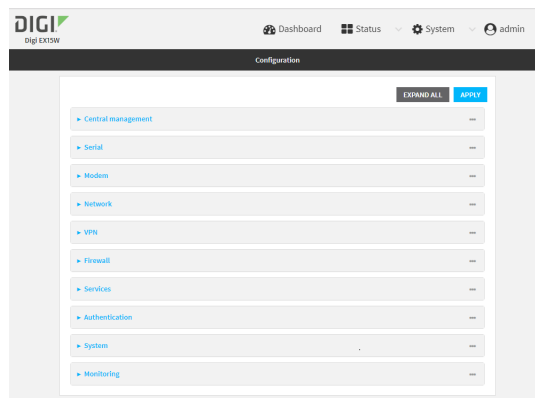
Goal: To create a user with administrator rights who is authenticated locally on the device.

#### WebUI

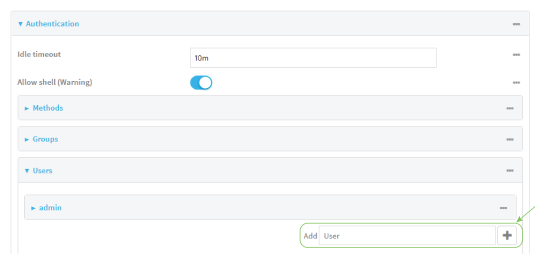
1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



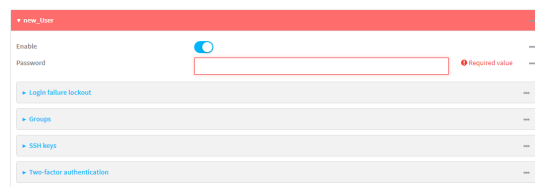
The **Configuration** window is displayed.



3. Click **Authentication > Users**.
4. In **Add User**: enter a name for the user and click **+**.



The user configuration window is displayed.



5. Enter a **Password** for the user.
6. Assign the user to the **admin** group:
  - a. Click **Groups**.
  - b. For **Add Group**, click **+**.
  - c. For **Group**, select the **admin** group.
  - d. Verify that the **admin** group has full administrator rights:
    - i. Click **Authentication > Groups**.
    - ii. Click **admin**.
    - iii. Verify that the admin group has **Admin access** enabled. If not, click **Admin access** to enable.
    - iv. Verify that **Access level** is set to **Full access**. If not, select **Full access**.
  - e. Verify that **Local users** is one of the configured authentication methods:
    - i. Click **Authentication > Methods**.
    - ii. Verify that **Local users** is one of the methods listed in the list. If not:
      - i. For **Add Method**, click **+**.
      - ii. For **Method**, select **Local users**.
7. Click **Apply** to save the configuration and apply the change.



## Command line

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the command line, type **config** to enter configuration mode:

```
> config
(config)>
```

3. Verify that the **admin** group has full administrator rights:

```
(config)> show auth group admin acl
admin
 enable true
 level full
...
(config)>
```

If **admin > enable** is set to false:

```
(config)> auth group admin acl admin enable true
(config)>
```

If **admin > level** is set to read-only:

```
(config)> auth group admin acl admin level full
(config)>
```

4. Verify that **local** is one of the configured authentication methods:

```
(config)> show auth method
0 local
(config)>
```

If **local** is not listed:

```
(config)> add auth method end local
(config)>
```

5. Create the user. In this example, the user is being created with the username **adminuser**:

```
(config)> add auth user adminuser
(config auth user adminuser)>
```

6. Assign a password to the user:

```
(config auth user adminuser)> password pwd
(config auth user adminuser)>
```

7. Assign the user to the **admin** group:

```
(config auth user adminuser)> add group end admin
(config auth user adminuser)>
```

8. Save the configuration and apply the change:

```
(config auth user adminuser)> save
Configuration saved.
>
```

9. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Example 2: RADIUS, TACACS+, and local authentication for one user

Goal: To create a user with administrator rights who is authenticated by using all three authentication methods.

In this example, when the user attempts to log in to the EX15 device, user authentication will occur in the following order:

1. The user is authenticated by the RADIUS server. If the RADIUS server is unavailable,
2. The user is authenticated by the TACACS+ server. If both the RADIUS and TACACS+ servers are unavailable,
3. The user is authenticated by the EX15 device using local authentication.

This example uses a FreeRadius 3.0 server running on ubuntu, and a TACACS+ server running on ubuntu. Server configuration may vary depending on the platforms or type of servers used in your environment.

## WebUI

1. Configure a user on the RADIUS server:
  - a. On the ubuntu machine hosting the FreeRadius server, open the **/etc/freeradius/3.0/users** file:

```
$ sudo gedit /etc/freeradius/3.0/users
```

- b. Add a RADIUS user to the **users** file:

```
admin1 Cleartext-Password := "password1"
 Unix-FTP-Group-Names := "admin"
```

In this example:

- The user's username is **admin1**.
- The user's password is **password1**.
- The authentication group on the EX15 device, **admin**, is identified in the **Unix-FTP-Group-Names** parameter.

- c. Save and close the **users** file.

2. Configure a user on the TACACS+ server:

- a. On the ubuntu machine hosting the TACACS+ server, open the **/etc/tacacs+/tac\_plus.conf** file:

```
$ sudo gedit /etc/tacacs+/tac_plus.conf
```

- b. Add a TACACS+ user to the **tac\_plus.conf** file:

```
user = admin1 {
 name = "Admin1 for TX64"
 pap = cleartext password1
 service = system {
 groupname = admin
 }
}
```

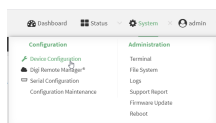
In this example:

- The user's username is **admin1**.
- The user's password is **password1**.
- The authentication group on the EX15 device, **admin**, is identified in the **groupname** parameter.

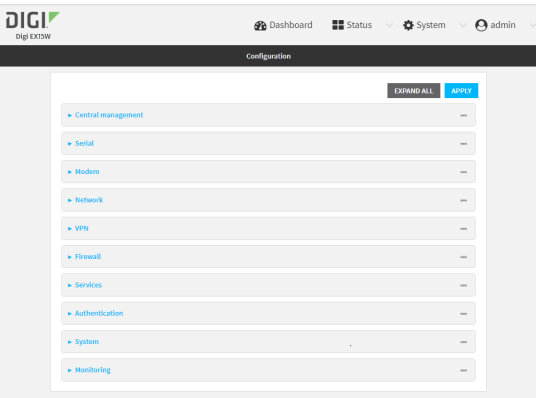
- c. Save and close the **tac\_plus.conf** file.

3. Log into the EX15 WebUI as a user with full Admin access rights.

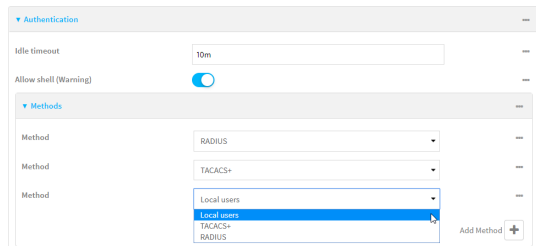
4. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



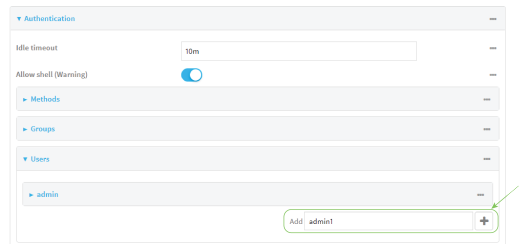
The **Configuration** window is displayed.



- 5. Configure the authentication methods:
  - a. Click **Authentication > Methods**.
  - b. For **Method**, select **RADIUS**.
  - c. For **Add Method**, click **+** to add a new method.
  - d. For the new method, select **TACACS+**.
  - e. Click **+** to add another new method.
  - f. For the new method, select **Local users**.



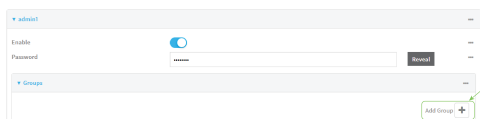
- 6. Create the local user:
  - a. Click **Authentication > Users**.
  - b. In **Add User:**, type **admin1** and click **+**.



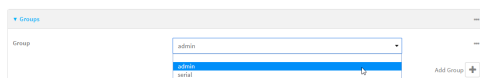
- c. For **password**, type **password1**.

d. Assign the user to the **admin** group:

- i. Click **Groups**.
- ii. For **Add Group**, click **+**.



iii. For **Group**, select the **admin** group.



a. Verify that the **admin** group has full administrator rights:

- i. Click **Authentication > Groups**.
- ii. Click **admin**.
- iii. Verify that the admin group has **Admin access** enabled. If not, click **Admin access** to enable.
- iv. Verify that **Access level** is set to **Full access**. If not, select **Full access**.

7. Click **Apply** to save the configuration and apply the change.



## Command line

1. Configure a user on the RADIUS server:

- a. On the ubuntu machine hosting the FreeRadius server, open the **/etc/freeradius/3.0/users** file:

```
$ sudo gedit /etc/freeradius/3.0/users
```

- b. Add a RADIUS user to the **users** file:

```
admin1 Cleartext-Password := "password1"
 Unix-FTP-Group-Names := "admin"
```

In this example:

- The user's username is **admin1**.
  - The user's password is **password1**.
  - The authentication group on the EX15 device, **admin**, is identified in the **Unix-FTP-Group-Names** parameter.
- c. Save and close the **users** file.

2. Configure a user on the TACACS+ server:
  - a. On the ubuntu machine hosting the TACACS+ server, open the **/etc/tacacs+/tac\_plus.conf** file:

---

```
$ sudo gedit /etc/tacacs+/tac_plus.conf
```

---

- b. Add a TACACS+ user to the **tac\_plus.conf** file:

---

```
user = admin1 {
 name = "Admin1 for TX64"
 pap = cleartext password1
 service = system {
 groupname = admin
 }
}
```

---

In this example:

- The user's username is **admin1**.
  - The user's password is **password1**.
  - The authentication group on the EX15 device, **admin**, is identified in the **groupname** parameter.
- c. Save and close the **tac\_plus.conf** file.
  3. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
  4. At the command line, type **config** to enter configuration mode:

---

```
> config
(config)>
```

---

5. Configure the authentication methods:
  - a. Determine the current authentication method configuration:

---

```
(config)> show auth method
0 local
(config)>
```

---

This output indicates that on this example system, only local authentication is configured.

- b. Add RADIUS authentication to the beginning of the list:

---

```
(config)> add auth method 0 radius
(config)>
```

---

- c. Add TACACS+ authentication second place in the list:

---

```
(config)> add auth method 1 tacacs+(config)>
```

---



- d. Verify that authentication will occur in the correct order:

```
(config)> show auth method
0 radius
1 tacacs+
2 local
(config)>
```

6. Verify that the **admin** group has full administrator rights:

```
(config)> show auth group admin acl
admin
 enable true
 level full
...
(config)>
```

If **admin > enable** is set to false:

```
(config)> auth group admin acl admin enable true
(config)>
```

If **admin > level** is set to read-only:

```
(config)> auth group admin acl admin level full
(config)>
```

7. Configure the local user:

- a. Create a local user with the username **admin1**:

```
(config)> add auth user admin1
(config auth user admin1)>
```

- b. Assign a password to the user:

```
(config auth user adminuser)> password password1
(config auth user adminuser)>
```

- c. Assign the user to the **admin** group:

```
(config auth user adminuser)> add group end admin
(config auth user adminuser)>
```

8. Save the configuration and apply the change:

```
(config auth user adminuser)> save
Configuration saved.
>
```

9. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

# Firewall

---

This chapter contains the following topics:

|                                            |     |
|--------------------------------------------|-----|
| Firewall configuration .....               | 623 |
| Port forwarding rules .....                | 628 |
| Packet filtering .....                     | 636 |
| Configure custom firewall rules .....      | 644 |
| Configure captive portals .....            | 646 |
| Configure Quality of Service options ..... | 651 |

## Firewall configuration

Firewall configuration includes the following configuration options:

- **Zones:** A zone is a firewall access group to which network interfaces can be added. You then use zones to configure packet filtering and access control lists for interfaces that are included in the zone. Preconfigured zones include:
  - **Any:** Matches any network interface, even if they are not assigned to this zone.
  - **Loopback:** Zone for interfaces that are used for communication between processes running on the device.
  - **Internal:** Used for interfaces connected to trusted networks. By default, the firewall will allow most access from this zone.
  - **External:** Used for interfaces to connect to untrusted zones, such as the internet. This zone has Network Address Translation (NAT) enabled by default. By default, the firewall will block most access from this zone.
  - **Edge:** Used for interfaces connected to trusted networks, where the device is a client on the edge of the network rather than a router or gateway.
  - **Setup:** Used for interfaces involved in the initial setup of the device. By default, the firewall will only allow this zone to access administration services.
  - **IPsec:** The default zone for IPsec tunnels.
  - **Dynamic routes:** Used for routes learned using routing services.
- **Port forwarding:** A list of rules that allow network connections to the EX15 to be forwarded to other servers by translating the destination address.
- **Packet filtering:** A list of packet filtering rules that determine whether to accept or reject network connections that are forwarded through the EX15.
- **Custom rules:** A script that is run to install advanced firewall rules beyond the scope/capabilities of the standard device configuration.
- **Captive portals:** A list of captive portals that restrict traffic on network interfaces until access is granted. Captive portals are commonly used on public-access networks to require users to login or accept terms and conditions before accessing the internet.
- **Quality Of Service:** Quality of Service (QOS) options for bandwidth allocation and policy-based traffic shaping and prioritizing.

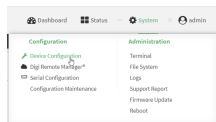
### Create a custom firewall zone

In addition to the preconfigured zones, you can create your custom zones that can be used to configure packet filtering and access control lists for network interfaces.

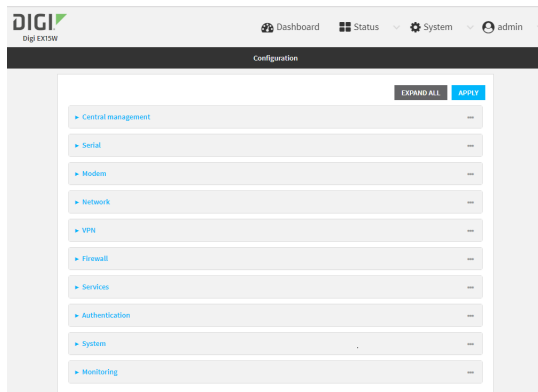
To create a zone:



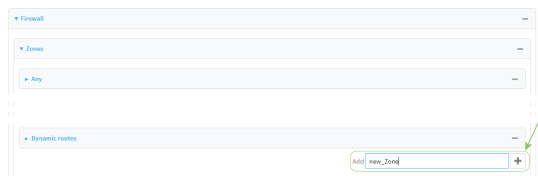
1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



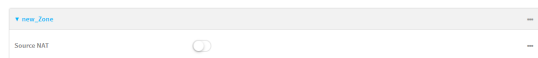
The **Configuration** window is displayed.



3. Click **Firewall > Zones**.
4. In **Add Zone**, enter a name for the zone and click **+**.



The firewall configuration window is displayed.



5. (Optional) If traffic on this zone will be forwarded from a private network to the internet, enable Network Address Translation (NAT).
6. Click **Apply** to save the configuration and apply the change.



See [Configure the firewall zone for a network interface](#) for information about how to configure network interfaces to use a zone.

## Command line

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.

2. At the command line, type **config** to enter configuration mode:

---

```
> config
(config)>
```

---

3. Add the new zone. For example, to add a zone named **my\_zone**:

---

```
(config)> add firewall zone my_zone
(config firewall zone my_zone)>
```

---

4. (Optional) Enable Network Address Translation (NAT):

---

```
(config firewall zone my_zone)> src_nat true
(config firewall zone my_zone)>
```

---

5. Save the configuration and apply the change:

---

```
(config firewall zone my_zone)> save
Configuration saved.
>
```

---

6. Type **exit** to exit the Admin CLI.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

See [Configure the firewall zone for a network interface](#) for information about how to configure network interfaces to use a zone.

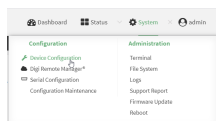
## Configure the firewall zone for a network interface

Firewall zones allow you to group network interfaces for the purpose of packet filtering and access control. There are several preconfigured firewall zones, and you can create custom zones as well. The firewall zone that a network interfaces uses is selected during interface configuration.

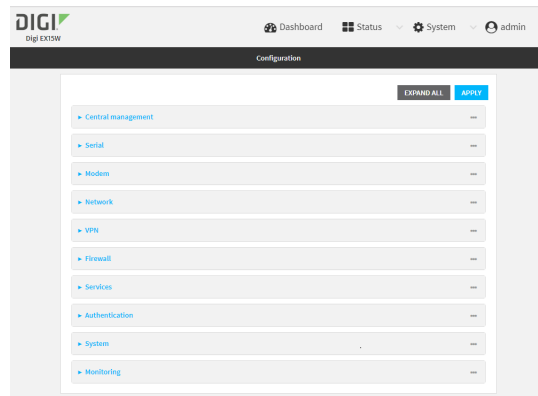
This example procedure uses an existing network interface named **LAN** and changes the firewall zone from the default zone, **Internal**, to **External**.

### WebUI

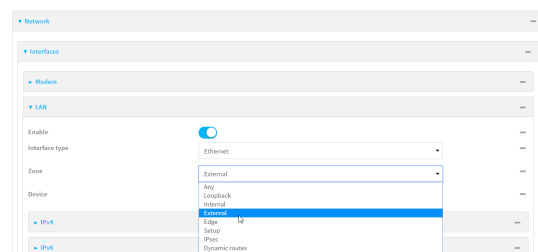
1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



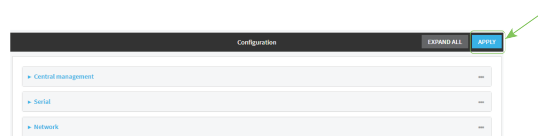
The **Configuration** window is displayed.



3. Click **Network > Interfaces > LAN**.
4. For **Zone**, select **External**.



5. Click **Apply** to save the configuration and apply the change.



## Command line

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the command line, type **config** to enter configuration mode:

```
> config
(config)>
```

3. At the config prompt, type:

```
(config)> network interface lan zone my_zone
(config)>
```

4. Save the configuration and apply the change:

```
(config)> save
Configuration saved.
>
```

5. Type **exit** to exit the Admin CLI.

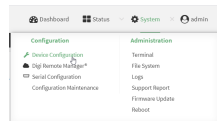
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Delete a custom firewall zone

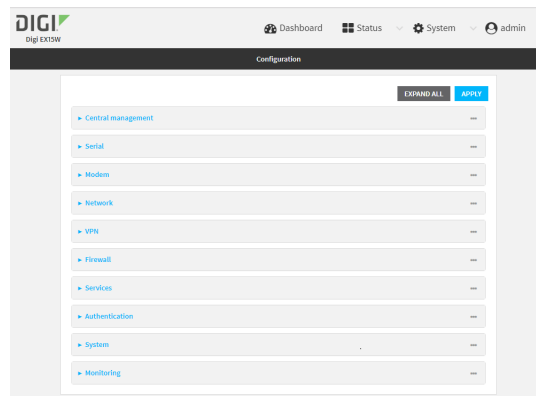
You cannot delete preconfigured firewall zones. To delete a custom firewall zone:

### WebUI

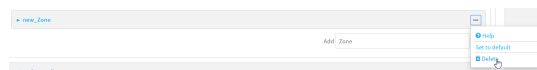
1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.



3. Click **Firewall > Zones**.
4. Click the menu icon (...) next to the appropriate custom firewall zone and select **Delete**.



5. Click **Apply** to save the configuration and apply the change.



## Command line

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the command line, type **config** to enter configuration mode:  

---

```
> config
(config)>
```

---
3. Use the **del** command to delete a custom firewall rule. For example:  

---

```
(config)> del firewall zone my_zone
```

---
4. Save the configuration and apply the change:  

---

```
(config)> save
Configuration saved.
>
```

---
5. Type **exit** to exit the Admin CLI.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Port forwarding rules

Most computers are protected by a firewall that prevents users on a public network from accessing servers on the private network. To allow a computer on the Internet to connect to a specific server on a private network, set up one or more port forwarding rules. Port forwarding rules provide mapping instructions that direct incoming traffic to the proper device on a LAN.

### Configure port forwarding

#### *Required configuration items*

- The network interface for the rule.  
Network connections will only be forwarded if their destination address matches the IP address of the selected network interface.
- The public-facing port number that network connections must use for their traffic to be forwarded.
- The IP address of the server to which traffic should be forwarded.
- The port on the server to which traffic should be forwarded.

#### *Additional configuration items*

- A label for the port forwarding rule.
- The IP version (either IPv4 or IPv6) that incoming network connections must match.
- The protocols that incoming network connections must match.

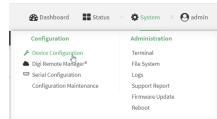


- A white list of devices, based on either IP address or firewall zone, that are authorized to leverage this forwarding rule.

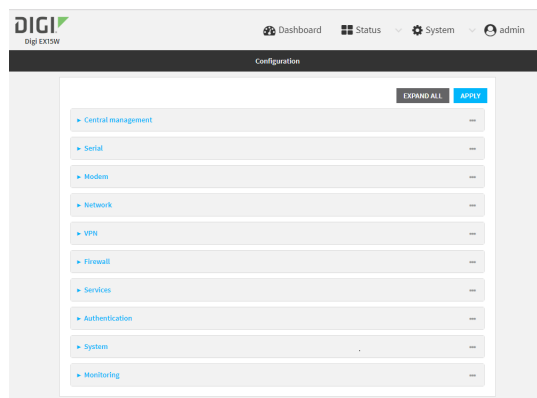
To configure a port forwarding rule:

## WebUI

1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



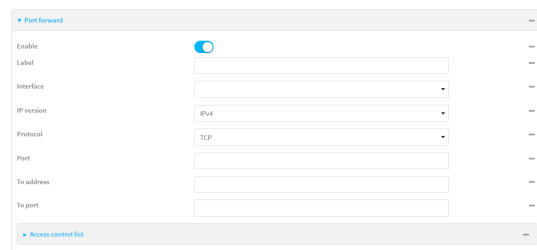
The **Configuration** window is displayed.



3. Click **Firewall > Port forwarding**.
4. For **Add port forward**, click **+**.



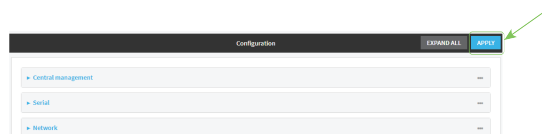
The port forwarding rule configuration window is displayed.



Port forwarding rules are enabled by default. To disable, click to toggle off **Enable**.

5. (Optional) Type a **Label** that will be used to identify the rule.

6. For **Interface**, select the network interface for the rule.  
Network connections will only be forwarded if their destination address matches the IP address of the selected network interface.
7. For **IP version**, select either **IPv4** or **IPv6**.  
Network connections will only be forwarded if they match the selected IP version.
8. For **Protocol**, select the type of internet protocol.  
Network connections will only be forwarded if they match the selected protocol.
9. For **Port**, type the public-facing port number that network connections must use for their traffic to be forwarded.
10. For **To Address**, type the IP address of the server to which traffic should be forwarded.
11. For **To port**, type the port number of the port on the server to which traffic should be forwarded.
12. (Optional) Click **Access control list** to create a white list of devices that are authorized to leverage this forwarding rule, based on either the IP address or firewall zone:
  - To white list IP addresses:
    - a. Click **Addresses**.
    - b. For **Add Address**, enter an IP address and click **+**.
    - c. Repeat for each additional IP address that should be white listed.
  - To specify firewall zones for white listing:
    - a. Click **Zones**.
    - b. For **Add zone**, click **+**.
    - c. For **Zone**, select the appropriate zone.
    - d. Repeat for each additional zone.
13. Click **Apply** to save the configuration and apply the change.



## Command line

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the command line, type **config** to enter configuration mode:

```
> config
(config)>
```

3. At the config prompt, type:

```
(config)> add firewall dn timer end
(config firewall dn timer 0)>
```

Port forwarding rules are enabled by default. To disable the rule:

---

```
(config firewall dnat 0)> enable false
(config firewall dnat 0)>
```

---

4. Set the network interface for the rule.

---

```
(config firewall dnat 0)> interface
(config firewall dnat 0)>
```

---

Network connections will only be forwarded if their destination address matches the IP address of this network interface.

- a. Use the **?** to determine available interfaces:

---

```
(config firewall dnat 0)>interface ?
```

Interface: Network connections will only be forwarded if their destination address matches the IP address of this network interface.

Format:

```
defaultip
defaultlinklocal
lan
loopback
modem
wan
```

Current value:

---

```
(config firewall dnat 0)> interface
```

---

- b. Set the interface. For example:

---

```
(config firewall dnat 0)> interface wan
(config firewall dnat 0)>
```

---

5. Set the IP version. Allowed values are **ipv4** and **ipv6**. The default is **ipv4**.

---

```
(config firewall dnat 0)> ip_version ipv6
(config firewall dnat 0)>
```

---

6. Set the public-facing port number that network connections must use for their traffic to be forwarded.

---

```
(config firewall dnat 0)> port port
(config firewall dnat 0)>
```

---

7. Set the type of internet protocol.

---

```
(config firewall dnat 0)> protocol value
(config firewall dnat 0)>
```

---

Network connections will only be forwarded if they match the selected protocol. Allowed values are **custom**, **tcp**, **tcpudp**, or **udp**. The default is **tcp**.

8. Set the IP address of the server to which traffic should be forwarded:

- For IPv4 addresses:

---

```
(config firewall dn timer 0)> to_address ip-address
(config firewall dn timer 0)>
```

---

- For IPv6 addresses:

---

```
(config firewall dn timer 0)> to_address6 ip-address
(config firewall dn timer 0)>
```

---

9. Set the public-facing port number that network connections must use for their traffic to be forwarded.

---

```
(config firewall dn timer 0)> to_port port
(config firewall dn timer 0)>
```

---

10. (Optional) To create a white list of devices that are authorized to leverage this forwarding rule, based on either the IP address or firewall zone, change to the acl node:

---

```
(config firewall dn timer 0)> acl
(config firewall dn timer 0 acl)>
```

---

- To white list an IP address:

- For IPv4 addresses:

---

```
(config firewall dn timer 0 acl)> add address end ip-address
(config firewall dn timer 0 acl)>
```

---

- For IPv6 addresses:

---

```
(config firewall dn timer 0 acl)> add address6 end ip-address
(config firewall dn timer 0 acl)>
```

---

Repeat for each appropriate IP address.

- To specify the firewall zone for white listing:

---

```
(config firewall dn timer 0 acl)> add zone end zone
```

---

Repeat for each appropriate zone.

To view a list of available zones:

---

```
(config firewall dn timer 0 acl)> zone ?
```

---

Zones: A list of groups of network interfaces that can be referred to by packet filtering rules and access control lists.

Additional Configuration

---



---

```

any
dynamic_routes
edge
external
internal
ipsec
loopback
setup

```

```
(config firewall dn timer acl)>
```

11. Save the configuration and apply the change:

```

(config)> save
Configuration saved.
>

```

12. Type **exit** to exit the Admin CLI.

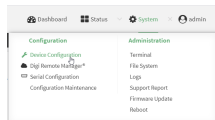
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Delete a port forwarding rule

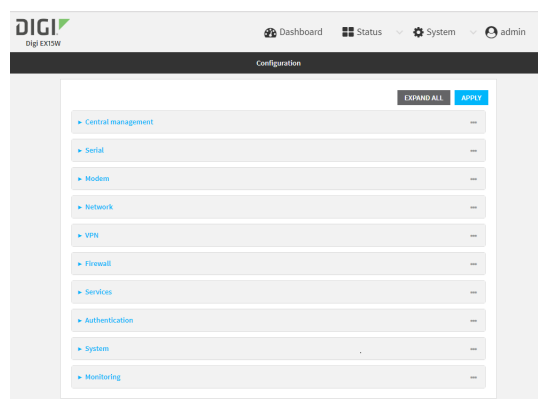
To delete a port forwarding rule:

### WebUI

1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.



3. Click **Firewall > Port forwarding**.

- Click the menu icon (...) next to the appropriate port forwarding rule and select **Delete**.



- Click **Apply** to save the configuration and apply the change.



## Command line

- Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
- At the command line, type **config** to enter configuration mode:

---

```
> config
(config)>
```

---

- Determine the index number of the port forwarding rule you want to delete:

---

```
(config)> show firewall dnat
0
 acl
 no address
 no zone
 enable true
 interface lan
 ip_version ipv4
 label IPv4 port forwarding rule
 port 10000
 protocol tcp
 to_address6 10.10.10.10
 to_port 10001

1
 acl
 no address6
 no zone
 enable false
 interface lan
 ip_version ipv6
 label IPv6 port forwarding rule
 port 10002
 protocol tcp
 to_address6 c097:4533:bd63:bb12:9a6f:5569:4b53:c29a
```

---

---

```
to_port 10003
(config)>
```

---

4. To delete the rule, use the index number with the **del** command. For example:

---

```
(config)> del firewall dnat 1
```

---

5. Save the configuration and apply the change:

---

```
(config)> save
Configuration saved.
>
```

---

6. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Packet filtering

By default, one preconfigured packet filtering rule, **Allow all outgoing traffic**, is enabled and monitors traffic going to and from the EX15 device. The predefined settings are intended to block unauthorized inbound traffic while providing an unrestricted flow of outgoing data. You can modify the default packet filtering rule and create additional rules to define how the device accepts or rejects traffic that is forwarded through the device.

## Configure packet filtering

### Required configuration items

- The action that the packet filtering rule will perform, either **Accept**, **Reject**, or **Drop**.
- The source firewall zone: Packets originating from interfaces on this zone will be monitored by this rule.
- The destination firewall zone: Packets destined for interfaces on this zone will be accepted, rejected, or dropped by this rule.

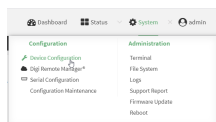
### Additional configuration requirements

- A label for the rule.
- The IP version to be matched, either **IPv4**, **IPv6**, or **Any**.
- The protocol to be matched, one of:
  - **TCP**
  - **UDP**
  - **ICMP**
  - **ICMP6**
  - **Any**

To configure a packet filtering rule:

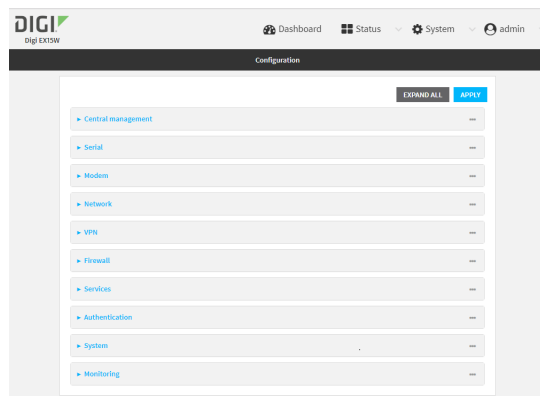
### WebUI

1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.





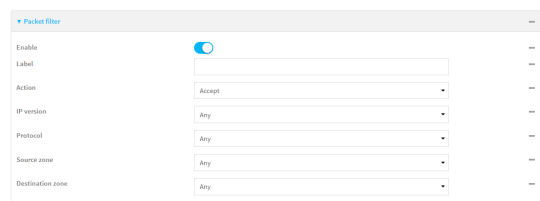
3. Click **Firewall > Packet filtering**.

- To create a new packet filtering rule, for **Add packet filter**, click **+**.



- To edit the default packet filtering rule or another existing packet filtering rule, click to expand the rule.

The packet filtering rule configuration window is displayed.



Packet filters are enabled by default. To disable, click to toggle off **Enable**.

- (Optional) Type a **Label** that will be used to identify the rule.
- For **Action**, select one of:
  - **Accept**: Allows matching network connections.
  - **Reject**: Blocks matching network connections, and sends an ICMP error if appropriate.
  - **Drop**: Blocks matching network connections, and does not send a reply.
- Select the **IP version**.
- Select the **Protocol**.
- For **Source zone**, select the firewall zone that will be monitored by this rule for incoming connections from network interfaces that are a member of this zone.  
See [Firewall configuration](#) for more information about firewall zones.
- For **Destination zone**, select the firewall zone. Packets destined for network interfaces that are members of this zone will either be accepted, rejected or dropped by this rule.  
See [Firewall configuration](#) for more information about firewall zones.

- Click **Apply** to save the configuration and apply the change.



## Command line

- Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
- At the command line, type **config** to enter configuration mode:

---

```
> config
(config)>
```

---

To edit the default packet filtering rule or another existing packet filtering rule:

- Determine the index number of the appropriate packet filtering rule:

---

```
(config)> show firewall filter
0
 action accept
 dst_zone any
 enable true
 ip_version any
 label Allow all outgoing traffic
 protocol any
 src_zone internal
1
 action drop
 dst_zone internal
 enable true
 ip_version any
 label myfilter
 protocol any
 src_zone external
(config)>
```

---

- Select the appropriate rule by using its index number:

---

```
(config)> firewall filter 1
(config firewall filter 1)>
```

---

To create a new packet filtering rule:

---

```
(config)> add firewall filter end
(config firewall filter 1)>
```

---

Packet filtering rules are enabled by default. To disable the rule:

---

```
(config firewall filter 1)> enable false
(config firewall filter 1)>
```

---

3. (Optional) Set the label for the rule.

---

```
(config firewall filter 1)> label "My filter rule"
(config firewall filter 1)>
```

---

4. Set the action to be performed by the filter rule.

---

```
(config firewall filter 1)> action value
(config firewall filter 1)>
```

---

where *value* is one of:

- **accept**: Allows matching network connections.
- **reject**: Blocks matching network connections, and sends an ICMP error if appropriate.
- **drop**: Blocks matching network connections, and does not send a reply.

5. Set the firewall zone that will be monitored by this rule for incoming connections from network interfaces that are a member of this zone:

See [Firewall configuration](#) for more information about firewall zones.

---

```
(config firewall filter 1)> src_zone my_zone
(config firewall filter 1)>
```

---

6. Set the destination firewall zone. Packets destined for network interfaces that are members of this zone will either be accepted, rejected or dropped by this rule.

See [Firewall configuration](#) for more information about firewall zones.

---

```
(config firewall filter 1)> dst_zone my_zone
(config firewall filter 1)>
```

---

7. Set the IP version.

---

```
(config firewall filter 1)> ip_version value
(config firewall filter 1)>
```

---

where *value* is one of:

- **any**
- **ipv4**
- **ipv6**
- The default is **any**.

8. Set the protocol.

---

```
(config firewall filter 1)> protocol value
(config firewall filter 1)>
```

---

where value is one of:

- **any**
- **icmp**
- **icmpv6**
- **tcp**
- **udp**

The default is **any**.

9. Save the configuration and apply the change:

```
(config)> save
Configuration saved.
>
```

10. Type **exit** to exit the Admin CLI.

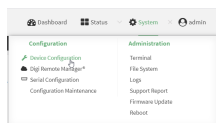
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Enable or disable a packet filtering rule

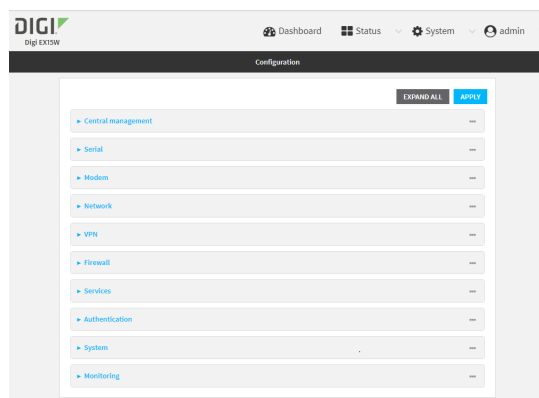
To enable or disable a packet filtering rule:

### WebUI

1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.

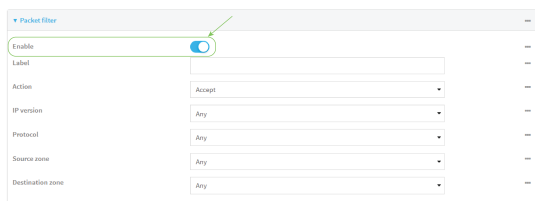


The **Configuration** window is displayed.



3. Click **Firewall > Packet filtering**.
4. Click the appropriate packet filtering rule.

- Click **Enable** to toggle the rule between enabled and disabled.



- Click **Apply** to save the configuration and apply the change.



## Command line

- Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
- At the command line, type **config** to enter configuration mode:

```
> config
(config)>
```

- Determine the index number of the appropriate port forwarding rule:

```
(config)> show firewall filter
0
 action accept
 dst_zone any
 enable true
 ip_version any
 label Allow all outgoing traffic
 protocol any
 src_zone internal
1
 action drop
 dst_zone internal
 enable true
 ip_version any
 label My packet filter
 protocol any
 src_zone external
(config)>
```

- To enable a packet filtering rule, use the index number with the **enable true** command. For example:

```
(config)> firewall filter 1 enable true
```

- To disable a packet filtering rule, use the index number with the **enable false** command. For example:

```
(config)> firewall filter 1 enable false
```

- Save the configuration and apply the change:

```
(config)> save
Configuration saved.
>
```

- Type **exit** to exit the Admin CLI.

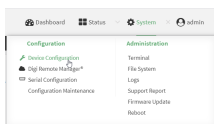
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Delete a packet filtering rule

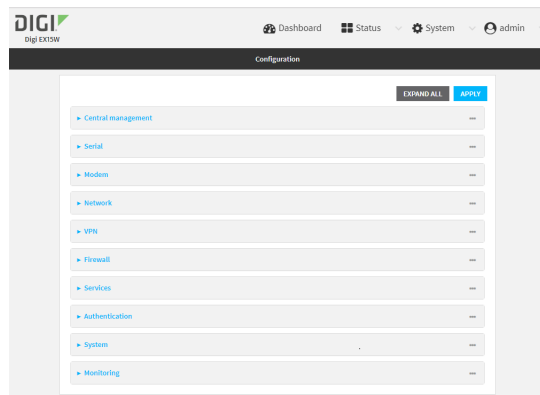
To delete a packet filtering rule:

### WebUI

- Log into the EX15 WebUI as a user with full Admin access rights.
- On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.



- Click **Firewall > Packet filtering**.
- Click the menu icon (...) next to the appropriate packet filtering rule and select **Delete**.



5. Click **Apply** to save the configuration and apply the change.



## Command line

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.

2. At the command line, type **config** to enter configuration mode:

```
> config
(config)>
```

3. Determine the index number of the packet filtering rule you want to delete:

```
(config)> show firewall filter
0
 action accept
 dst_zone any
 enable true
 ip_version any
 label Allow all outgoing traffic
 protocol any
 src_zone internal
1
 action drop
 dst_zone internal
 enable true
 ip_version any
 label My packet filter
 protocol any
 src_zone external
(config)>
```

4. To delete the rule, use the index number with the **del** command. For example:

```
(config)> del firewall filter 1
```

5. Save the configuration and apply the change:

```
(config)> save
Configuration saved.
>
```

6. Type **exit** to exit the Admin CLI.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

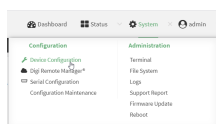
## Configure custom firewall rules

Custom firewall rules consist of a script of shell commands that can be used to install firewall rules, ipsets, and other system configuration. These commands are run whenever system configuration changes occur that might cause changes to the firewall.

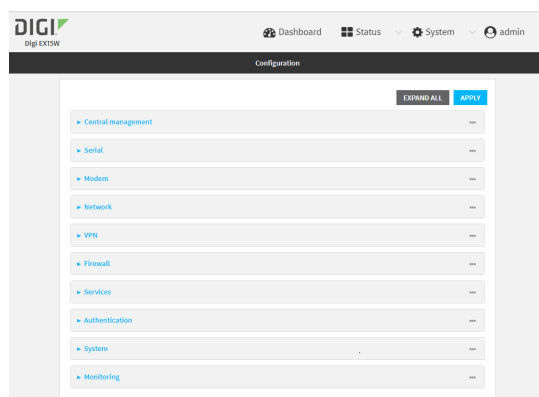
To configure custom firewall rules:

### WebUI

1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.



3. Click **Firewall > Custom rules**.



4. **Enable** the custom rules.
5. (Optional) Enable **Override** to override all preconfigured firewall behavior and rely solely on the custom firewall rules.
6. For **Rules**, type the shell command that will execute the custom firewall rules script.
7. Click **Apply** to save the configuration and apply the change.





 **Command line**

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.

2. At the command line, type **config** to enter configuration mode:

---

```
> config
(config)>
```

---

3. Enable custom firewall rules:

---

```
(config)> firewall custom enable true
(config)>
```

---

4. (Optional) Instruct the device to override all preconfigured firewall behavior and rely solely on the custom firewall rules:

---

```
(config)> firewall custom override true
(config)>
```

---

5. Set the shell command that will execute the custom firewall rules script:

---

```
(config)> firewall custom rules "shell-command"
(config)>
```

---

6. Save the configuration and apply the change:

---

```
(config)> save
Configuration saved.
>
```

---

7. Type **exit** to exit the Admin CLI.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

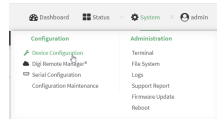
## Configure captive portals

Captive portals are commonly used on public-access networks to require users to login or accept terms and conditions before accessing the internet.

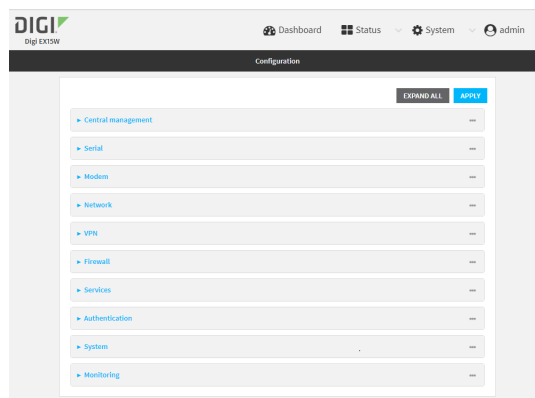
To configure captive portals:

### WebUI

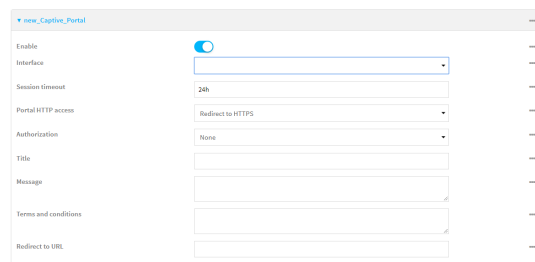
1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.



3. Click **Firewall > Captive portals**.
4. For **Add captive portal**:, enter a name for the portal and click **+**.



The captive portal configuration window is displayed.

The captive portal is enabled by default. To disable, click to toggle off **Enable**.

5. For **Interface**, select the network interface for the portal.  
Traffic received on this interface's network device will not be forwarded unless the client has been granted access.

6. For **Session timeout**, type the amount of time that a user session remains valid. After the session times out, the user will be required to log in again.  
Allowed values are any number of weeks, days, hours, minutes, or seconds, and take the format **number{w|d|h|m|s}**.  
For example, to set **Session timeout** to ten minutes, enter **10m** or **600s**.
  7. For **Portal HTTP access**, configure whether the portal can be accessed over an insecure connection.
    - **Allow**: Allows access to the portal page over an insecure connection (HTTP port 80).
    - **Redirect to HTTPS**: Automatically redirects the request to a secure connection (HTTPS port 443).
    - **Disallow**: Does not allow access over an insecure connection (HTTP port 80).
- 
- Note** This setting does not affect access to HTTP port 80 after the client has been granted access to the portal.
- 
8. For **Authorization**, select the method that will be used to authorize the user:
    - **None**: Users are not required to enter any information to access the portal.
    - **User login**: Users are required to authenticate with an account on this device. Users must be part of a user group that allows access to this portal.
    - **Collect user information**: Users are required to complete a form to continue. The form fields may be customize.
  9. (Optional) For **Title**, enter the title of the portal page that the user will see when accessing the portal.
  10. (Optional) For **Message**, enter a message that will appear on the portal page.
  11. (Optional) For **Terms and Conditions**, enter the terms and conditions that will appear on the portal page. Users will be required to agree to the terms and conditions before being granted access to the portal.
  12. (Optional) For **Redirect to URL**, enter the URL to which the user will be directed when granted access to the portal. If left blank, the user will be directed to the domain of the URL in the original access request.
  13. Click **Apply** to save the configuration and apply the change.



## Command line

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.

2. At the command line, type **config** to enter configuration mode:

---

```
> config
(config)>
```

---

3. To create an active portal called **portal1**:

---

```
(config)> add firewall portal portal1
(config firewall portal portal1)>
```

---

Captive portals are enabled by default. To disable the portal:

---

```
(config firewall portal portal1)> enable false
(config firewall portal portal1)>
```

---

4. Set the network interface for the portal. Traffic received on this interface's network device will not be forwarded unless the client has been granted access.
  - a. Use the **?** to determine available interfaces:

---

```
(config firewal portal portal1)>interface ?
```

---

Interface: The network interface to run the portal on. Traffic received on this interface's network device will not be forwarded unless the client has been granted access.

Format:

```
/network/interface/defaultip
/network/interface/defaultlinklocal
/network/interface/lan
/network/interface/loopback
/network/interface/modem
/network/interface/wan
```

Current value:

---

```
(config firewal portal portal1)> interface
```

---

- b. Set the interface. For example:

---

```
(config firewal portal portal1)> interface /network/interface/wan
(config firewal portal portal1)>
```

---

5. Set the amount of time that a user session remains valid. After the session times out, the user will be required to log in again.

---

```
(config firewall portal portal1)> timeout value
(config firewall portal portal1)>
```

---

where *value* is any number of weeks, days, hours, minutes, or seconds, and takes the format **number{w|d|h|m|s}**.

For example, to set **Session timeout** to ten minutes, enter either **10m** or **600s**:

---

```
(config firewall portal portal1)> timeout 600s
(config firewall portal portal1)>
```

---

6. Configure whether the portal can be accessed over an insecure connection.

---

```
(config firewall portal portal1)> http value
(config firewall portal portal1)>
```

---

where *value* is one of:

- **allow**: Allows access to the portal page over an insecure connection (HTTP port 80).
- **redirect**: Automatically redirects the request to a secure connection (HTTPS port 443).
- **disallow**: Does not allow access over an insecure connection (HTTP port 80).

---

**Note** This setting does not affect access to HTTP port 80 after the client has been granted access to the portal.

---

7. Set the method that will be used to authorize the user:

---

```
(config firewall portal portal1)> auth value
(config firewall portal portal1)>
```

---

where *value* is one of:

- **none**: Users are not required to enter any information to access the portal.
- **login**: Users are required to authenticate with an account on this device. Users must be part of a user group that allows access to this portal.
- **info**: Users are required to complete a form to continue. The form fields may be customize.

8. (Optional) Set the title of the portal page that the user will see when accessing the portal:

---

```
(config firewall portal portal1)> title "Corporate portal"
(config firewall portal portal1)>
```

---

9. (Optional) Set a message that will appear on the portal page:

---

```
(config firewall portal portal1)> message "Welcome to the corporate web
portal"
(config firewall portal portal1)>
```

---

10. (Optional) Set the terms and conditions that will appear on the portal page. Users will be required to agree to the terms and conditions before being granted access to the portal.

---

```
(config firewall portal portal1)> terms "Accept the terms and conditions of
this portal"
(config firewall portal portal1)>
```

---

11. (Optional) Set the URL to which the user will be directed when granted access to the portal. If left blank, the user will be directed to the domain of the URL in the original access request.

---

```
(config firewall portal portal1)> url https://myportal.com
(config firewall portal portal1)>
```

---

12. Save the configuration and apply the change:

```
(config)> save
Configuration saved.
>
```

13. Type **exit** to exit the Admin CLI.

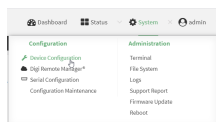
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Delete captive portals

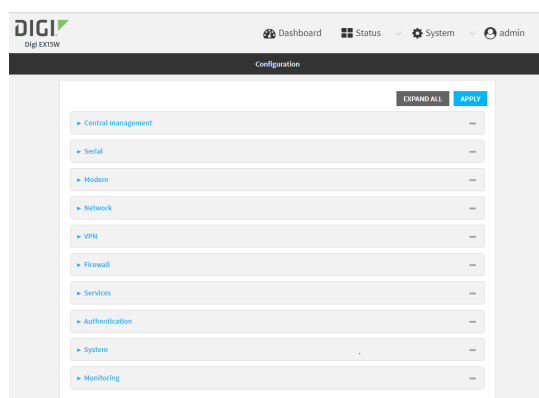
To delete captive portals:

### WebUI

1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.



3. Click **Firewall > Captive portals**.
4. Click the down caret (▼) next to the appropriate captive portal and select **Delete**.
5. Click **Apply** to save the configuration and apply the change.



### Command line

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the command line, type **config** to enter configuration mode:

```
> config
(config)>
```

3. To delete a captive portal, use the **del** command. For example:

```
(config)# del firewall portal portal1
```

4. Save the configuration and apply the change:

```
(config)# save
Configuration saved.
>
```

5. Type **exit** to exit the Admin CLI.
- Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Configure Quality of Service options

Quality of Service (QoS) options allow you to manage the traffic performance of various services, such as Voice over IP (VoIP), cloud computing, traffic shaping, traffic prioritizing, and bandwidth allocation. When configuring QoS, you can only control the queue for outgoing packets on each interface (egress packets), not what is received on the interface (packet ingress).

A QoS *binding* contains the policies and rules that apply to packets exiting the EX15 device on the binding's interface. By default, the EX15 device has two preconfigured QoS bindings, **Outbound** and **Inbound**. These bindings are an example configuration designed for a typical VoIP site:

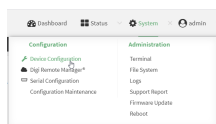
- **Outbound** provides an example of matching packets as they are routed from the device onto the WAN interface.
- **Inbound** provides an example of matching packets as they are routed from the device onto a LAN interface.

These example bindings are disabled by default.

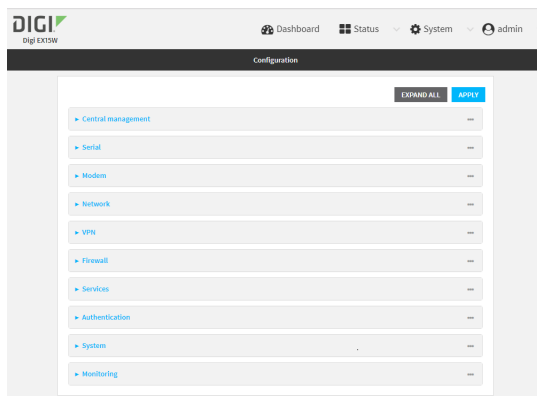
## Enable the preconfigured bindings

 WebUI

1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.



3. Click **Firewall > Quality of Service**.
4. Click to expand either **Outbound** or **Inbound**.
5. **Enable** the binding.
6. Select an **Interface**.
7. Examine the remaining default settings and modify as appropriate for your network.
8. Click **Apply** to save the configuration and apply the change.



## Command line

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the command line, type **config** to enter configuration mode:

```
> config
(config)>
```

3. Enable one of the preconfigured bindings:

- To enable the Outbound binding:

```
(config)> firewall qos 0 enable true
(config)>
```

- To enable the Inbound binding:

```
(config)> firewall qos 1 enable true
(config)>
```

4. Set the interface for the binding. Use the index number of the binding; for example, to set the interface for the Outbound binding:



- a. Use the **?** to determine available interfaces:

```
(config)>firewall qos 0 interface ?
```

Interface: The network interface.

Format:

```
/network/interface/defaultip
/network/interface/defaultlinklocal
/network/interface/lan
/network/interface/loopback
/network/interface/modem
/network/interface/wan
```

Current value:

```
(config)> firewall qos 0 interface
```

- b. Set the interface. For example:

```
(config)> firewall qos 0 interface /network/interface/wan
(config)>
```

5. Examine the remaining default settings and modify as appropriate for your network.
6. Save the configuration and apply the change:

```
(config)> save
Configuration saved.
>
```

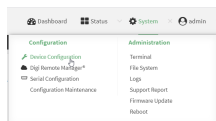
7. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

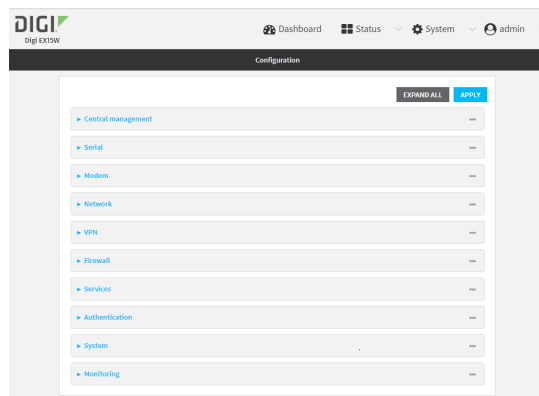
## Create a new binding

### WebUI

1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



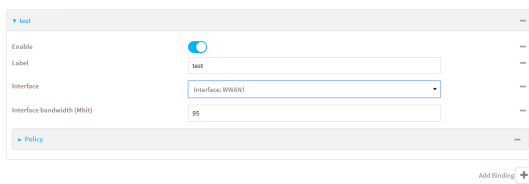
The **Configuration** window is displayed.



3. Click **Firewall > Quality of Service**.
4. For **Add Binding**, click **+**.



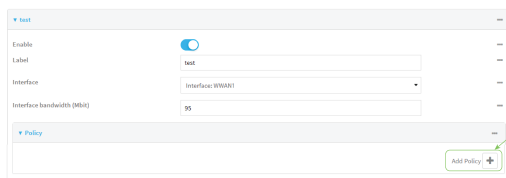
The quality of service binding configuration window is displayed.



5. **Enable** the binding.
6. (Optional) Type a **Label** for the binding.
7. Select an **Interface** to queue egress packets on. The binding will only match traffic that is being sent out on this interface.
8. (Optional) For **Interface bandwidth (Mbit)**, set the maximum egress bandwidth of the interface, in megabits, allocated to this binding. Typically, this should be 95% of the available bandwidth. Allowed value is any integer between **1** and **1000**.
9. Create a policy for the binding:
 

At least one policy is required for each binding. Each policy can contain up to 30 rules.

  - a. Click to expand **Policy**.
  - b. For **Add Policy**, click **+**.



The QoS binding policy configuration window is displayed.

New QoS binding policies are enabled by default. To disable, click **Enable**.

- c. (Optional) Type a **Label** for the binding policy.
- d. For **Weight**, type a value for the amount of available bandwidth allocated to the policy, relative to other policies for this binding.  
The larger the weight, with respect to the other policy weights, the larger portion of the maximum bandwidth is available for this policy. For example, if a binding contains three policies, and each policy contains a weight of 10, each policy will be allocated one third of the total interface bandwidth.
- e. For **Latency**, type the maximum delay before the transmission of packets. A lower latency means that the packets will be scheduled more quickly for transmission.
- f. Select **Default** to identify this policy as a fall-back policy. The fall-back policy will be used for traffic that is not matched by any other policy. If there is no default policy associated with this binding, packets that do not match any policy rules will be dropped.
- g. If **Default** is disabled, you must configure at least one rule:
  - i. Click to expand **Rule**.
  - ii. For **Add Rule**, click **+**.

The QoS binding policy rule configuration window is displayed.

New QoS binding policy rules are enabled by default. To disable, click **Enable**.

- iii. (Optional) Type a **Label** for the binding policy rule.
- iv. For **Type Of Service**, type the value of the Type of Service (ToS) packet header that defines packet priority. If unspecified, this field is ignored.

See <https://www.tucny.com/Home/dscp-tos> for a list of common TOS values.

- v. For **Protocol**, select the IP protocol matching criteria for this rule.
- vi. For **Source port**, type the port, or **any**, as a source traffic matching criteria.
- vii. For **Destination port**, type the port, or **any**, as a destination traffic matching criteria.
- viii. Click to expand **Source address** and select the **Type**:
  - **Any**: Source traffic from any address will be matched.
  - **Interface**: Only traffic from the selected **Interface** will be matched.
  - **IPv4 address**: Only traffic from the IP address typed in **IPv4 address** will be matched. Use the format **IPv4\_address[/netmask]**, or use **any** to match any IPv4 address.
  - **IPv6 address**: Only traffic from the IP address typed in **IPv6 address** will be matched. Use the format **IPv6\_address[/prefix\_length]**, or use **any** to match any IPv6 address.
  - **MAC address**: Only traffic from the MAC address typed in **MAC address** will be matched.
- ix. Click to expand **Destination address** and select the **Type**:
  - **Any**: Traffic destined for anywhere will be matched.
  - **Interface**: Only traffic destined for the selected **Interface** will be matched.
  - **IPv4 address**: Only traffic destined for the IP address typed in **IPv4 address** will be matched. Use the format **IPv4\_address[/netmask]**, or use **any** to match any IPv4 address.
  - **IPv6 address**: Only traffic destined for the IP address typed in **IPv6 address** will be matched. Use the format **IPv6\_address[/prefix\_length]**, or use **any** to match any IPv6 address.

Repeat to add a new rule. Up to 30 rules can be configured.

10. Click **Apply** to save the configuration and apply the change.



## Command line

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.

2. At the command line, type **config** to enter configuration mode:

---

```
> config
(config)>
```

---

3. Add a binding:

---

```
(config)> add firewall qos end
(config firewall qos 2)>
```

---

New binding are enabled by default. To disable:

---

```
(config firewall qos 2)> enable false
(config firewall qos 2)>
```

---

4. (Optional) Set a label for the new binding:

---

```
(config firewall qos 2)> label my_binding
(config firewall qos 2)>
```

---

5. Set the interface to queue egress packets on. The binding will only match traffic that is being sent out on this interface:

- a. Use the **?** to determine available interfaces:

---

```
(config firewall qos 2)>interface ?
```

Interface: The network interface.

Format:

```
/network/interface/defaultip
/network/interface/defaultlinklocal
/network/interface/lan
/network/interface/loopback
/network/interface/modem
/network/interface/wan
```

Current value:

---

```
(config firewall qos 2)> interface
```

---

- b. Set the interface. For example:

---

```
(config firewall qos 2)> interface /network/interface/wan
(config firewall qos 2)>
```

---

6. (Optional) Set the maximum egress bandwidth of the interface, in megabits, allocated to this binding.

---

```
(config firewall qos 2)> bandwidth int
(config firewall qos 2)>
```

---

where *int* is an integer between **1** and **1000**. Typically, this should be 95% of the available bandwidth. The default is **95**.

7. Create a policy for the binding:

At least one policy is required for each binding. Each policy can contain up to 30 rules.

a. Change to the policy node of the configuration:

---

```
(config firewall qos 2)> policy
(config firewall qos 2 policy)>
```

---

b. Add a policy:

---

```
(config firewall qos 2 policy)> add end
(config firewall qos 2 policy 0)>
```

---

New QoS binding policies are enabled by default. To disable:

---

```
(config firewall qos 2 policy 0)> enable false
(config firewall qos 2 policy 0)>
```

---

c. (Optional) Set a label for the new binding policy:

---

```
(config firewall qos 2 policy 0)> label my_binding_policy
(config firewall qos 2 policy 0)>
```

---

d. Set a value for the amount of available bandwidth allocated to the policy, relative to other policies for this binding.

The larger the weight, with respect to the other policy weights, the larger portion of the maximum bandwidth is available for this policy. For example, if a binding contains three policies, and each policy contains a weight of 10, each policy will be allocated one third of the total interface bandwidth.

---

```
(config firewall qos 2 policy 0)> weight int
(config firewall qos 2 policy 0)>
```

---

where *int* is any integer between **1** and **65535**. The default is **10**.

e. Set the maximum delay before the transmission of packets. A lower number means that the packets will be scheduled more quickly for transmission.

---

```
(config firewall qos 2 policy 0)> latency int
(config firewall qos 2 policy 0)>
```

---

where *int* is any integer, **1** or greater. The default is **100**.

f. To identify this policy as a fall-back policy:

---

```
(config firewall qos 2 policy 0)> default true
(config firewall qos 2 policy 0)>
```

---

The fall-back policy will be used for traffic that is not matched by any other policy. If there is no default policy associated with this binding, packets that do not match any policy rules will be dropped. If the policy is not a fall-back policy, you must configure at least one rule:

- i. Change to the rule node of the configuration:

---

```
(config firewall qos 2 policy 0)> rule
(config firewall qos 2 policy 0 rule)>
```

---

- ii. Add a rule:

---

```
(config firewall qos 2 policy 0 rule)> add end
(config firewall qos 2 policy 0 rule 0)>
```

---

New QoS binding policy rules are enabled by default. To disable:

---

```
(config firewall qos 2 policy 0 rule 0)> enable false
(config firewall qos 2 policy 0 rule 0)>
```

---

- iii. (Optional) Set a label for the new binding policy rule:

---

```
(config firewall qos 2 policy 0 rule 0)> label my_binding_policy_
rule
(config firewall qos 2 policy 0 rule 0)>
```

---

- iv. Set the value of the Type of Service (ToS) packet header that defines packet priority. If unspecified, this field is ignored.

---

```
(config firewall qos 2 policy 0 rule 0)> tos value
(config firewall qos 2 policy 0 rule 0)>
```

---

where *value* is a hexadecimal number. See <https://www.tucny.com/Home/dscp-tos> for a list of common TOS values.

- v. Set the IP protocol matching criteria for this rule:

---

```
(config firewall qos 2 policy 0 rule 0)> protocol value
(config firewall qos 2 policy 0 rule 0)>
```

---

where *value* is one of **tcp**, **udp**, or **any**.

- vi. Set the source port to define a source traffic matching criteria:

---

```
(config firewall qos 2 policy 0 rule 0)> srcport value
(config firewall qos 2 policy 0 rule 0)>
```

---

where *value* is the IP port number, a range of port numbers using the format *IP\_port-IP\_port*, or **any**.

- vii. Set the destination port to define a destination matching criteria:

---

```
(config firewall qos 2 policy 0 rule 0)> dstport value
(config firewall qos 2 policy 0 rule 0)>
```

---

where *value* is the IP port number, a range of port numbers using the format *IP\_port-IP\_port*, or **any**.

## viii. Set the source address type:

---

```
(config network qos 2 policy 0 rule 0)> src type value
(config network qos 2 policy 0 rule 0)>
```

---

where *value* is one of:

- **any:** Source traffic from any address will be matched.  
See [Firewall configuration](#) for more information about firewall zones.
- **interface:** Only traffic from the selected interface will be matched. Set the interface:
  - i. Use the **?** to determine available interfaces:

---

```
(config network qos 2 policy 0 rule 0)>src interface ?
```

---

Interface: Match the IP address with the specified interface's network address.

Format:

```
/network/interface/defaultip
/network/interface/defaultlinklocal
/network/interface/lan
/network/interface/loopback
/network/interface/modem
/network/interface/wan
```

Current value:

---

```
(config network qos 2 policy 0 rule 0)> src interface
```

---

- ii. Set the interface. For example:

---

```
(config network qos 2 policy 0 rule 0)> src interface
/network/interface/wan
(config network qos 2 policy 0 rule 0)>
```

---

- **address:** Only traffic from the IP address typed in **IPv4 address** will be matched. Set the address that will be matched:

---

```
(config network qos 2 policy 0 rule 0)> src address value
(config network qos 2 policy 0 rule 0)>
```

---

where *value* uses the format **IPv4\_address[/netmask]**, or **any** to match any IPv4 address.

- **address6:** Only traffic from the IP address typed in **IPv6 address** will be matched. Set the address that will be matched:

---

```
(config network qos 2 policy 0 rule 0)> src address6 value
(config network qos 2 policy 0 rule 0)>
```

---

where *value* uses the format **IPv6\_address[/prefix\_length]**, or **any** to match any IPv6 address.



- **mac:** Only traffic from the MAC address typed in **MAC address** will be matched. Set the MAC address to be matched:

---

```
(config network qos 2 policy 0 rule 0)> src mac MAC_address
(config network qos 2 policy 0 rule 0)>
```

---

- ix. Set the destination address type:

---

```
(config network qos 2 policy 0 rule 0)> dst type value
(config network qos 2 policy 0 rule 0)>
```

---

where *value* is one of:

- **any:** Traffic destined for anywhere will be matched.  
See [Firewall configuration](#) for more information about firewall zones.
- **interface:** Only traffic destined for the selected **Interface** will be matched. Set the interface:
  - Use the **?** to determine available interfaces:

---

```
(config network qos 2 policy 0 rule 0)>dst interface ?
```

---

Interface: Match the IP address with the specified interface's network address.

Format:

```
/network/interface/defaultip
/network/interface/defaultlinklocal
/network/interface/lan
/network/interface/loopback
/network/interface/modem
/network/interface/wan
```

Current value:

---

```
(config network qos 2 policy 0 rule 0)> dst interface
```

---

- Set the interface. For example:

---

```
(config network qos 2 policy 0 rule 0)> dst interface
/network/interface/wan
(config network qos 2 policy 0 rule 0)>
```

---

- **address:** Only traffic destined for the IP address typed in **IPv4 address** will be matched. Set the address that will be matched:

---

```
(config network qos 2 policy 0 rule 0)> src address value
(config network qos 2 policy 0 rule 0)>
```

---

where *value* uses the format **IPv4\_address[/netmask]**, or **any** to match any IPv4 address.

- **address6:** Only traffic destined for the IP address typed in **IPv6 address** will be matched. Set the address that will be matched:

---

```
(config network qos 2 policy 0 rule 0)> src address6 value
(config network qos 2 policy 0 rule 0)>
```

---

where value uses the format **IPv6\_address[/prefix\_length]**, or **any** to match any IPv6 address.

Repeat to add a new rule. Up to 30 rules can be configured.

8. Save the configuration and apply the change:

---

```
(config)> save
Configuration saved.
>
```

---

9. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## System administration

---

This chapter contains the following topics:

|                                                                |     |
|----------------------------------------------------------------|-----|
| Review device status .....                                     | 664 |
| Configure system information .....                             | 665 |
| Update system firmware .....                                   | 667 |
| Update cellular module firmware .....                          | 671 |
| Reboot your EX15 device .....                                  | 675 |
| Erase device configuration and reset to factory defaults ..... | 678 |
| Configuration files .....                                      | 685 |
| Schedule system maintenance tasks .....                        | 690 |
| Disable device encryption .....                                | 697 |
| Configure the speed of your Ethernet ports .....               | 700 |

## Review device status

You can review the system of your device from either the **Status** page of the Web interface, or from the command line:

### WebUI

To display system information:

1. Log into the EX15 WebUI as a user with Admin access.
2. On the main menu, click **Status**.  
A secondary menu appears, along with a status panel.
3. On the secondary menu, click to display the details panel for the status you want to view.

### Command line

To display system information, use the `show system` command.

- Show basic system information:

1. Log into the EX15 command line as a user with Admin access.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. Enter **show system** at the prompt:

---

```
> show system
```

```

Model : Digi EX15
Serial Number : EX15-000065
SKU : EX15
Hostname : EX15
MAC : DF:DD:E2:AE:21:18

Hardware Version : 50001947-01 1P
Firmware Version : 21.2.39.67
Alt. Firmware Version : 21.2.39.67
Bootloader Version : 19.7.23.0-15f936e0ed

Current Time : Fri, 26 Feb 2021 8:04:23 +0000
CPU : 1.4%
Uptime : 6 days, 6 hours, 21 minutes, 57 seconds
(541317s)
Temperature : 40C

>
```

---

- Show more detailed system information:

1. Log into the EX15 command line as a user with Admin access.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. Enter **show system verbose** at the prompt:

---

```
> show system verbose

Model : Digi EX15
Serial Number : EX15-000065
SKU : EX15
Hostname : EX15
MAC : DF:DD:E2:AE:21:18

Hardware Version : 50001947-01 1P
Firmware Version : 21.2.39.67
Alt. Firmware Version : 21.2.39.67
Bootloader Version : 19.7.23.0-15f936e0ed

Schema Version : 715
Timezone : UTC
Current Time : Fri, 26 Feb 2021 8:04:23 +0000
CPU : 1.4%
Uptime : 6 days, 6 hours, 21 minutes, 57 seconds
(541317s)
Temperature : 40C

Disk

Load Average : 0.09, 0.10, 0.08
RAM Usage : 127.843MB/1880.421MB(6%)
Disk /etc/config Usage : 18.421MB/4546.371MB(0%)
Disk /opt Usage : -4523.-46MB/549.304MB(-822%)
Disk /overlay Usage : MB/MB(%)
Disk /tmp Usage : 0.007MB/256.0MB(0%)
Disk /var Usage : 1.765MB/256.0MB(1%)

>
```

---

## Configure system information

You can configure information related to your EX15 device, such as providing a name and location for the device.

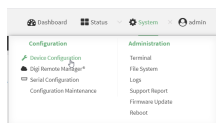
### Configuration items

- A name for the device.
- The name of a contact for the device.
- The location of the device.
- A description of the device.
- A banner that will be displayed when users access terminal services on the device.

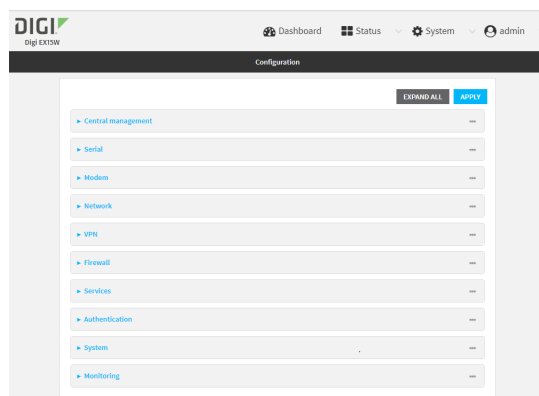
To enter system information:

## WebUI

1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.



3. Click **System**.
4. For **Name**, type a name for the device. This name will appear in log messages and at the command prompt.
5. For **Contact**, type the name of a contact for the device.
6. For **Location**, type the location of the device.
7. For **Banner**, type a banner message that will be displayed when users log into terminal services on the device.
8. Click **Apply** to save the configuration and apply the change.



## Command line

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.

2. At the command line, type **config** to enter configuration mode:

---

```
> config
(config)>
```

---

3. Set a name for the device. This name will appear in log messages and at the command prompt.

---

```
(config)> system name 192.168.3.1
192.168.3.1(config)>
```

---

4. Set the contact for the device:

---

```
192.168.3.1(config)> system contact "Jane User"
192.168.3.1(config)>
```

---

5. Set the location for the device:

---

```
192.168.3.1(config)> system location "9350 Excelsior Blvd., Suite 700,
Hopkins, MN"
192.168.3.1(config)>
```

---

6. Set the banner for the device. This is displayed when users access terminal services on the device.

---

```
192.168.3.1(config)> system banner "Welcome to the Digi EX15."
192.168.3.1(config)>
```

---

7. Save the configuration and apply the change:

---

```
192.168.3.1(config)> save
Configuration saved.
192.168.3.1>
```

---

8. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Update system firmware

The EX15 operating system firmware images consist of a single file with the following naming convention:

***platform-version.bin***

For example, **EX15-21.2.39.67.bin**.

## Manage firmware updates using Digi Remote Manager

If you have a network of many devices, you can use Digi Remote Manager **Profiles** to manage firmware updates. Profiles ensure all your devices are running the correct firmware version and that all newly installed devices are updated to that same version. For more information, see the **Profiles** section of the [Digi Remote Manager User Guide](#).

## Certificate management for firmware images

The system firmware files are signed to ensure that only Digi-approved firmware load onto the device. The EX15 device validates the system firmware image as part of the update process and only successfully updates if the system firmware image can be authenticated.

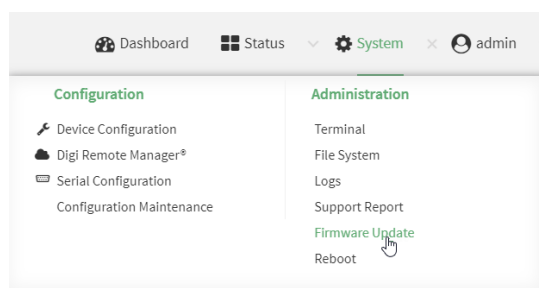
## Downgrading

Downgrading to an earlier release of the firmware may result in the device configuration being erased.

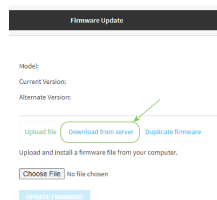
### WebUI

#### Install firmware from the Digi firmware server

1. Log into the EX15 WebUI as a user with Admin access.
2. On the main menu, click **System**. Under **Administration**, click **Firmware Update**.



3. Click **Download from server**.



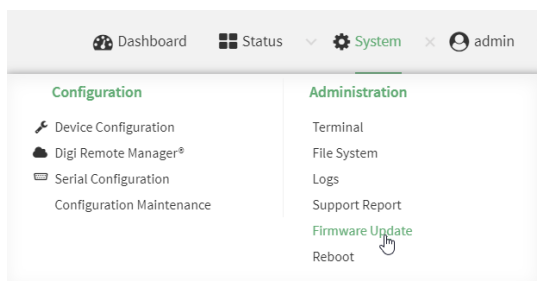
4. For **Version**, select the appropriate version of the device firmware.
5. Click **Update Firmware**.

#### Update firmware from a local file

1. Download the EX15 operating system firmware from the Digi Support FTP site to your local machine.
2. Log into the EX15 WebUI as a user with Admin access.



- On the main menu, click **System**. Under **Administration**, click **Firmware Update**.



- Click **Choose file**.
- Browse to the location of the firmware on your local file system and select the file.
- Click **Update Firmware**.

## Command line

- Download the EX15 operating system firmware from the Digi Support FTP site to your local machine.
- Log into the EX15 command line as a user with Admin access.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
- Load the firmware image onto the device:

```
> scp host hostname-or-ip user username remote remote-path local local-path
to local
```

where:

- *hostname-or-ip* is the hostname or ip address of the remote host.
- *username* is the name of the user on the remote host.
- *remote-path* is the path and filename of the file on the remote host that will be copied to the EX15 device.
- *local-path* is the location on the EX15 device where the copied file will be placed.

For example:

```
> scp host 192.168.4.1 user admin remote /home/admin/bin/EX15-
21.2.39.67.bin local /etc/config/ to local
admin@192.168.4.1's password: adminpwd
EX15-21.2.39.67.bin 100% 36MB 11.1MB/s 00:03
>
```

- Verify that the firmware file has been successfully uploaded to the device:

```
> ls /etc/config/scripts
-rw-r--r-- 1 root root 37511229 May 16 20:10 EX15-
21.2.39.67.bin
```

---

```
-rw-r--r-- 1 root root 2580 May 16 16:44 accns.json
...
>
```

---

5. Update the firmware by entering the [update firmware](#) command, specifying the firmware file name:

---

```
> system firmware update file EX15-21.2.39.67.bin
36632K
netflash: got "/etc/config/EX15-21.2.39.67.bin", length=37511229
netflash: authentication successful
netflash: programming FLASH device /dev/flash/image
36633K 100%
Firmware update completed, reboot device
>
```

---

6. Reboot the device to run the new firmware image using the [reboot](#) command.

---

```
> reboot
Rebooting system
>
```

---

7. Once the device has rebooted, log into the EX15's command line as a user with Admin access and verify the running firmware version by entering the [show system](#) command.

---

```
> show system

Hostname : EX15
FW Version : 21.2.39.67
MAC : 0040FF800120
Model : Digi EX15
Current Time : Fri, 26 Feb 2021 8:04:23 +0000
Uptime : 42 seconds (42s)

>
```

---

## Dual boot behavior

By default, the EX15 device stores two copies of firmware in two flash memory banks:

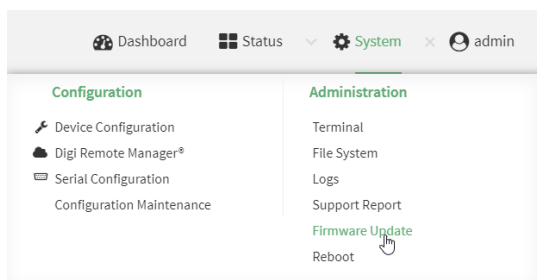
- The current firmware version that is used to boot the device.
- A copy of the firmware that was in use prior to your most recent firmware update.

When the device reboots, it will attempt to use the current firmware version. If the current firmware version fails to load after three consecutive attempts, it is marked as invalid and the device will use the previous firmware version stored in the alternate memory bank.

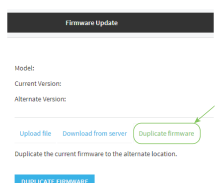
If the device consistently loses power during the boot process, this may result in the current firmware being marked as invalid and the device downgrading to a previous version of the firmware. As a result of this behavior, you can use the following procedure to guarantee that the same firmware is stored in both memory banks:



1. Log into the EX15 WebUI as a user with Admin access.
2. On the main menu, click **System**. Under **Administration**, click **Firmware Update**.



3. Click **Duplicate firmware**.



4. Click **Duplicate Firmware**.

## Command line

1. Log into the EX15 command line as a user with Admin access.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. Duplicate the firmware:

```
> system duplicate-firmware
>
```

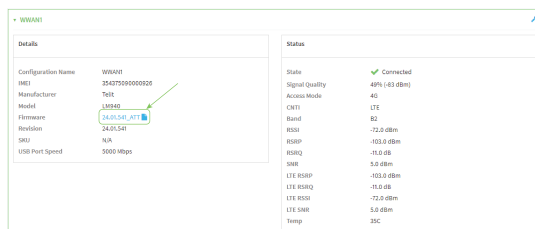
## Update cellular module firmware

You can update modem firmware by downloading firmware from the Digi firmware repository, or by uploading firmware from your local storage onto the device. You can also schedule modem firmware updates. See [Schedule system maintenance tasks](#) for details.

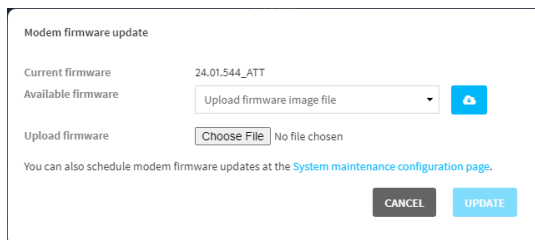
## WebUI

1. (Optional) Download the appropriate modem firmware from the Digi repository to your local machine.
2. Log into the EX15 WebUI as a user with Admin access.
3. From the main menu, click **Status > Modems**.

- Click the modem firmware version.



The **Modem firmware update** window opens.



- To update using firmware from the Digi firmware repository:
  - Click to view available versions.
  - For Available firmware, select the firmware.
- To update using firmware from your local file system:
  - Click **Choose File**.
  - Select the firmware.
- To schedule firmware updates, click **System maintenance configuration page**. See [Schedule system maintenance tasks](#) for details.
- Click **Update**.

## Command line

### Update modem firmware over the air (OTA)

You can update your modem firmware by querying the Digi firmware repository to determine if there is new firmware available for your modem and performing an OTA modem firmware update:

- Log into the EX15 command line as a user with Admin access.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
- Use the **modem firmware ota check** command to determine if new modem firmware is available on the Digi firmware repository.

```
> modem firmware ota check
```

```
Checking for latest ATT firmware ...
Retrieving modem firmware list ...
Newest firmware version available to download is '24.01.5x4_ATT'
Modem firmware update from '24.01.544_ATT' to '24.01.5x4_ATT' is needed
```

---

```
24.01.5x4_ATT
24.01.544_ATT
```

---

```
>
```

---

3. Use the **modem firmware ota list** command to list available firmware on the Digi firmware repository.

---

```
> modem firmware ota list
```

---

```
Retrieving modem firmware list ...
25.20.664_CUST_044_3
25.20.666_CUST_067_1
25.20.663_CUST_040
```

---

```
>
```

---

4. Perform an OTA firmware update:

- To perform an OTA firmware update by using the most recent available modem firmware from the Digi firmware repository, type:

---

```
> modem firmware ota update
```

---

```
Checking for latest Generic firmware ...
Retrieving modem firmware list ...
Newest firmware version available to download is '25.20.666_CUST_067_1'
Retrieving download location for modem firmware '25.20.666_CUST_067_1'
...
>
```

---

- To perform an OTA firmware update by using a specific version from the Digi firmware repository, use the **version** parameter to identify the appropriate firmware version as determined using the **modem firmware ota check** or **modem firmware ota list** command. For example::

---

```
> modem firmware ota update version 24.01.5x4_ATT
```

---

```
Retrieving download location for modem firmware '24.01.5x4_ATT' ...
Downloading modem firmware '24.01.5x4_ATT' to '/opt/LE910C4_NF/Custom_Firmware' ...
Modem firmware '24.01.5x4_ATT' downloaded
Updating modem firmware ...
Programming modem firmware ...

Found modem ...
Validate modem firmware ...
Getting ready for update ...
Stopping services ...
```

---

---

```
Running update pass 1 of 3 ...
Restarting services ...

Successfully updated firmware
Modem firmware update complete

>
```

---

5. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Update modem firmware by using a local firmware file

You can update your modem firmware by uploading a modem firmware file to your EX15 device. Firmware should be uploaded to `/opt/MODEM_MODEL/Custom_Firmware`, for example, `/opt/LM940/Custom_Firmware`. Modem firmware can be downloaded from Digi at [https://ftp1.digi.com/support/firmware/dal/carrier\\_firmware/](https://ftp1.digi.com/support/firmware/dal/carrier_firmware/). See [Use the scp command](#) for information about uploading files to the EX15 device.

1. Log into the EX15 command line as a user with Admin access.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. Use the **modem firmware check** command to determine if new modem firmware is available on local device.

---

```
> modem firmware check

Checking for latest ATT firmware in flash ...
Newest firmware version available in flash is '05.05.58.00_ATT_005.026_000'
Modem firmware up to date
05.05.58.00_ATT_005.026_000

> modem firmware check
```

---

3. Use the **modem firmware list** command to list available firmware on the EX15 device.

---

```
> modem firmware list

ATT, 24.01.544_ATT, current
Generic, 24.01.514_Generic, image
Verizon, 24.01.524_Verizon, image
ATT, 24.01.544_ATT, image
Sprint, 24.01.531-B003_Sprint, image

>
```

---

4. To perform an firmware update by using a local file, use the **version** parameter to identify the appropriate firmware version as determined using the **modem firmware check** or **modem firmware list** command. For example::

---

```
> modem firmware update version 24.01.5x4_ATT
```

```
Updating modem firmware ...
```

```

Successfully updated firmware
Modem firmware update complete
```

```
>
```

---

5. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Reboot your EX15 device

You can reboot the EX15 device immediately or schedule a reboot for a specific time every day.

---

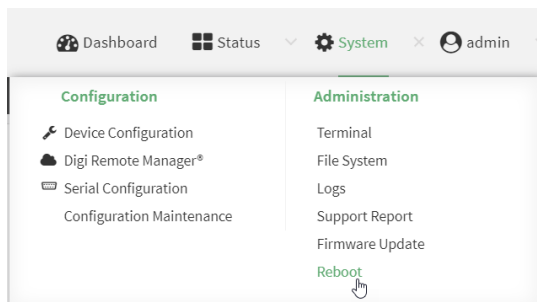
**Note** You may want to save your configuration settings to a file before rebooting. See [Save configuration to a file](#).

---

## Reboot your device immediately

### ≡ WebUI

1. Log into the EX15 WebUI as a user with Admin access.
2. From the main menu, click **System**.
3. Click **Reboot**.



4. Click **Reboot** to confirm that you want to reboot the device.

### ⌨ Command line

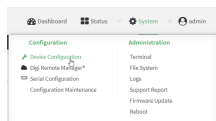
1. Log into the EX15 command line as a user with Admin access.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the prompt, type:

```
> reboot
```

## Schedule reboots of your device

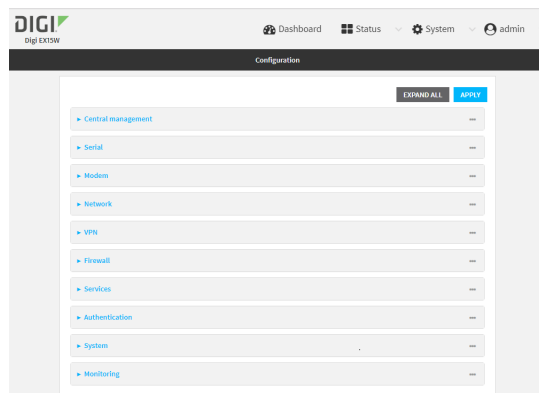
### ≡ WebUI

1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.





3. Select **System** > **Scheduled tasks**.
4. For **Reboot time**, enter the time of the day that the device should reboot, using the format *HH:MM*. The device will reboot at this time every day.  
If a value is set for **Reboot time** but the device is unable to synchronize its time with an NTP server, the device will reboot after it has been up for 24 hours. See [System time](#) for information about configuring NTP servers.
5. Click **Apply** to save the configuration and apply the change.



## Command line

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the command line, type **config** to enter configuration mode:

```
> config
(config)>
```

3. Set the reboot time:

```
(config)>> system schedule reboot_time time
(config)>
```

where *time* is the time of the day that the device should reboot, using the format *HH:MM*. For example, the set the device to reboot at two in the morning every day:

```
(config)>> system schedule reboot_time 02:00
(config)>
```

If a value is set for **reboot\_time** but the device is unable to synchronize its time with an NTP server, the device will reboot after it has been up for 24 hours. See [System time](#) for information about configuring NTP servers.

4. Save the configuration and apply the change:

```
(config)> save
Configuration saved.
>
```

5. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Erase device configuration and reset to factory defaults

You can erase the device configuration in the WebUI, at the command line, or by using the **ERASE** button on the device. Erasing the device configuration performs the following actions:

- Clears all configuration settings. When the device restarts, it uses the factory default configuration.
- Deletes all user files including Python scripts.
- Clears event and system log files.

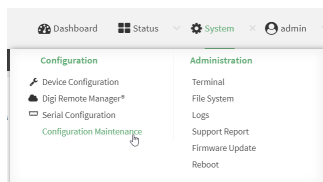
Additionally, if the **ERASE** button is used to erase the configuration, pressing the **ERASE** button a second time immediately after the device has rebooted:

- Erases all automatically generated certificates and keys.

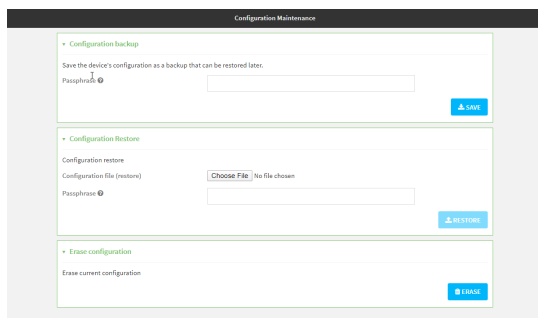
You can also reset the device to the default configuration without removing scripts, keys, and logfiles by using the **revert** command.

### WebUI

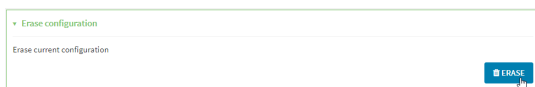
1. Log into the EX15 WebUI as a user with Admin access.
2. On the main menu, click **System**. Under **Configuration**, click **Configuration Maintenance**.



The **Configuration Maintenance** window is displayed.



3. In the **Erase configuration** section, click **ERASE**.



4. Click **CONFIRM**.
5. After resetting the device:
  - a. Connect to the EX15 by using the serial port or by using an Ethernet cable to connect the EX15 **LAN** port to your PC.
  - b. Log into the EX15:

**User name:** Use the default user name: **admin**.

**Password:** Use the unique password printed on the bottom label of the device (or the printed label included in the package).

---

**Note** If your device was manufactured prior to the release of firmware version 19.11.x, the default user name may be **root**.

---

When you first log into the WebUI or the command line, you must change the password for the **admin** user. See [Change the default password for the admin user](#) for instructions.

Additionally, for Wi-Fi enabled models, when you first log into the WebUI or the command line, you will be required to change the SSID and pre-shared key (password) for the preconfigured Wi-Fi access point. See [Reset default SSID and pre-shared key for the preconfigured Wi-Fi access point](#) for instructions.

---

Devices that connect to Digi aView for cloud management may have a different password for the default user, based on the aView configuration profile used by the device. Devices with firmware prior to release 20.2.x are configured to connect to aView by default.

To connect to the local Web UI in this case, you must either know the password from the aView configuration profile, or you must disconnect from aView and reset the device to factory defaults.

To disconnect from aView and reset the device:

- i. Remove any SIM and WAN connections to prevent the device from connecting to aView after resetting to factory defaults.
  - ii. Follow the instructions at [Erase device configuration and reset to factory defaults](#) to reset the device to factory defaults.
  - iii. Log into the local Web UI by using the default username and password.
  - iv. Prior to inserting a SIM or connecting to a WAN connection, disable central management or configure the device to connect to Digi Remote Manager, as described in [Configure Digi Remote Manager](#).
- 
- c. Reset the default password for the admin account. See [Change the default password for the admin user](#) for further information.



## Command line

1. Log into the EX15 command line as a user with Admin access.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.

2. Enter the following:

---

```
> system factory-erase
```

---

3. After resetting the device:
  - a. Connect to the EX15 by using the serial port or by using an Ethernet cable to connect the EX15 **LAN** port to your PC.
  - b. Log into the EX15:

**User name:** Use the default user name: **admin**.

**Password:** Use the unique password printed on the bottom label of the device (or the printed label included in the package).

---

**Note** If your device was manufactured prior to the release of firmware version 19.11.x, the default user name may be **root**.

---

When you first log into the WebUI or the command line, you must change the password for the **admin** user. See [Change the default password for the admin user](#) for instructions.

Additionally, for Wi-Fi enabled models, when you first log into the WebUI or the command line, you will be required to change the SSID and pre-shared key (password) for the preconfigured Wi-Fi access point. See [Reset default SSID and pre-shared key for the preconfigured Wi-Fi access point](#) for instructions.

---

Devices that connect to Digi aView for cloud management may have a different password for the default user, based on the aView configuration profile used by the device. Devices with firmware prior to release 20.2.x are configured to connect to aView by default.

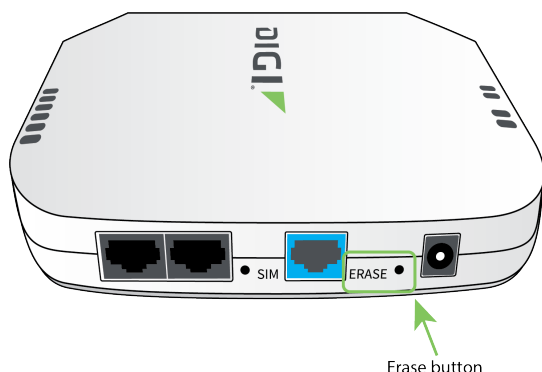
To connect to the local Web UI in this case, you must either know the password from the aView configuration profile, or you must disconnect from aView and reset the device to factory defaults.

To disconnect from aView and reset the device:

- i. Remove any SIM and WAN connections to prevent the device from connecting to aView after resetting to factory defaults.
  - ii. Follow the instructions at [Erase device configuration and reset to factory defaults](#) to reset the device to factory defaults.
  - iii. Log into the local Web UI by using the default username and password.
  - iv. Prior to inserting a SIM or connecting to a WAN connection, disable central management or configure the device to connect to Digi Remote Manager, as described in [Configure Digi Remote Manager](#).
- 
- c. Reset the default password for the admin account. See [Change the default password for the admin user](#) for further information.

**Reset the device by using the ERASE button.**

1. Locate the **ERASE** button on your device.



2. Press and hold the **ERASE** button perform a device reset. The **ERASE** button has two modes:
  - **Configuration reset:**
    - Press and release the **ERASE** button.
    - The device reboots automatically and resets to factory defaults. This does not remove any automatically generated certificates and keys.
  - **Full device reset:**
    - After the device reboots from the first button press, immediately press and release the **ERASE** button again.
    - The device reboots again and resets to factory defaults, as well as also removing generated certificates and keys.
3. After resetting the device:
  - a. Connect to the EX15 by using the serial port or by using an Ethernet cable to connect the EX15 **LAN** port to your PC.
  - b. Log into the EX15:

**User name:** Use the default user name: **admin**.

**Password:** Use the unique password printed on the bottom label of the device (or the printed label included in the package).

---

**Note** If your device was manufactured prior to the release of firmware version 19.11.x, the default user name may be **root**.

---

When you first log into the WebUI or the command line, you must change the password for the **admin** user. See [Change the default password for the admin user](#) for instructions.

Additionally, for Wi-Fi enabled models, when you first log into the WebUI or the command line, you will be required the change the SSID and pre-shared key (password) for the preconfigured Wi-Fi access point. See [Reset default SSID and pre-shared key for the preconfigured Wi-Fi access point](#) for instructions.

---

Devices that connect to Digi aView for cloud management may have a different password for the default user, based on the aView configuration profile used by the device. Devices with firmware prior to release 20.2.x are configured to connect to aView by default.

---

---

To connect to the local Web UI in this case, you must either know the password from the aView configuration profile, or you must disconnect from aView and reset the device to factory defaults.

To disconnect from aView and reset the device:

- i. Remove any SIM and WAN connections to prevent the device from connecting to aView after resetting to factory defaults.
  - ii. Follow the instructions at [Erase device configuration and reset to factory defaults](#) to reset the device to factory defaults.
  - iii. Log into the local Web UI by using the default username and password.
  - iv. Prior to inserting a SIM or connecting to a WAN connection, disable central management or configure the device to connect to Digi Remote Manager, as described in [Configure Digi Remote Manager](#).
- 
- c. Reset the default password for the admin account. See [Change the default password for the admin user](#) for further information.

### Reset the device with the revert command

You can reset the device to the default configuration without removing scripts, keys, and logfiles by using the **revert** command:

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the command line, type **config** to enter configuration mode:  

---

```
> config
(config)>
```

---
3. At the config prompt, enter **revert**:  

---

```
(config)> revert
(config)>
```

---
4. Set the password for the admin user prior to saving the changes:  

---

```
(config)> auth user admin password pwd
(config)>
```

---
5. Save the configuration and apply the change:  

---

```
(config)> save
Configuration saved.
>
```

---
6. Type **exit** to exit the Admin CLI.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Configure the EX15 device to use custom factory default settings

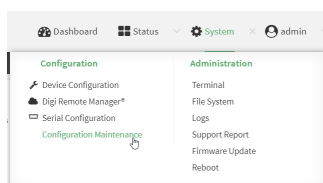
You can configure your EX15 device to use custom factory default settings. This way, when you erase the device's configuration, the device will reset to your custom configuration rather than to the original factory defaults.

### Required configuration items

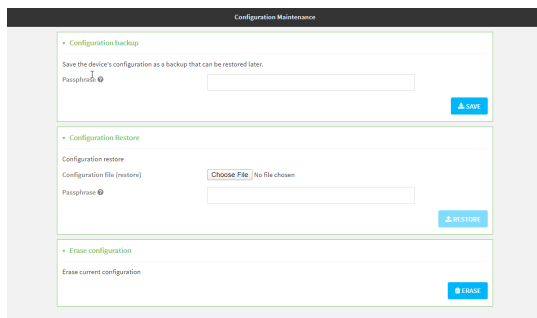
- Custom factory default file

### WebUI

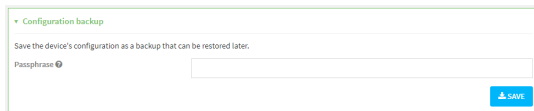
1. Log into the EX15 WebUI as a user with Admin access.
2. Configure your EX15 device to match the desired custom factory default configuration.  
For example, you may want to configure the device to use a custom APN or a particular network configuration, so that when you reset the device to factory defaults, it will automatically have your required configuration.
3. On the main menu, click **System**. Under **Configuration**, click **Configuration Maintenance**.



The **Configuration Maintenance** window is displayed.



4. In the **Configuration backup** section, click **SAVE**.



Do not set a **Passphrase** for the configuration backup. The file will be downloaded using your browser's standard download process.

5. After the configuration backup file has been downloaded, rename the file to:  
**custom-default-config.bin**
6. Upload the file to the device, into the **/opt** directory.  
See [Upload and download files](#) for information about uploading a file to the device.

If you use the Web UI to upload the file, you will need to use the **mv** command at the Admin CLI to move the file to the **/opt** directory. For example:

---

```
> mv /etc/config/scripts/custom-default-config.bin /opt
>
```

---

### Command line

1. Log into the EX15 command line as a user with Admin access.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.

2. Enter the following:

---

```
> system backup /opt/custom-default-config.bin type archive
Backup saved as /opt/custom-default-config.bin
>
```

---

3. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.



## Configuration files

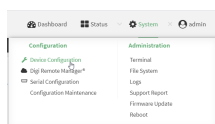
The EX15 configuration file, `/etc/config/accns.json`, contains all configuration changes that have been made to the device. It does not contain the complete device configuration; it only contains changes to the default configuration. Both the default configuration and the changes contained in the `accns.json` file are applied when the device reboots.

## Save configuration changes

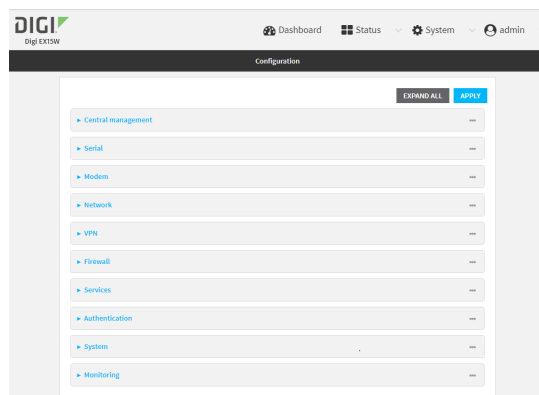
When you make changes to the EX15 configuration, the changes are not automatically saved. You must explicitly save configuration changes, which also applies the changes. If you do not save configuration changes, the system discards the changes.

### WebUI

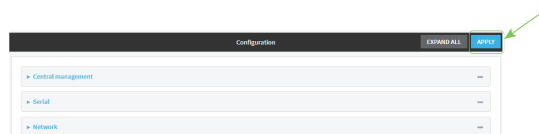
1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.



3. Make any necessary configuration changes.
4. Click **Apply** to save the configuration and apply the change.



### Command line

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the command line, type **config** to enter configuration mode:

```
> config
(config)>
```

3. Make any necessary configuration changes.
4. Save the configuration and apply the change:

```
(config)> save
Configuration saved.
>
```

5. Type **exit** to exit the Admin CLI.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

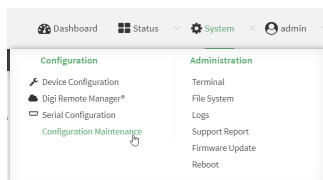
## Save configuration to a file

You can save your EX15 device's configuration to a file and use this file to restore the configuration, either to the same device or to similar devices.

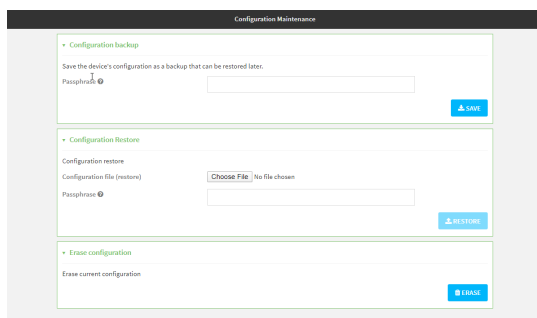
### WebUI

This procedure creates a binary archive file containing the device's configuration, certificates and keys, and other information.

1. Log into the EX15 WebUI as a user with Admin access.
2. On the main menu, click **System**. Under **Configuration**, click **Configuration Maintenance**.



The **Configuration Maintenance** window is displayed.



3. In the **Configuration backup** section:
  - a. (Optional) To encrypt the configuration using a passphrase, for **Passphrase (save/restore)**, enter the passphrase.
  - b. Click **SAVE**.

The file will be downloaded using your browser's standard download process.



## Command line

1. Log into the EX15 command line as a user with Admin access.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. Enter the following:

---

```
> system backup path [passphrase passphrase] type type
```

---

where

- *path* is the location on the EX15's filesystem where the configuration backup file should be saved.
- *passphrase* (optional) is a passphrase used to encrypt the configuration backup.
- *type* is the type of backup, either:
  - **archive**: Creates a binary archive file containing the device's configuration, certificates and keys, and other information.
  - **cli-config**: Creates a text file containing only the configuration changes.

For example:

---

```
> system backup /etc/config/scripts/ type archive
```

---

3. (Optional) Use **scp** to copy the file from your device to another host:

---

```
> scp host hostname-or-ip user username remote remote-path local local-path
to remote
```

---

where:

- *hostname-or-ip* is the hostname or ip address of the remote host.
- *username* is the name of the user on the remote host.
- *remote-path* is the location on the remote host where the file will be copied.
- *local-path* is the path and filename on the EX15 device.

For example:

---

```
> scp host 192.168.4.1 user admin remote /home/admin/bin/ local
/etc/config/backup-archive-0040FF800120-19.05.17-19.01.17.bin to remote
```

---

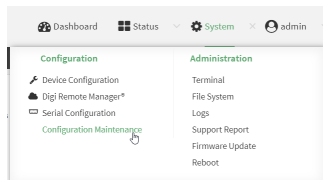
## Restore the device configuration

You can restore a configuration file to your EX15 device by using a backup from the device, or a backup from a similar device.

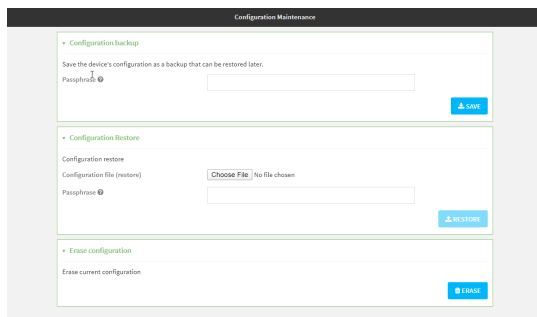


## WebUI

1. Log into the EX15 WebUI as a user with Admin access.
2. On the main menu, click **System**. Under **Configuration**, click **Configuration Maintenance**.



The **Configuration Maintenance** window is displayed.



3. In the **Configuration Restore** section:
  - a. If a passphrase was used to create the configuration backup, for **Passphrase (save/restore)**, enter the passphrase.
  - b. Under **Configuration Restore**, click **Choose File**.
  - c. Browse to the system firmware file location on your local computer and select the file.
  - d. Click **RESTORE**.
4. Click **CONFIRM**.

The configuration will be restored and the device will be rebooted.

## Command line

1. Log into the EX15 command line as a user with Admin access.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. If the configuration backup is on a remote host, use **scp** to copy the file from the host to your device:

---

```
> scp host hostname-or-ip user username remote remote-path local local-path
to local
```

---

where:

- *hostname-or-ip* is the hostname or ip address of the remote host.
- *username* is the name of the user on the remote host.
- *remote-path* is the path and filename of the file on the remote host that will be copied to the EX15 device.
- *local-path* is the location on the EX15 device where the copied file will be placed.

For example:

---

```
> scp host 192.168.4.1 user admin remote /home/admin/bin/backup-archive-0040FF800120-21.2.39.67-19.23.42.bin local /opt to local
```

---

3. Enter the following:

---

```
> system restore filepath [passphrase passphrase]
```

---

where

- *filepath* is the the path and filename of the configuration backup file on the EX15's filesystem (*local-path* in the previous step).
- *passphrase* (optional) is the passphrase to restore the configuration backup, if a passphrase was used when the backup was created.

For example:

---

```
> system restore /opt/backup-archive-0040FF800120-21.2.39.67-19.23.42.bin
```

---

## Schedule system maintenance tasks

You can configure tasks and custom scripts to be run during a specified maintenance window.

### Required configuration items

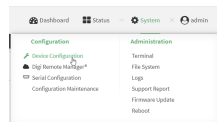
- The time that the system maintenance tasks will start.
- The duration window during which the system maintenance tasks can run.
- The frequency (either daily or weekly) that the tasks will run.
- The tasks to be performed. Options are:
  - Modem firmware update.
  - Configuration check.

### Additional configuration items

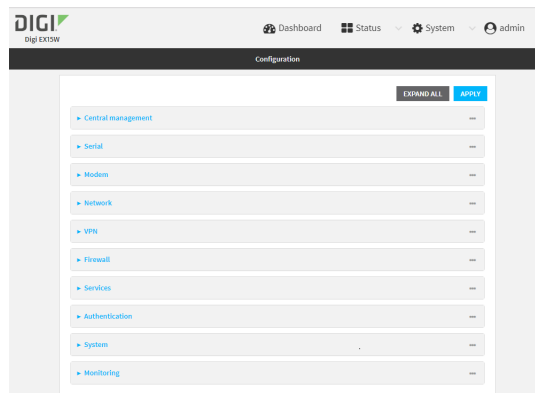
- Custom scripts that should be run as part of the configuration check.

## WebUI

1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.



3. Click **System** > **Scheduled tasks** > **System maintenance**.

4. For **Start time**, type the time of day that the maintenance window should start, using the syntax **HH:MM**. If **Start time** is not set, maintenance tasks are not scheduled and will not be run.  
The behavior of **Start time** varies depending on the setting of **Duration window**, which is configured in the next step.
  - If **Duration window** is set to **Immediately**, all scheduled tasks will begin at the exact time specified in **Start time**.
  - If **Duration window** is set to **24 hours**, **Start time** is effectively obsolete and the maintenance tasks will be scheduled to run at any time. Setting **Duration window** to **24 hours** can potentially overstress the device and should be used with caution.
  - If **Duration window** is set to any value other than to **Immediately** or **24 hours**, the maintenance tasks will run at a random time during the time allotted for the duration window.
  - If **Duration window** is set to one or more hours, the minutes field in **Start time** is ignored and the duration window will begin at the beginning of the specified hour.
5. For **Duration window**, select the amount of time that the maintenance tasks will be run. If **Immediately** is selected, all scheduled tasks will begin at the exact time specified in **Start time**.
6. For **Frequency**, select either **Daily** or **Weekly** for the frequency that the maintenance tasks should be run.
7. (Optional) Click to enable **Modem firmware update** to instruct the system to look for any updated modem firmware during the maintenance window. If updated firmware is found, it will then be installed. Modem firmware update looks for updated firmware both on the local device and over the network, using either a WAN or cellular connection.
8. (Optional) Click to enable **Configuration check** to allow for the configuration to be updated, including by custom scripts, during the maintenance window.
9. (Optional) Configure automated checking for device firmware updates:
  - a. Click to expand **Firmware update check**.
  - b. **Device firmware update check** is enabled by default. This enables to automated checking for device firmware updates.
  - c. **Modem firmware update check** is enabled by default. This enables to automated checking for modem firmware updates.
  - d. For Frequency, select how often automated checking for device and modem firmware should take place. Allowed values are **Daily**, **Weekly**, and **Monthly**. The default is **Daily**.

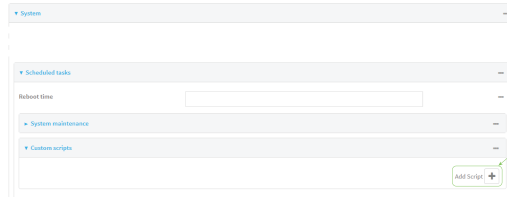
10. (Optional) Enable **Allow scheduled scripts to handle SMS** to allow scheduled scripts to handle SMS messages.
11. (Optional) To schedule custom scripts:
  - a. Click **Custom scripts**.

---

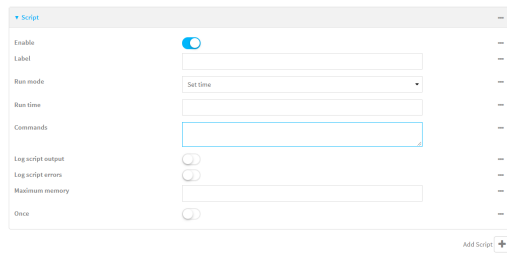
**Note** This feature does not provide syntax or error checking. Certain commands can render the device inoperable. Use with care. Scripts created here are also automatically entered in **Configuration > Applications**.

---

- b. For **Add Script**, click **+**.



The schedule script configuration window is displayed.



Scheduled scripts are enabled by default. To disable, click **Enable** to toggle off.

- c. (Optional) For **Label**, provide a label for the script.
  - d. For **Run mode**, select the mode that will be used to run the script. Available options are:
    - **On boot**: The script will run once each time the device boots.
      - If **On boot** is selected, select the action that will be taken when the script completes in **Exit action**. Available options are:
        - **None**: Action taken when the script exits.
        - **Restart script**: Runs the script repeatedly.
        - **Reboot**: The device will reboot when the script completes.
    - **Interval**: The script will start running at the specified interval, within 30 seconds after the configuration change is saved.
      - If **Interval** is selected, in **Interval**, type the interval.  
 Allowed values are any number of weeks, days, hours, minutes, or seconds, and take the format **number{w|d|h|m|s}**.  
 For example, to set **Interval** to ten minutes, enter **10m** or **600s**.
      - Click to enable **Run single** to run only a single instance of the script at a time.  
 If **Run single** is not selected, a new instance of the script will be started at every interval, regardless of whether the script is still running from a previous



interval.

- **Set time:** Runs the script at a specified time of the day.
  - If **Set Time** is selected, specify the time that the script should run in **Run time**, using the format *HH:MM*.
- **During system maintenance:** The script will run during the system maintenance time window.

- e. For **Commands**, enter the commands that will execute the script.

If the script begins with **#!**, then the script will be invoked in the location specified by the path for the script command. Otherwise, the default shell will be used (equivalent to **#!/bin/sh**).

- f. Script logging options:

- i. Click to enable **Log script output** to log the script's output to the system log.
- ii. Click to enable **Log script errors** to log script errors to the system log.

If neither option is selected, only the script's exit code is written to the system log.

- g. For **Maximum memory**, enter the maximum amount of memory available to be used by the script and its subprocesses, using the format *number*

**{b|bytes|KB|k|MB|MB|M|GB|G|TB|T}**.

- h. Click to enable **Once** to configure the script to run only once at the specified time.

If **Once** is enabled, rebooting the device will cause the script to not run again. The only way to re-run the script is to:

- Remove the script from the device and add it again.
- Make a change to the script.
- Uncheck **Once**.

- i. **Sandbox** is enabled by default, which restricts access to the file system and available commands that can be used by the script. This option protects the script from accidentally destroying the system it is running on.

12. Click **Apply** to save the configuration and apply the change.



## Command line

- Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
- At the command line, type **config** to enter configuration mode:

```
> config
(config)>
```

3. Schedule system maintenance:

- a. Configure the time of day that the maintenance window should start, using the syntax *HH:MM*. If the start time is not set, maintenance tasks are not scheduled and will not be run.

---

```
(config)> system schedule maintenance from HH:MM
(config)>
```

---

The behavior of the start time varies depending on the setting of the duration length, which is configured in the next step.

- If the duration length is set to **0**, all scheduled tasks will begin at the exact time specified in the start time.
  - If the duration length is set to **24 hours**, the start time is effectively obsolete and the maintenance tasks will be scheduled to run at any time. Setting the duration length to **24 hours** can potentially overstress the device and should be used with caution.
  - If the duration length is set to any value other than to **0** or **24 hours**, the maintenance tasks will run at a random time during the time allotted for the duration window.
  - If the duration length is set to one or more hours, the minutes field in the start time is ignored and the duration window will begin at the beginning of the specified hour.
- b. Configure the duration length (the amount of time that the maintenance tasks will be run). If **0** is used, all scheduled tasks will begin at the start time, defined in the previous step.

---

```
(config)> system schedule maintenance length num
(config)>
```

---

where *num* is any whole number between **0** and **24**.

- c. Configure the frequency that the maintenance tasks should be run:

---

```
(config)> system schedule maintenance frequency value
(config)>
```

---

where *value* is either **daily** or **weekly**. **Daily** is the default.

4. Configure the device to look for any updated modem firmware during the maintenance window. If updated firmware is found, it will then be installed. The device will look for updated firmware both on the local device and over the network, using either a WAN or cellular connection.

---

```
system schedule maintenance modem_fw_update value
(config)>
```

---

where *value* is either **true** or **false**. **yes** or **no**, and **1** or **0** are also allowed.

5. (Optional) Configure automated checking for device firmware updates:

- a. **Device firmware update check** is enabled by default. This enables to automated checking for device firmware updates. To disable:

---

```
(config)> system schedule maintenance firmware_update_check device false
(config)>
```

---

- b. Set how often automated checking for device firmware should take place:

---

```
(config)> system schedule maintenance frequency value
(config)>
```

---

where *value* is either **daily**, **weekly**, or **monthly**. **daily** is the default.

6. (Optional) Allow scheduled scripts to handle SMS messages:

---

```
(config)> system schedule sms_script_handling true
(config)>
```

---

7. (Optional) Schedule custom scripts:

- a. Add a script:

---

```
(config)> add system schedule script end
(config system schedule script 0)>
```

---

Scheduled scripts are enabled by default. To disable:

---

```
(config system schedule script 0)> enable false
(config system schedule script 0)>
```

---

- b. (Optional) Provide a label for the script.

---

```
(config system schedule script 0)> label value
(config system schedule script 0)>
```

---

where *value* is any string. if spaces are used, enclose *value* within double quotes.

- c. Set the mode that will be used to run the script:

---

```
(config system schedule script 0)> when mode
(config system schedule script 0)>
```

---

where *mode* is one of the following:

- **boot**: The script will run once each time the device boots.
  - If **boot** is selected, set the action that will be taken when the script completes:

---

```
(config system schedule script 0)> exit_action action
(config system schedule script 0)>
```

---

where *action* is one of the following:

- **none**: Action taken when the script exits.
  - **restart**: Runs the script repeatedly.
  - **reboot**: The device will reboot when the script completes.
- **interval**: The script will start running at the specified interval, within 30 seconds after the configuration change is saved. If **interval** is selected:

- Set the interval:

---

```
(config system schedule script 0)> on_interval value
(config system schedule script 0)>
```

---

where *value* is any number of weeks, days, hours, minutes, or seconds, and takes the format **number{w|d|h|m|s}**.

For example, to set **on\_interval** to ten minutes, enter either **10m** or **600s**:

---

```
(config system schedule script 0)> on_interval 600s
(config system schedule script 0)>
```

---

- (Optional) Configure the script to run only a single instance at a time:

---

```
(config system schedule script 0)> once true
(config system schedule script 0)>
```

---

If **once** is set to **false**, a new instance of the script will be started at every interval, regardless of whether the script is still running from a previous interval.

- **set\_time**: Runs the script at a specified time of the day.

- If **set\_time** is set, set the time that the script should run, using the format *HH:MM*:

---

```
(config system schedule script 0)> run_time HH:MM
(config system schedule script 0)>
```

---

- **maintenance\_time**: The script will run during the system maintenance time window.

- d. Set the commands that will execute the script:

---

```
(config system schedule script 0)> commands filename
(config system schedule script 0)>
```

---

where *filename* is the path and filename of the script, and any related command line information.

If the script begins with **#!**, then the script will be invoked in the location specified by the path for the script command. Otherwise, the default shell will be used (equivalent to **#!/bin/sh**).

- e. Script logging options:

- To log the script's output to the system log:

---

```
(config system schedule script 0)> syslog_stdout true
(config system schedule script 0)>
```

---

- To log script errors to the system log:

---

```
(config system schedule script 0)> syslog_stderr true
(config system schedule script 0)>
```

---

If **syslog\_stdout** and **syslog\_stderr** are not enabled, only the script's exit code is written to the system log.

- f. Set the maximum amount of memory available to be used by the script and its subprocesses:

---

```
(config system schedule script 0)> max_memory value
(config system schedule script 0)>
```

---

where *value* uses the syntax **number**{**b**|**bytes**|**KB**|**k**|**MB**|**M**|**GB**|**G**|**TB**|**T**}.

- g. To run the script only once at the specified time:

---

```
(config system schedule script 0)> once true
(config system schedule script 0)>
```

---

If **once** is enabled, rebooting the device will cause the script to run again. The only way to re-run the script is to:

- Remove the script from the device and add it again.
- Make a change to the script.
- Disable **once**.

- h. **Sandbox** is enabled by default. This option protects the script from accidentally destroying the system it is running on.

---

```
(config system schedule script 0)> sandbox true
(config system schedule script 0)>
```

---

8. Allow for the configuration to be updated, including by custom scripts, during the maintenance window:

---

```
system schedule maintenance config_check value
(config)>
```

---

where *value* is either **true** or **false**. **yes** or **no**, and **1** or **0** are also allowed.

9. Save the configuration and apply the change:

---

```
(config)> save
Configuration saved.
>
```

---

10. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Disable device encryption

You can disable the cryptography on your EX15 device. This can be used to ship unused devices from overseas without needing export licenses from the country from which the device is being shipped.

When device encryption is disabled, the following occurs:

- The device is reset to the default configuration and rebooted.
- After the reboot:

- Access to the device via the WebUI and SSH are disabled.
- All internet connectivity is disabled, including WAN and WWAN. Connectivity to central management software is also disabled.
- All IP networks and addresses are disabled except for the default 192.168.210.1/24 network on the local LAN Ethernet port. DHCP server is also disabled.  
The device can only be accessed by using telnet from a local machine connecting to the 192.168.210.1/24 network.

Disabling device encryption is not available in the WebUI. It can only be performed from the Admin CLI.

### Command line

1. Log into the EX15 command line as a user with Admin access.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. Disable encryption with the following command:  

---

```
> system disable-cryptography
>
```

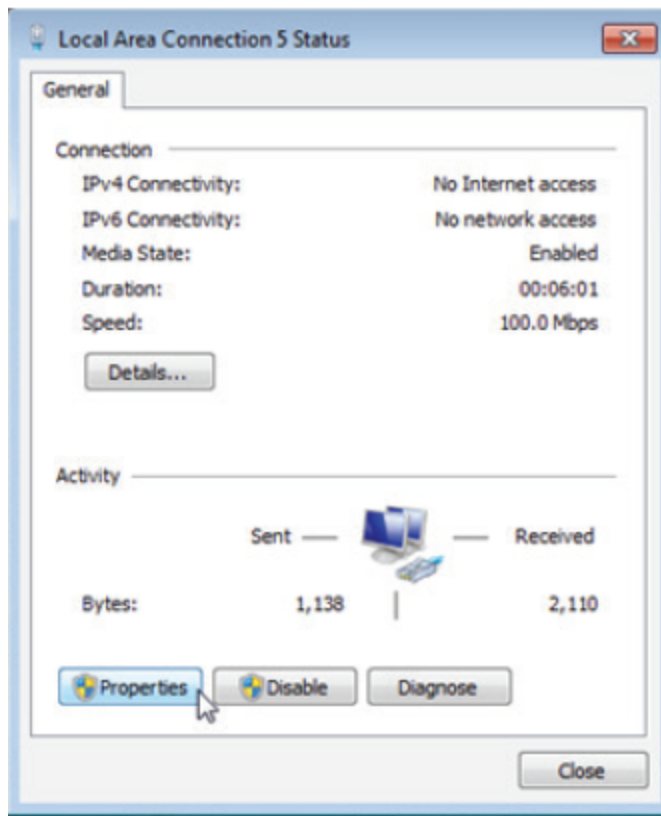
---
3. Type **exit** to exit the Admin CLI.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Re-enable cryptography after it has been disabled.

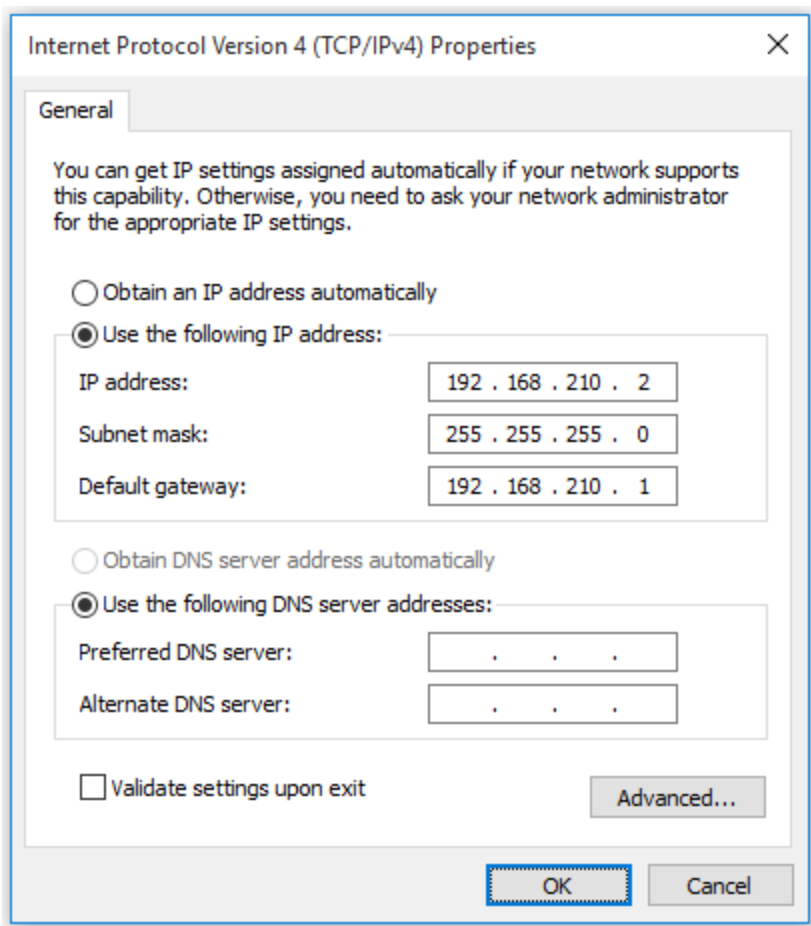
To re-enable cryptography:

1. Configure your PC network to connect to the 192.168.210 subnet. For example, on a Windows PC:

- a. Select the **Properties** of the relevant network connection on the Windows PC.



- b. Click the **Internet Protocol Version 4 (TCP/IPv4)** parameter.
- c. Click **Properties**. The **Internet Protocol Version 4 (TCP/IPv4) Properties** dialog appears.
- d. Configure with the following details:
- **IP address** for PC: 192.168.210.2
  - **Subnet**: 255.255.255.0
  - **Gateway**: 192.168.210.1



2. Connect the PC's Ethernet port to the 1/PoE Ethernet port on your EX15 device.
3. Open a telnet session and connect to the EX15 device at the IP address of 192.168.210.1.
4. Log into the device:
  - Username: **admin**
  - Password: The default unique password for your device is printed on the device label.
5. At the shell prompt, type:

---

```
rm /etc/config/.nocrypt
flatfsd -i
```

---

This will re-enable encryption and leave the device at its factory default setting.

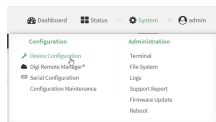
## Configure the speed of your Ethernet ports

You can configure the speed of your EX15 device's Ethernet ports.

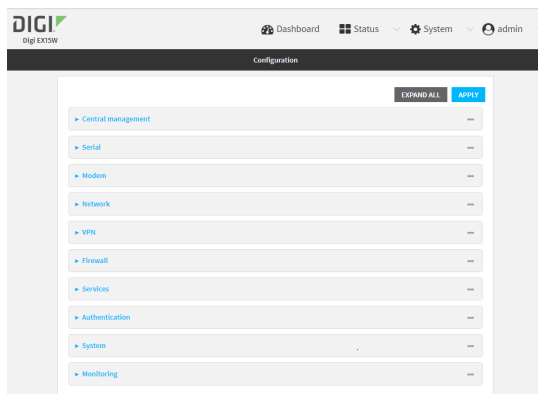




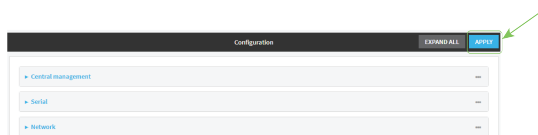
1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.



3. Click **Network > Device**.
4. Click to expand the Ethernet port to be configured.
5. For **Speed**, select the appropriate speed for the Ethernet port, or select **Auto** to automatically detect the speed. The default is **Auto**.
6. Click **Apply** to save the configuration and apply the change.



## Command line

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the command line, type **config** to enter configuration mode:

```
> config
(config)>
```

3. At the config prompt, type:

```
(config)> network device eth_port value
```

where:

- *eth\_port* is the name of the Ethernet port (for example, **eth1**)
- *value* is one of:

- **10**—Sets the speed to 10 Mbps.
  - **100**—Sets the speed to 100 Mbps.
  - **1000**—Sets the speed to 1 Gbps. Available only for devices with Gigabit Ethernet ports.
- auto**—Configures the device to automatically determine the best speed for the Ethernet port.

The default is **auto**.

4. Save the configuration and apply the change:

---

```
(config)> save
Configuration saved.
>
```

---

5. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Monitoring

---

This chapter contains the following topics:

|                               |     |
|-------------------------------|-----|
| intelliFlow .....             | 704 |
| Configure NetFlow Probe ..... | 711 |

## intelliFlow

intelliFlow monitors system information, network data usage, and traffic information, and displays the information in a series of charts available in the local WebUI. To use intelliFlow, the EX15 must be powered on and you must have access to the local WebUI. Once you enable intelliFlow, the **Status > intelliFlow** option is available in the main menu. By default, intelliFlow is disabled.

intelliFlow provides charts on the following information:

- System utilisation
- Top data usage by host
- Top data usage by server
- Top data usage by service
- Host data usage over time

intelliFlow charts are dynamic; at any point, you can click inside the chart to drill down to view more granular information, and menu options allow you to change various aspects of the information being displayed.

---

**Note** When intelliFlow is enabled, it adds an estimated 50MB of data usage for the device by reporting the metrics to Digi Remote Manager.

---

## Enable intelliFlow

### *Required configuration items*

- Enable intelliFlow.

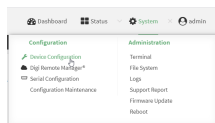
### *Additional configuration items*

- The firewall zone for internal clients being monitored by intelliFlow.

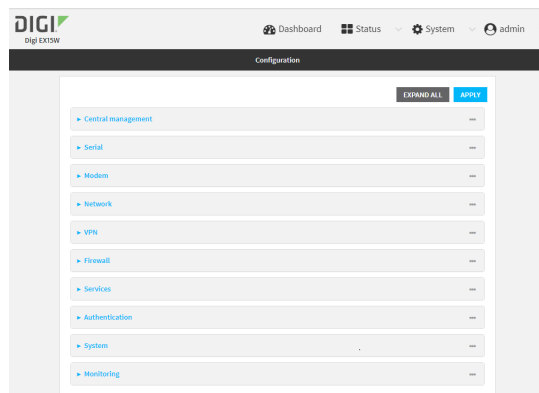
To enable intelliFlow:

## WebUI

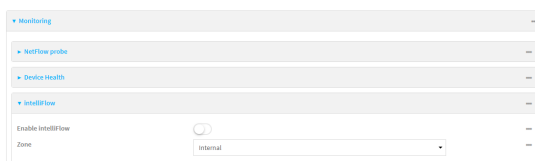
1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



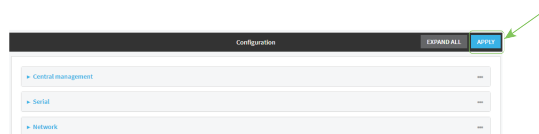
The **Configuration** window is displayed.



3. Click **Monitoring > intelliFlow**.  
The intelliFlow configuration window is displayed.



4. Click **Enable intelliFlow**.
5. For **Zone**, select the firewall zone. Internal clients that are being monitored by IntelliFlow should be present on the specified zone.
6. Click **Apply** to save the configuration and apply the change.



## Command line

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the command line, type **config** to enter configuration mode:
 

```
> config
(config)>
```
3. Enable IntelliFlow:
 

```
(config)> monitoring intelliflow enable true
```
4. Set the firewall zone. Internal clients that are being monitored by IntelliFlow should be present on the specified zone:

- a. Determine available zones:

---

```
(config)> monitoring intelliflow zone ?
```

Zone: The firewall zone which is assigned to the network interface(s) that intelliFlow will see as internal clients. intelliFlow relies on an internal to external relationship, where the internal clients are present on the zone specified.

Format:

any  
dynamic\_routes  
edge  
external  
internal  
ipsec  
loopback  
setup

Default value: internal

Current value: internal

```
(config)>
```

---

- b. Set the zone to be used by IntelliFlow:

---

```
(config)> monitoring intelliflow zone my_zone
```

---

5. Save the configuration and apply the change:

---

```
(config)> save
Configuration saved.
>
```

---

6. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Use intelliFlow to display average CPU and RAM usage

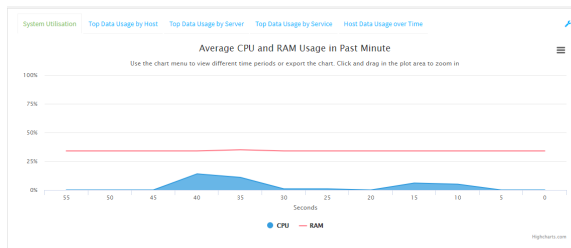
This procedure is only available from the WebUI.

To display display average CPU and RAM usage:

### WebUI

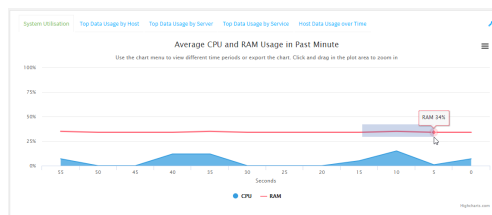
1. Log into the EX15 WebUI as a user with Admin access.
2. If you have not already done so, enable intelliFlow. See [Enable intelliFlow](#).
3. From the menu, click **Status > intelliFlow**.

The System Utilisation chart is displayed:

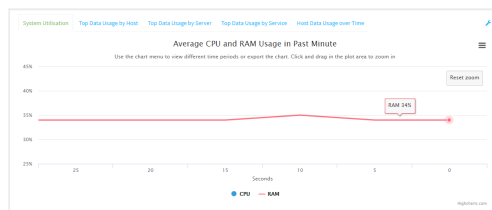


#### ■ Display more granular information:

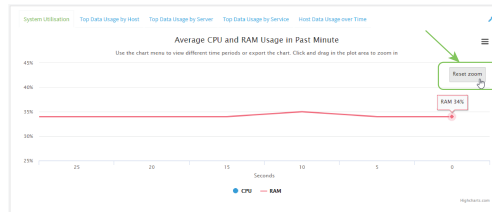
1. Click and drag over an area in the chart to zoom into that area and provide more granular information.



2. Release to display the selected portion of the chart:



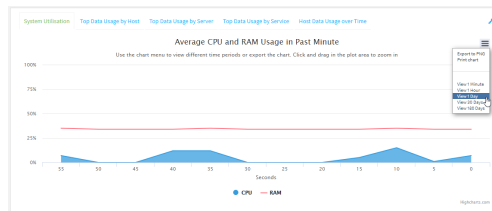
3. Click **Reset zoom** to return to the original display:



- Change the time period displayed by the chart.

By default, the **System utilisation** chart displays the average CPU and RAM usage over the last minute. You can change this to display the average CPU and RAM usage:

- Over the last hour.
  - Over the last day.
  - Over the last 30 days.
  - Over the last 180 days.
1. Click the menu icon (☰).
  2. Select the time period to be displayed.



- Save or print the chart.
1. Click the menu icon (☰).
  2. To save the chart to your local filesystem, select **Export to PNG**.
  3. To print the chart, select **Print chart**.

## Use intelliFlow to display top data usage information

With intelliFlow, you can display top data usage information based on the following:

- Top data usage by host
- Top data usage by server
- Top data usage by service

To generate a top data usage chart:

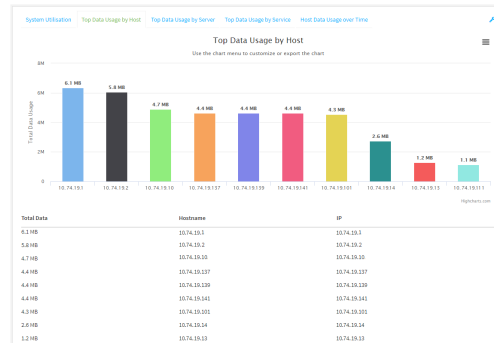
### ☰ WebUI

1. Log into the EX15 WebUI as a user with Admin access.
2. If you have not already done so, enable intelliFlow. See [Enable intelliFlow](#).
3. From the menu, click **Status > intelliFlow**.

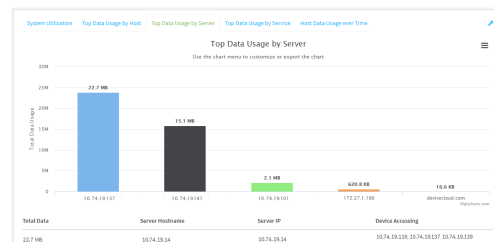


## 4. Display a data usage chart:

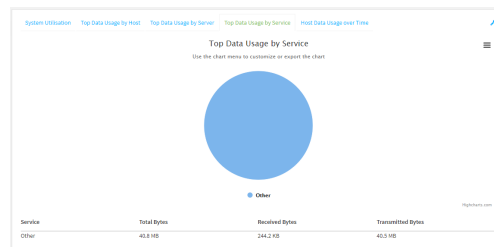
- To display the **Top Data Usage by Host** chart, click **Top Data Usage by Host**.



- To display the **Top Data Usage by Server** chart, click **Top Data Usage by Server**.

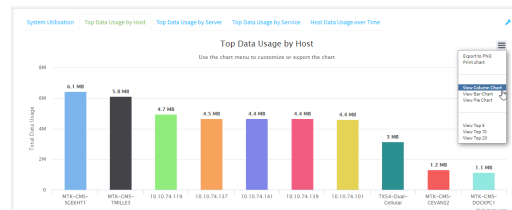


- To display the **Top Data Usage by Service** chart, click **Top Data Usage by Service**.



## 5. Change the type of chart that is used to display the data:

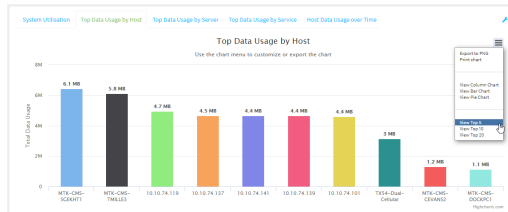
- Click the menu icon (≡).
- Select the type of chart.



## 6. Change the number of top users displayed.

You can display the top five, top ten, or top twenty data users.

- Click the menu icon (≡).
- Select the number of top users to displayed.



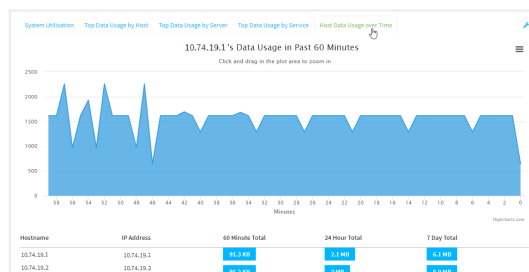
- Save or print the chart.
  - Click the menu icon (≡).
  - To save the chart to your local filesystem, select **Export to PNG**.
  - To print the chart, select **Print chart**.

## Use intelliFlow to display data usage by host over time

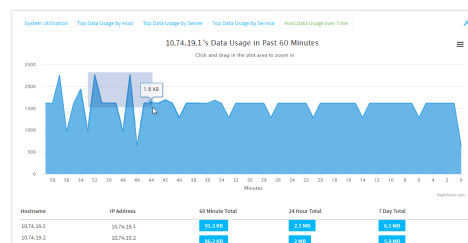
To generate a chart displaying a host's data usage over time:

### WebUI

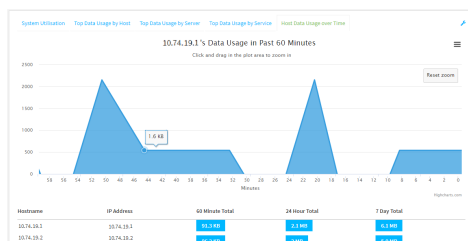
- Log into the EX15 WebUI as a user with Admin access.
- If you have not already done so, enable intelliFlow. See [Enable intelliFlow](#).
- From the menu, click **Status > intelliFlow**.
- Click **Host Data Usage Over Time**.



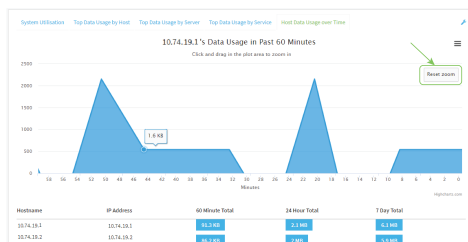
- Display more granular information:
  - Click and drag over an area in the chart to zoom into that area and provide more granular information.



- b. Release to display the selected portion of the chart:



- c. Click **Reset zoom** to return to the original display:



- Save or print the chart.
  - a. Click the menu icon (≡).
  - b. To save the chart to your local filesystem, select **Export to PNG**.
  - c. To print the chart, select **Print chart**.

## Configure NetFlow Probe

NetFlow probe is used to probe network traffic on the EX15 device and export statistics to NetFlow collectors.

### Required configuration items

- Enable NetFlow.
- The IP address of a NetFlow collector.

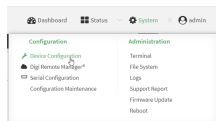
### Additional configuration items

- The NetFlow version.
- Enable flow sampling and select the flow sampling technique.
- The number of flows from which the flow sampler can sample.
- The number of seconds that a flow is inactive before it is exported to the NetFlow collectors.
- The number of seconds that a flow is active before it is exported to the NetFlow collectors.
- The maximum number of simultaneous flows.
- A label for the NetFlow collector.
- The port of the NetFlow collector.
- Additional NetFlow collectors.

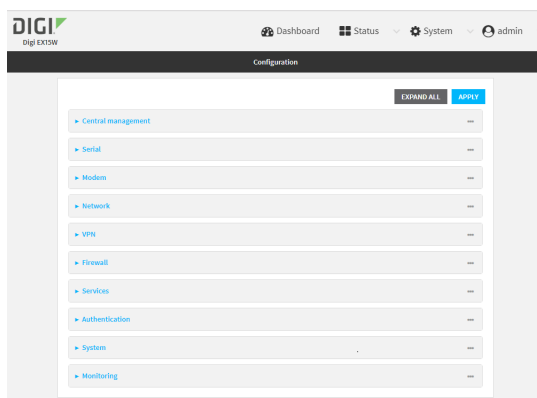
To probe network traffic and export statistics to NetFlow collectors:

## WebUI

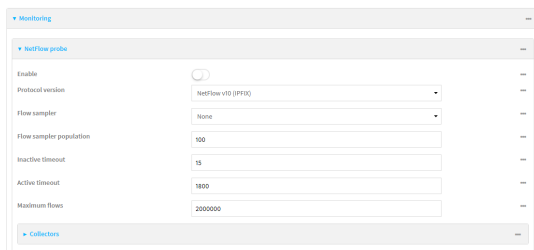
1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.



3. Click **Monitoring > NetFlow probe**.



4. **Enable** NetFlow probe.
5. **Protocol version:** Select the **Protocol version**. Available options are:
  - **NetFlow v5**—Supports IPv4 only.
  - **NetFlow v9**—Supports IPv4 and IPv6.
  - **NetFlow v10 (IPFIX)**—Supports both IPv4 and IPv6 and includes IP Flow Information Export (IPFIX).

The default is **NetFlow v10 (IPFIX)**.

6. Enable **Flow sampler** by selecting a sampling technique. Flow sampling can reduce flow processing and transmission overhead by providing a representative subset of all flows. Available options are:
  - **None**—No flow sampling method is used. Each flow is accounted.
  - **Deterministic**—Selects every  $n$ th flow, where  $n$  is the value of **Flow sampler population**.

- **Random**—Randomly selects one out of every  $n$  flows, where  $n$  is the value of **Flow sampler population**.
  - **Hash**—Randomly selects one out of every  $n$  flows using the hash of the flow key, where  $n$  is the value of **Flow sampler population**.
7. For **Flow sampler population**, if you selected a flow sampler, enter the number of flows for the sampler. Allowed value is any number between **2** and **16383**. The default is **100**.
  8. For **Inactive timeout**, type the the number of seconds that a flow can be inactive before sent to a collector. Allowed value is any number between **1** and **15**. The default is **15**.
  9. For **Active timeout**, type the number of seconds that a flow can be active before sent to a collector. Allowed value is any number between **1** and **1800**. The default is **1800**.
  10. For **Maximum flows**, type the maximum number of flows to probe simultaneously. Allowed value is any number between **0** and **2000000**. The default is **2000000**.
  11. Add collectors:
    - a. Click to expand **Collectors**.
    - b. For **Add Collector**, click **+**.
    - c. (Optional) Type a **Label** for the collector.
    - d. For **Address**, type the IP address of the collector.
    - e. (Optional) For **Port**, enter the port number used by the collector. The default is 2055.
 Repeat to add additional collectors.
  12. Click **Apply** to save the configuration and apply the change.



## Command line

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the command line, type **config** to enter configuration mode:

```
> config
(config)>
```

3. Enable NetFlow:

```
(config)> monitoring netflow enable true
(config)>
```

4. Set the protocol version:

```
(config)> monitoring netflow protocol version
 (config)>
```

where *version* is one of:

- **v5**—NetFlow v5 supports IPv4 only.
- **v9**—NetFlow v9 supports IPv4 and IPv6.
- **v10**—NetFlow v10 (IPFIX) supports both IPv4 and IPv6 and includes IP Flow Information Export (IPFIX).

The default is **v10**.

1. Enable flow sampling by selecting a sampling technique. Flow sampling can reduce flow processing and transmission overhead by providing a representative subset of all flows.

---

```
(config)> monitoring netflow sampler type
(config)>
```

---

where *type* is one of:

- **none**—No flow sampling method is used. Each flow is accounted.
- **deterministic**—Selects every *n*th flow, where *n* is the value of the flow sample population.
- **random**—Randomly selects one out of every *n* flows, where *n* is the value of the flow sample population.
- **hash**—Randomly selects one out of every *n* flows using the hash of the flow key, where *n* is the value of the flow sample population.

5. If you are using a flow sampler, set the number of flows for the sampler:

---

```
(config)> monitoring netflow sampler_population value
(config)>
```

---

where *value* is any number between **2** and **16383**. The default is **100**.

6. Set the number of seconds that a flow can be inactive before sent to a collector:

---

```
(config)> monitoring netflow inactive_timeout value
(config)>
```

---

where *value* is any number between **1** and **15**. The default is **15**.

7. Set the number of seconds that a flow can be active before sent to a collector:

---

```
(config)> monitoring netflow active_timeout value
(config)>
```

---

where *value* is any number between **1** and **1800**. The default is **1800**.

8. Set the maximum number of flows to probe simultaneously:

---

```
(config)> monitoring netflow max_flows value
(config)>
```

---

where *value* is any number between **0** and **2000000**. The default is **2000000**.

## 9. Add collectors:

## a. Add a collector:

---

```
(config)> add monitoring netflow collector end
(config monitoring netflow collector 0)>
```

---

## b. Set the IP address of the collector:

---

```
(config monitoring netflow collector 0)> address ip_address
(config monitoring netflow collector 0)>
```

---

## c. (Optional) Set the port used by the collector:

---

```
(config monitoring netflow collector 0)> port port
(config monitoring netflow collector 0)>
```

---

## d. (Optional) Set a label for the collector:

---

```
(config monitoring netflow collector 0)> label "This is a collector."
(config monitoring netflow collector 0)>
```

---

Repeat to add additional collectors.

## 10. Save the configuration and apply the change:

---

```
(config monitoring netflow collector 0)> save
Configuration saved.
>
```

---

11. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Central management

---

This chapter contains the following topics:

|                                                              |     |
|--------------------------------------------------------------|-----|
| Digi Remote Manager support .....                            | 717 |
| Configure Digi Remote Manager .....                          | 717 |
| Collect device health data and set the sample interval ..... | 723 |
| Log into Digi Remote Manager .....                           | 727 |
| Use Digi Remote Manager to view and manage your device ..... | 728 |
| Add a device to Digi Remote Manager .....                    | 729 |
| View Digi Remote Manager connection status .....             | 729 |
| Use the Digi Remote Manager mobile app .....                 | 730 |
| Configure multiple devices using profiles .....              | 731 |
| Learn more .....                                             | 731 |



## Digi Remote Manager support

Digi Remote Manager is a hosted remote configuration and management system that allows you to remotely manage a large number of devices. Remote Manager includes a web-based interface that you can use to perform device operations, such as viewing and changing device configurations and performing firmware updates. Remote Manager servers also provide a data storage facility. The Digi Remote Manager is the default cloud-based management system, and is enabled by default. You can also select to use Digi aView as the cloud-based management system. See [Digi aView User Guide](#) for information about aView.

To use Remote Manager, you must set up a Remote Manager account. To set up a Remote Manager account and learn more about Digi Remote Manager, go to [www.digi.com/products/cloud/digi-remote-manager](http://www.digi.com/products/cloud/digi-remote-manager).

To learn more about Remote Manager features and functions, see the [Digi Remote Manager User Guide](#).

## Configure Digi Remote Manager

By default, your EX15 device is configured to use central management using Digi Remote Manager.

### ***Additional configuration options***

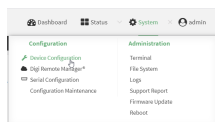
These additional configuration settings are not typically configured, but you can set them as needed:

- Disable the Digi Remote Manager connection if it is not required. You can also configure an alternate cloud-based central management application.
- Change the reconnection timer.
- The non-cellular keepalive timeout.
- The cellular keepalive timeout.
- The keepalive count before the Remote Manager connection is dropped.
- SMS support.
- HTTP proxy server support.

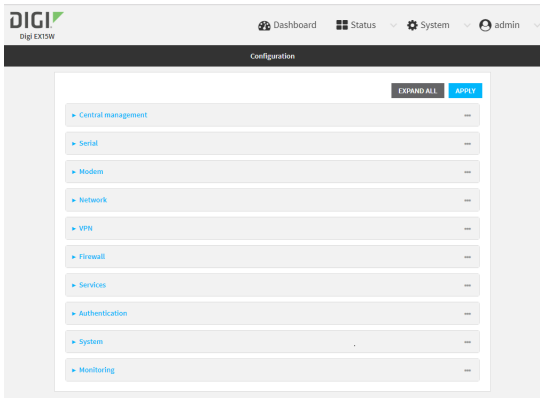
To configure Digi Remote Manager:

### **WebUI**

1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.



3. Click **Central management**.

The Central management configuration window is displayed.

Digi Remote Manager support is enabled by default. To disable, click **Enable central management**.

4. (Optional) For **Service**, select either **Digi Remote Manager** or **Digi aView**. The default is **Digi Remote Manager**.
5. (Optional) For **Management server**, type the URL for the central management server. The default is the Digi Remote Manager server, [my.devicecloud.com](https://my.devicecloud.com).
6. (Optional) For **Management port**, type the destination port for the remote cloud services connection. The default is **3199**.
7. (Optional) For **Retry interval**, type the amount of time that the EX15 device should wait before reattempting to connect to remote cloud services after being disconnected. The default is 30 seconds.

Allowed values are any number of hours, minutes, or seconds, and take the format **number {h|m|s}**.

For example, to set **Retry interval** to ten minutes, enter **10m** or **600s**.

8. (Optional) For **Keep-alive interval**, type the amount of time that the EX15 device should wait between sending keep-alive messages to remote cloud services when using a non-cellular interface. The default is 60 seconds.

Allowed values are any number of hours, minutes, or seconds, and take the format **number {h|m|s}**.

For example, to set **Keep-alive interval** to ten minutes, enter **10m** or **600s**.

9. (Optional) For **Cellular keep-alive interval**, type the amount of time that the EX15 device should wait between sending keep-alive messages to remote cloud services when using a cellular interface. The default is 290 seconds.

Allowed values are any number of hours, minutes, or seconds, and take the format **number {h|m|s}**.

For example, to set **Cellular keep-alive interval** to ten minutes, enter **10m** or **600s**.

10. (Optional) For **Allowed keep-alive misses**, type the number of allowed keep-alive misses. The default is **3**.
11. **Enable watchdog** is used to monitor the connection to remote cloud services. If the connection is down, you can configure the device to restart the connection, or to reboot. The watchdog is enabled by default.

12. If **Enable watchdog** is enabled:
  - a. (Optional) For **Restart Timeout**, type the amount of time to wait before restarting the connection to the remote cloud services, once the connection is down.  
 Allowed values are any number of hours, minutes, or seconds, and take the format **number {h|m|s}**.  
 For example, to set **Restart Timeout** to ten minutes, enter **10m** or **600s**.  
 The minimum value is 30 minutes and the maximum is 48 hours. If not set, this option is disabled. The default is 30 minutes.
  - b. (Optional) For **Reboot Timeout**, type the amount of time to wait before rebooting the device, once the connection to the remote cloud services is down. By default, this option is not set, which means that the option is disabled.  
 Allowed values are any number of hours, minutes, or seconds, and take the format **number {h|m|s}**.  
 For example, to set **Reboot Timeout** to ten minutes, enter **10m** or **600s**.  
 The minimum value is 30 minutes and the maximum is 48 hours. If not set, this option is disabled. The default is disabled.
13. (Optional) Enable **Locally authenticate CLI** to require a login and password to authenticate the user from the remote cloud services CLI. If disabled, no login prompt will be presented and the user will be logged in as **admin**. The default is disabled.
14. (Optional) Configure the EX15 device to communicate with remote cloud services by using SMS:
  - a. Click to expand **Short message service**.
  - b. **Enable** SMS messaging.
  - c. For **Destination phone number**, type the phone number for the remote cloud services.
  - d. (Optional) Type the **Service identifier**.
15. (Optional) Configure the EX15 device to communicate with remote cloud services by using an HTTP proxy server:
  - a. Click to expand **HTTP Proxy**.
  - b. **Enable** the use of an HTTP proxy server.
  - c. For **Server**, type the hostname of the HTTP proxy server.
  - d. For **Port**, type or select the port number on the HTTP proxy server that the device should connect to. The default is **2138**.
16. Click **Apply** to save the configuration and apply the change.



## Command line

1. Log into the EX15 command line as a user with full Admin access rights.  
 Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.

- At the command line, type **config** to enter configuration mode:

---

```
> config
(config)>
```

---

- Digi Remote Manager support is enabled by default. To disable Digi Remote Manager support:

---

```
(config)> cloud enable false
(config)>
```

---

- (Optional) Set the service:

---

```
(config)> cloud service value
(config)>
```

---

where *value* is either:

- **drm**: Digi Remote Manager
- **aview**: Digi aView

The default is Digi Remote Manager.

- (Optional) Set the URL for the central management server. The default is the Digi Remote Manager server, [my.devicecloud.com](https://my.devicecloud.com).

---

```
(config)> cloud drm drm_url url
(config)>
```

---

- (Optional) Set the amount of time that the EX15 device should wait before reattempting to connect to the remote cloud services after being disconnected. The minimum value is ten seconds. The default is 30 seconds.

---

```
(config)> cloud drm retry_interval value
```

---

where *value* is any number of hours, minutes, or seconds, and takes the format **number{h|m|s}**.

For example, to set **the retry interval** to ten minutes, enter either **10m** or **600s**:

---

```
(config)> cloud drm retry_interval 600s
(config)>
```

---

- (Optional) Set the amount of time that the EX15 device should wait between sending keep-alive messages to the Digi Remote Manager when using a non-cellular interface. Allowed values are from 30 seconds to two hours. The default is 60 seconds.

---

```
(config)> cloud drm keep_alive value
(config)>
```

---

where *value* is any number of hours, minutes, or seconds, and takes the format **number{h|m|s}**.

For example, to set **the keep-alive interval** to ten minutes, enter either **10m** or **600s**:

---

```
(config)> cloud drm keep_alive 600s
(config)>
```

---

- (Optional) Set the amount of time that the EX15 device should wait between sending keep-alive messages to the Digi Remote Manager when using a cellular interface. Allowed values are

from 30 seconds to two hours. The default is 290 seconds.

---

```
(config)> cloud drm cellular_keep_alive value
(config)>
```

---

where *value* is any number of hours, minutes, or seconds, and takes the format **number{h|m|s}**. For example, to set **the cellular keep-alive interval** to ten minutes, enter either **10m** or **600s**:

---

```
(config)> cloud drm cellular_keep_alive 600s
(config)>
```

---

9. Set the number of allowed keep-alive misses. Allowed values are any integer between **2** and **64**. The default is **3**.

---

```
(config)> cloud drm keep_alive_misses integer
(config)>
```

---

10. The **watchdog** is used to monitor the connection to remote cloud services. If the connection is down, you can configure the device to restart the connection, or to reboot. The watchdog is enabled by default. To disable:

---

```
(config)> cloud drm watchdog false
(config)>
```

---

11. If **watchdog** is enabled:

- a. (Optional) Set the amount of time to wait before restarting the connection to the remote cloud services, once the connection is down.

where *value* is any number of hours, minutes, or seconds, and takes the format **number{h|m|s}**.

For example, to set **restart\_timeout** to ten minutes, enter either **10m** or **600s**:

---

```
(config)> cloud drm restart_timeout 600s
(config)>
```

---

The minimum value is 30 minutes and the maximum is 48 hours. If not set, this option is disabled. The default is 30 minutes.

- b. (Optional) Set the amount of time to wait before rebooting the device, once the connection to the remote cloud services is down. By default, this option is not set, which means that the option is disabled.

where *value* is any number of hours, minutes, or seconds, and takes the format **number{h|m|s}**.

For example, to set **reboot\_timeout** to ten minutes, enter either **10m** or **600s**:

---

```
(config)> cloud drm reboot_timeout 600s
(config)>
```

---

The minimum value is 30 minutes and the maximum is 48 hours. If not set, this option is disabled. The default is disabled.

12. (Optional) Determine whether to require a login and password to authenticate the user from the remote cloud services CLI:

---

```
(config)> cloud drm cli_local_auth true
(config)>
```

---

If set to **false**, no login prompt will be presented and the user will be logged in as **admin**. The default is **false**.

13. (Optional) Configure the EX15 device to communicate with remote cloud services by using SMS:

- a. **Enable** SMS messaging:

---

```
(config)> cloud drm sms enable true
(config)>
```

---

- b. Set the phone number for Digi Remote Manager:

---

```
(config)> cloud drm sms destination drm_phone_number
(config)>
```

---

- c. (Optional) Set the service identifier:

---

```
(config)> cloud drm sms service_id id
(config)>
```

---

1. (Optional) Configure the EX15 device to communicate with remote cloud services by using an HTTP proxy server:

- a. **Enable** the use of an HTTP proxy server:

---

```
(config)> cloud drm proxy enable true
(config)>
```

---

- b. Set the hostname of the proxy server:

---

```
(config)> cloud drm proxy host hostname
(config)>
```

---

- c. (Optional) Set the port number on the proxy server that the device should connect to. The default is 2138.

---

```
(config)> cloud drm proxy port integer
(config)>
```

---

14. Save the configuration and apply the change:

---

```
(config)> save
Configuration saved.
>
```

---

15. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Collect device health data and set the sample interval

You can enable or disable the collection of device health data to upload to Digi Remote Manager, and configure the interval between health sample uploads. By default, device health data upload is

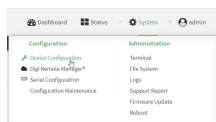
enabled, and the health sample interval is set to 60 minutes.

To avoid a situation where several devices are uploading health metrics information to Remote Manager at the same time, the EX15 device includes a preconfigured randomization of two minutes for uploading metrics. For example, if **Health sample interval** is set to five minutes, the metrics will be uploaded to Remote Manager at a random time between five and seven minutes.

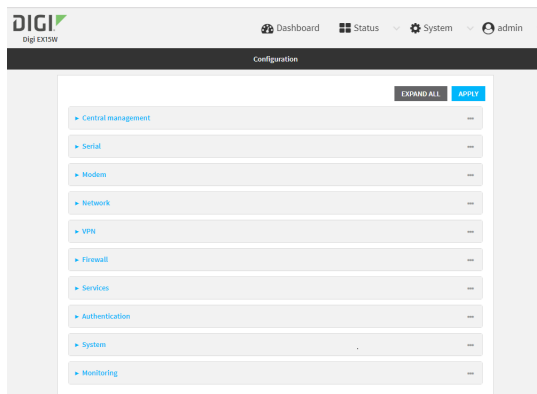
To disable the collection of device health data or enable it if it has been disabled, or to change the health sample interval:

## WebUI

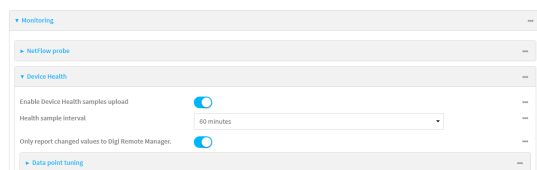
1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.



3. Click **Monitoring > Device Health**.



Device health data upload is enabled by default. To disable, click to toggle off **Enable Device Health samples upload**.

4. For **Health sample interval**, select the interval between health sample uploads.
5. **Only report changed values to Digi Remote Manager** is enabled by default.

When enabled:

- The device only reports device health metrics that have changed health metrics were last uploaded. This is useful to reduce the bandwidth used to report health metrics.
- All metrics are uploaded once every hour.

When disabled, all metrics are uploaded every **Health sample interval**.



6. (Optional) Click to expand **Data point tuning**.

Data point tuning options allow you to configure what data are uploaded to the Digi Remote Manager. All options are enabled by default.

7. Click **Apply** to save the configuration and apply the change.



## Command line

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the command line, type **config** to enter configuration mode:

```
> config
(config)>
```

3. Device health data upload is enabled by default. To enable or disable:

- To enable:

```
(config)> monitoring devicehealth enable true
(config)>
```

- To disable:

```
(config)> monitoring devicehealth enable false
(config)>
```

4. The interval between health sample uploads is set to 60 minutes by default. To change:

```
(config)> monitoring devicehealth interval value
(config)>
```

where *value* is one of **1, 5, 15, 30**, or **60**, and represents the number of minutes between uploads of health sample data.

5. By default, the device will only report health metrics values to Digi Remote Manager that have changed health metrics were last uploaded. This is useful to reduce the bandwidth used to report health metrics. This is useful to reduce the bandwidth used to report health metrics. Even if enabled, all metrics are uploaded once every hour.

To disable:

```
(config)> monitoring devicehealth only_send_deltas false
(config)>
```

When disabled, all metrics are uploaded every **Health sample interval**.

6. (Optional) Tuning parameters allow you to configure what data are uploaded to the Digi Remote Manager. By default, all tuning parameters are enabled.

To view a list of all available tuning parameters, use the **show** command:

---

```
(config)> show monitoring devicehealth tuning
all
 cellular
 rx
 bytes
 enable true
 tx
 bytes
 enable true
 eth
 rx
 bytes
 enable true
 tx
 bytes
 enable true
 serial
 rx
 bytes
 enable true
 tx
 bytes
 enable true
cellular
 1
 rx
 bytes
 enable true
 packets
 enable true
...
 (config)>
```

---

To disable a tuning parameter, set its value to false. For example, to turn off all reporting for the serial port:

---

```
(config)> monitoring devicehealth tuning all serial rx bytes enabled false
(config)> monitoring devicehealth tuning all serial tx bytes enabled false
(config)>
```

---

7. Save the configuration and apply the change:

---

```
(config)> save
Configuration saved.
>
```

---

8. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Log into Digi Remote Manager

To start Digi Remote Manager

1. If you have not already done so, click [here](#) to sign up for a Digi Remote Manager account.
2. Check your email for Digi Remote Manager login instructions.
3. Go to [remotemanager.digi.com](https://remotemanager.digi.com).
4. Log into your Digi Remote Manager account.

## Use Digi Remote Manager to view and manage your device

To view and manage your device:

1. If you have not already done so, connect to your Digi Remote Manager account.
2. Click **Device Management** to display a list of your devices.
3. Use the Search bar to locate the device you want to manage.

| MAC Address   | Device ID                           | IP Address      | Device Type | Description | Firmware Level |
|---------------|-------------------------------------|-----------------|-------------|-------------|----------------|
| 0004F3:0E4824 | 00000000-00000000-0004F3FF-FF0E4824 | 178.139.186.192 | Digi IX14   | ...         | 18.7.147.4     |
| 0004F3:0E47E0 | 00000000-00000000-0004F3FF-FF0E47E0 | 192.168.123.4   | Digi IX14   | ...         | 18.7.15.30     |
| 0004F3:0E4848 | 00000000-00000000-0004F3FF-FF0E4848 | 172.19.92.50    | Digi IX14   | ...         | 18.8.4.2       |

4. Select the device and click **Properties** to view general information for the device.
5. Click the **More** menu to perform a task.

| Devices          | Update              | SMS          |
|------------------|---------------------|--------------|
| Add Devices      | Update Firmware     | Send Message |
| Bulk Add Devices |                     | Provision    |
| Remove Devices   | Organize            | Configure    |
| Properties       | Edit Tags           |              |
| Upload Files     | Edit MetaData       | Satellite    |
| Reboot           | Assign to Group     | Send Message |
| Disconnect       | Export Devices      | Configure    |
| Restrict         | UI Descriptors      |              |
| Show Tasks       | Refresh Descriptors | SM/UDP       |
|                  | Edit Descriptors    | Send Message |
|                  | Clear Descriptors   | Configure    |

## Add a device to Digi Remote Manager

1. If you have not already done so, connect to your Digi Remote Manager account.
2. Click **Device Management** to display a list of your devices.
3. Click **Add Devices**.
4. Select **MAC Address** and enter the Ethernet MAC address for your device.
5. For **Install Code**, enter the default password on the printed label packaged with your device. The same default password is also shown on the label affixed to the bottom of the device.
6. Click **Add**.
7. Click **OK**.

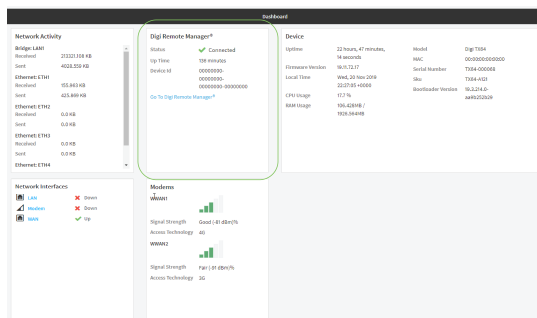
Digi Remote Manager adds your EX15 device to your account and it appears in the **Device Management** view.

## View Digi Remote Manager connection status

To view the current Digi Remote Manager configuration:

### WebUI

1. Log into the EX15 WebUI as a user with Admin access.
2. The dashboard includes a Digi Remote Manager status pane:



### Command line

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the command line, type **config** to enter configuration mode:

```
> config
(config)>
```

3. View the central management configuration:

---

```
(config)> show cloud
drm
 cellular_keep_alive 290s
 drm_url my.devicecloud.com
 keep_alive 60s
 keep_alive_misses 3
 retry_interval 30s
enable true
(config)>
```

---

1. Type **cancel** to exit configuration mode:

---

```
(config)> cancel
>
```

---

2. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

To view the status of your device's connection to Remote Manager, use the [show cloud](#) command at the command line:

### Command line

---

```
> show cloud

Device Cloud Status

Status : Connected
Server : my.devicecloud.com
Device ID : 00000000-00000000-0040FFFF-FF0F4594
>
```

---

The **Device ID** is the unique identifier for the device, as used by the Remote Manager.

## Use the Digi Remote Manager mobile app

If you have a smart phone or tablet, you can use the Digi Remote Manager mobile app to automatically provision a new devices and monitor devices in your account.

### To download the mobile app:

- For iPhone, go to the [App Store](#)
- For Android phones, go to [Google Play](#)

### To sign up for a new Digi Remote Manager account using the mobile app:

1. From the menu, click **Log in or Sign Up**.
2. Click **Sign up** to create a new account.

3. You'll receive an email with login instructions.
4. From the **Digi Remote Manager** mobile app, click **Log in** and log into your new account.

**To register a new device:**

1. From the menu, select **Install a device with a QR or bar code** and scan the installation QR code on the label.
2. Follow the prompts to complete your EX15 registration.

Digi Remote Manager registers your EX15 and adds it to your Digi Remote Manager device list. You can now manage the device remotely using Digi Remote Manager.

## Configure multiple devices using profiles

Digi recommends you take advantage of Digi Remote Manager profiles to manage multiple EX15 routers. Typically, if you want to provision multiple EX15 routers:

1. Using the EX15 local WebUI, configure one EX15 router to use as the model configuration for all subsequent EX15s you need to manage.
2. Register the configured EX15 device in your Digi Remote Manager account.
3. In Digi Remote Manager, create a profile based on the configured EX15.
4. Apply the profile to the EX15 devices you need to configure.

Digi Remote Manager provides multiple methods for applying profiles to registered devices. You can also include site-specific settings with a profile to override settings on a device-by-device basis.

## Learn more

- For information on using Digi Remote Manager to configure and manage EX15 routers, see the [Digi Remote Manager User Guide](#).
- For information on using Digi Remote Manager APIs to develop custom applications, see the [Digi Remote Manager Programmer Guide](#).

# **File system**

---

This chapter contains the following topics:

|                                          |     |
|------------------------------------------|-----|
| The EX15 local file system .....         | 733 |
| Display directory contents .....         | 733 |
| Create a directory .....                 | 734 |
| Display file contents .....              | 735 |
| Copy a file or directory .....           | 735 |
| Move or rename a file or directory ..... | 736 |
| Delete a file or directory .....         | 737 |
| Upload and download files .....          | 738 |



## The EX15 local file system

The EX15 local file system has approximately 250 MB of space available for storing files, such as Python programs, alternative configuration files and firmware versions, and release files, such as cellular module images. The writable directories within the filesystem are:

- /tmp
- /opt
- /etc/config

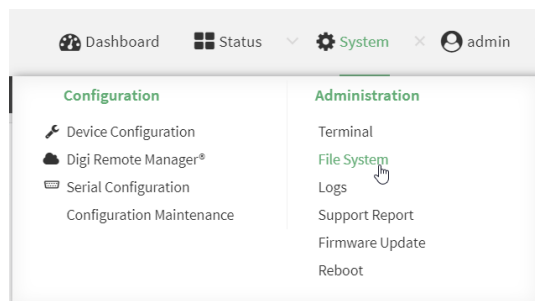
Files stored in the /tmp directory do not persist across reboots. Therefore, /tmp is a good location to upload temporary files, such as files used for firmware updates. Files stored in /opt and /etc/config do persist across reboots, but are deleted if a factory reset of the system is performed. See [Erase device configuration and reset to factory defaults](#) for more information.

## Display directory contents

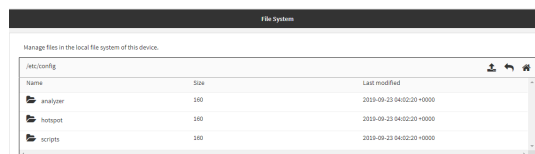
To display directory contents by using the WebUI or the Admin CLI:

### WebUI

1. Log into the EX15 WebUI as a user with Admin access.
2. On the menu, click **System**. Under **Administration**, click **File System**.



The **File System** page appears.



3. Highlight a directory and click ➞ to open the directory and view the files in the directory.

### Command line

1. Log into the EX15 command line as a user with Admin access.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the Admin CLI prompt, type **ls /path/dir\_name**. For example, to display the contents of the **/etc/config** directory:

---

```
> ls /etc/config
-rw-r--r-- 1 root root 856 Nov 20 20:12 accns.json
drw----- 2 root root 160 Sep 23 04:02 analyzer
drwxr-xr-x 3 root root 224 Sep 23 04:02 cc_acl
-rw-r--r-- 1 root root 47 Sep 23 04:02 dhcp.leases
...
>
```

---

3. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Create a directory

### Command line

This procedure is not available through the WebUI. To make a new directory, use the **mkdir** command, specifying the name of the directory.

For example:

1. Log into the EX15 command line as a user with Admin access.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.

2. At the Admin CLI prompt, type **mkdir /path/dir\_name**. For example, to create a directory named **temp** in **/etc/config**:

---

```
> mkdir /etc/config/temp
>
```

---

3. Verify that the directory was created:

---

```
> ls /etc/config
...
-rw-r--r-- 1 root root 1436 Aug 12 21:36 ssl.crt
-rw----- 1 root root 3895 Aug 12 21:36 ssl.pem
-rw-r--r-- 1 root root 10 Aug 5 06:41 start
drwxr-xr-x 2 root root 160 Aug 25 17:49 temp
>
```

---

4. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Display file contents

This procedure is not available through the WebUI. To display the contents of a file by using the Admin CLI, use the [more](#) command, specifying the name of the directory.

For example:

### Command line

1. Log into the EX15 command line as a user with Admin access.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the Admin CLI prompt, type **more /path/filename**. For example, to view the content of the file **accns.json** in **/etc/config**:

---

```
> more /etc/config/accns.json
{
 "auth": {
 "user": {
 "admin": {
 "password":
"$2a$05$W1s1s1oxsadf/n4J0XT.Rgr6ewr1yerHtXQdbafsatGswKg0YUm"
 }
 },
 "schema": {
 "version": "461"
 }
 }
}
```

---

3. Type **exit** to exit the Admin CLI.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Copy a file or directory

This procedure is not available through the WebUI. To copy a file or directory by using the Admin CLI, use the [cp](#) command, specifying the existing path and filename followed by the path and filename of the new file, or specifying the existing path and directory name followed by the path and directory name of the new directory.

### Command line

1. Log into the EX15 command line as a user with Admin access.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the Admin CLI prompt, type **cp /path/filename|dir\_name /path[f filename]|dir\_name**. For example:

- To copy the file **/etc/config/accns.json** to a file named **backup\_cfg.json** in a directory named **/etc/config/test**, enter the following:

---

```
> cp /etc/config/accns.json /etc/config/test/backup_cfg.json
>
```

---

- To copy a directory named **/etc/config/test** to **/opt**:

---

```
> cp /etc/config/test/ /opt/
>
```

---

3. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Move or rename a file or directory

This procedure is not available through the WebUI. To move or rename a file or directory by using the Admin CLI, use the **mv** command.

### Command line

To rename a file named **test.py** in **/etc/config/scripts** to **final.py**:

1. Log into the EX15 command line as a user with Admin access.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.

2. At the Admin CLI prompt, type:

---

```
> mv /etc/config/scripts/test.py /etc/config/scripts/final.py
>
```

---

3. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

To move **test.py** from **/etc/config/scripts** to **/opt**:

1. Log into the EX15 command line as a user with Admin access.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.

2. At the Admin CLI prompt, type:

---

```
> mv /etc/config/scripts/test.py /opt/
>
```

---

3. Type **exit** to exit the Admin CLI.

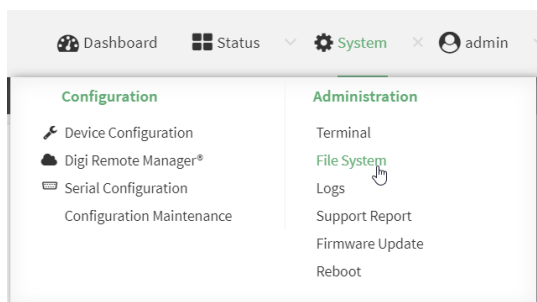
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Delete a file or directory

To delete a file or directory by using the WebUI or the Admin CLI:

### WebUI

1. Log into the EX15 WebUI as a user with Admin access.
2. On the menu, click **System**. Under **Administration**, click **File System**.



The **File System** page appears.



3. Highlight the directory containing the file to be deleted and click  to open the directory.
4. Highlight the file to be deleted and click .
5. Click **OK** to confirm.

### Command line

To delete a file named **test.py** in **/etc/config/scripts**:

1. Log into the EX15 command line as a user with Admin access.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the Admin CLI prompt, type:

```
> rm /etc/config/scripts/test.py
rm: remove '/etc/config/scripts/test.py'? yes
>
```

3. Type **exit** to exit the Admin CLI.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

To delete a directory named **temp** from **/opt**:

1. Log into the EX15 command line as a user with Admin access.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.

- At the Admin CLI prompt, type:

```
> rm /opt/temp/
rm: descend into directory '/opt/temp'? yes
rm: remove directory '/opt/temp'? yes
>
```

- Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

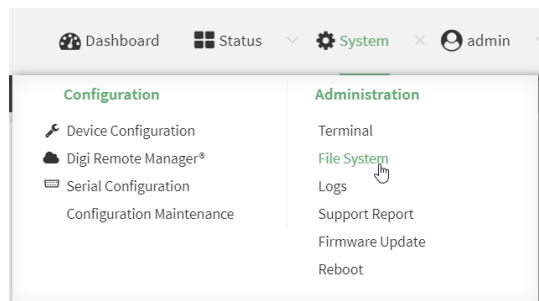
## Upload and download files

You can download and upload files by using the WebUI or from the command line by using the [scp](#) Secure Copy command, or by using a utility such as SSH File Transfer Protocol (SFTP) or an SFTP application like FileZilla.

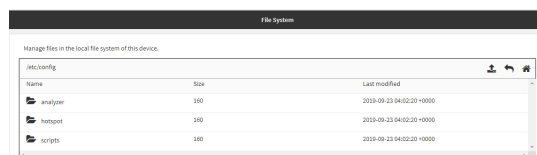
### Upload and download files by using the WebUI

#### Upload files

- Log into the EX15 WebUI as a user with Admin access.
- On the menu, click **System**. Under **Administration**, click **File System**.



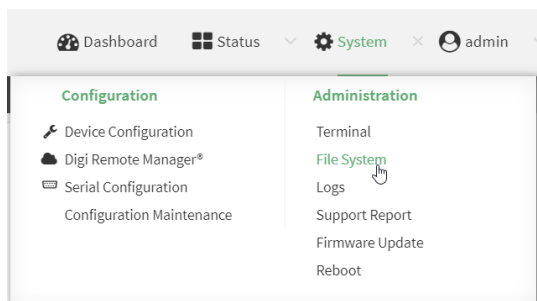
The **File System** page appears.



- Highlight the directory to which the file will be uploaded and click ↶ to open the directory.
- Click ↗ (upload).
- Browse to the location of the file on your local machine. Select the file and click **Open** to upload the file.

## Download files

1. Log into the EX15 WebUI as a user with Admin access.
2. On the menu, click **System**. Under **Administration**, click **File System**.



The **File System** page appears.



3. Highlight the directory to which the file will be uploaded and click ➡ to open the directory.
4. Highlight the appropriate file and click ⬇ (download).

## Upload and download files by using the Secure Copy command

### Copy a file from a remote host to the EX15 device

To copy a file from a remote host to the EX15 device, use the `scp` command as follows:

```
> scp host hostname-or-ip user username remote remote-path local local-path to local
```

where:

- *hostname-or-ip* is the hostname or ip address of the remote host.
- *username* is the name of the user on the remote host.
- *remote-path* is the path and filename of the file on the remote host that will be copied to the EX15 device.
- *local-path* is the location on the EX15 device where the copied file will be placed.

For example:

To copy firmware from a remote host with an IP address of 192.168.4.1 to the `/etc/config/scripts` directory on the EX15 device, issue the following command:

```
> scp host 192.168.4.1 user admin remote /home/admin/bin/EX15-21.2.39.67.bin
local /etc/config/scripts to local
admin@192.168.4.1's password: adminpwd
EX15-21.2.39.67.bin 100% 36MB 11.1MB/s 00:03
>
```

### Transfer a file from the EX15 device to a remote host

To copy a file from the EX15 device to a remote host, use the `scp` command as follows:

---

```
> scp host hostname-or-ip user username remote remote-path local local-path to
remote
```

---

where:

- *hostname-or-ip* is the hostname or ip address of the remote host.
- *username* is the name of the user on the remote host.
- *remote-path* is the location on the remote host where the file will be copied.
- *local-path* is the path and filename on the EX15 device.

For example:

To copy a support report from the EX15 device to a remote host at the IP address of 192.168.4.1:

1. Use the **system support-report** command to generate the report:

---

```
> system support-report /var/log/
Saving support report to /var/log/support-report-0040D0133536-21-02-26-
8:04:23.bin
Support report saved.
>
```

---

2. Use the **scp** command to transfer the report to a remote host:

---

```
> scp host 192.168.4.1 user admin remote /home/admin/temp/ local
/var/log/support-report-00:40:D0:13:35:36-21-02-26-8:04:23.bin to remote
admin@192.168.4.1's password: adminpwd
support-report-0040D0133536-21-02-26-8:04:23.bin
>
```

---

## Upload and download files using SFTP

### Transfer a file from a remote host to the EX15 device

This example uploads firmware from a remote host to the EX15 device with an IP address of **192.168.2.1**, using the username **ahmed**:

---

```
$ sftp ahmed@192.168.2.1
Password:
Connected to 192.168.2.1
sftp> put EX15-21.2.39.67
Uploading EX15-21.2.39.67 to EX15-21.2.39.67
EX15-21.2.39.67
 100% 24M 830.4KB/s 00:00
sftp> exit
$
```

---

### Transfer a file from the EX15 device to a remote host

This example downloads a file named **test.py** from the EX15 device at the IP address of **192.168.2.1** with a username of **ahmed** to the local directory on the remote host:



---

```
$ sftp ahmed@192.168.2.1
Password:
Connected to 192.168.2.1
sftp> get test.py
Fetching test.py to test.py
test.py
 100% 254 0.3KB/s 00:00
sftp> exit
$
```

---

## Diagnostics

---

This chapter contains the following topics:

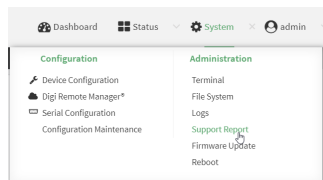
|                                                                  |     |
|------------------------------------------------------------------|-----|
| Generate a support report .....                                  | 743 |
| View system and event logs .....                                 | 744 |
| Configure syslog servers .....                                   | 748 |
| Configure options for the event and system logs .....            | 750 |
| Analyze network traffic .....                                    | 755 |
| Use the ping command to troubleshoot network connections .....   | 768 |
| Use the traceroute command to diagnose IP routing problems ..... | 768 |

## Generate a support report

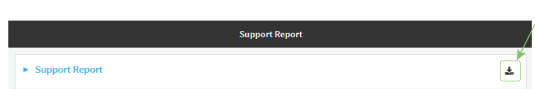
To generate and download a support report:

### WebUI

1. Log into the EX15 WebUI as a user with Admin access.
2. On the main menu, click **System**. Under **Administration**, click **Support Report**.



3. Click  to generate and download the support report.



Attach the support report to any support requests.

### Command line

1. Log into the EX15 command line as a user with Admin access.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.

2. Use the **system support-report** command to generate the report:

---

```
> system support-report /var/log/
Saving support report to /var/log/support-report-0040D0133536-21-02-26-
8:04:23.bin
Support report saved.
>
```

---

3. Use the **scp** command to transfer the report to a remote host:

---

```
> scp host 192.168.4.1 user admin remote /home/admin/temp/ local
/var/log/support-report-00:40:D0:13:35:36-21-02-26-8:04:23.bin to remote
admin@192.168.4.1's password: adminpwd
support-report-0040D0133536-21-02-26-8:04:23.bin
>
```

---

4. Type **exit** to exit the Admin CLI.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

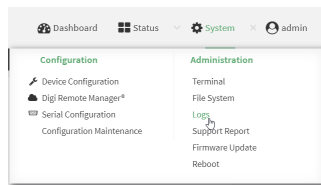
## View system and event logs

See [Configure options for the event and system logs](#) for information about configuring the information displayed in event and system logs.

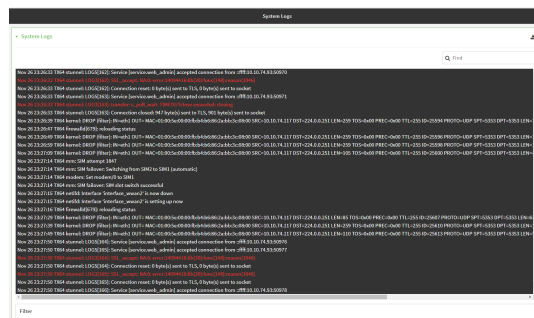
### View System Logs



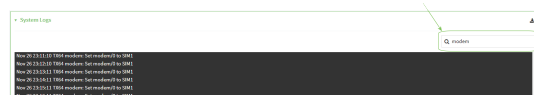
1. Log into the EX15 WebUI as a user with Admin access.
2. On the main menu, click **System > Logs**.



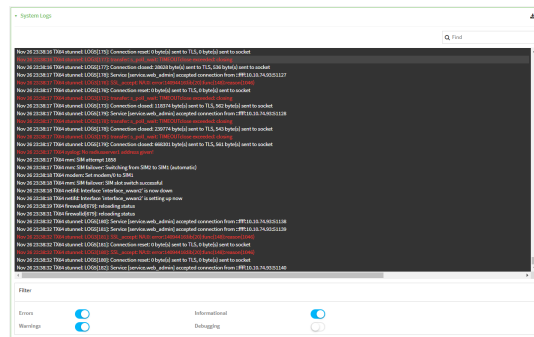
The system log displays:



3. Limit the display in the system log by using the **Find** search tool.



4. Use filters to configure the types of information displayed in the system logs.



- Click  to download the system log.



## Command line

- Log into the EX15 command line as a user with Admin access.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
- Use **show log** at the Admin CLI prompt:

```
> show log
```

| Timestamp       | Message                                                  |
|-----------------|----------------------------------------------------------|
| Nov 26 21:54:34 | EX15 netifd: Interface 'interface_wan' is setting up now |
| Nov 26 21:54:35 | EX15 firewallld[621]: reloading status                   |
| ...             |                                                          |

- (Optional) Use the **show log number num** command to limit the number of lines that are displayed. For example, to limit the log to the most recent ten lines:

```
> show log number 10
```

| Timestamp       | Message                                                  |
|-----------------|----------------------------------------------------------|
| Nov 26 21:54:34 | EX15 netifd: Interface 'interface_wan' is setting up now |
| Nov 26 21:54:35 | EX15 firewallld[621]: reloading status                   |
| ...             |                                                          |

- (Optional) Use the **show log filter value** command to limit the number of lines that are displayed. Allowed values are **critical**, **warning**, **info**, and **debug**. For example, to limit the event list to only info messages:

```
> show log filter info
```

| Timestamp       | Type | Category | Message                                                |
|-----------------|------|----------|--------------------------------------------------------|
| Nov 26 22:01:26 | info | user     | name=admin~service=cli~state=opened~remote=192.168.1.2 |
| Nov 26 22:01:25 | info | user     | name=admin~service=cli~state=closed~remote=192.168.1.2 |
| ...             |      |          |                                                        |

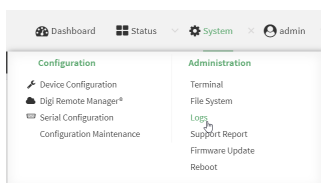
5. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

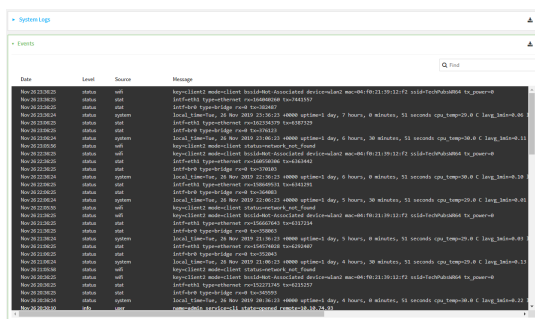
## View Event Logs



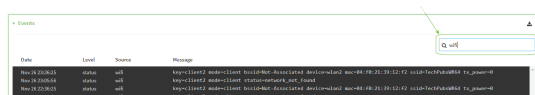
1. Log into the EX15 WebUI as a user with Admin access.
2. On the main menu, click **System** > **Logs**.



3. Click ▼ **System Logs** to collapse the system logs viewer, or scroll down to **Events**.
4. Click ▶ **Events** to expand the event viewer.



- Limit the display in the event log by using the **Find** search tool.



6. Click  to download the event log.



## Command line

1. Log into the EX15 command line as a user with Admin access.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.

2. Use **show event** at the Admin CLI prompt:

---

```
> show event
```

| Timestamp       | Type   | Category | Message                                                                          |
|-----------------|--------|----------|----------------------------------------------------------------------------------|
| ---             |        |          |                                                                                  |
| Nov 26 21:42:37 | status | stat     | intf=eth1~type=ethernet~rx=11332435~tx=5038762                                   |
| Nov 26 21:42:35 | status | system   | local_time=Thu, 08 Aug 2019 21:42:35 +0000~uptime=3 hours, 0 minutes, 48 seconds |
| ...             |        |          |                                                                                  |

---

```
>
```

3. (Optional) Use the **show event number num** command to limit the number of lines that are displayed. For example, to limit the event list to the most recent ten lines:

---

```
> show event number 10
```

| Timestamp       | Type   | Category | Message                                                                          |
|-----------------|--------|----------|----------------------------------------------------------------------------------|
| ---             |        |          |                                                                                  |
| Nov 26 21:42:37 | status | stat     | intf=eth1~type=ethernet~rx=11332435~tx=5038762                                   |
| Nov 26 21:42:35 | status | system   | local_time=Thu, 08 Aug 2019 21:42:35 +0000~uptime=3 hours, 0 minutes, 48 seconds |
| ...             |        |          |                                                                                  |

---

```
>
```

4. (Optional) Use the **show event table value** command to limit the number of lines that are displayed. Allowed values are **error**, **info**, and **status**. For example, to limit the event list to only info messages:

---

```
> show event table info
```

| Timestamp       | Type | Category | Message                                                |
|-----------------|------|----------|--------------------------------------------------------|
| ---             |      |          |                                                        |
| Nov 26 22:01:26 | info | user     | name=admin~service=cli~state=opened~remote=192.168.1.2 |
| Nov 26 22:01:25 | info | user     | name=admin~service=cli~state=closed~remote=192.168.1.2 |
| ...             |      |          |                                                        |

---

```
>
```

5. Type **exit** to exit the Admin CLI.

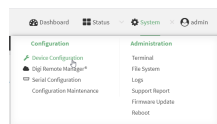
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Configure syslog servers

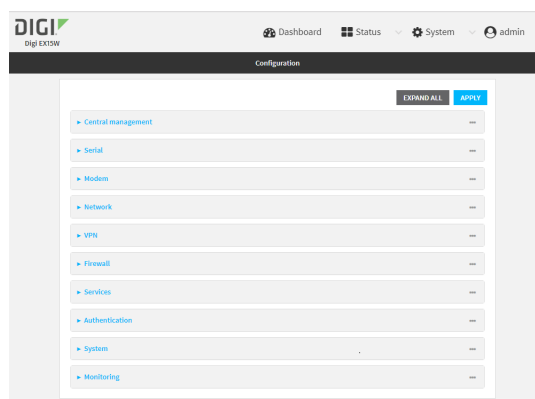
You can configure remote syslog servers for storing event and system logs.

### WebUI

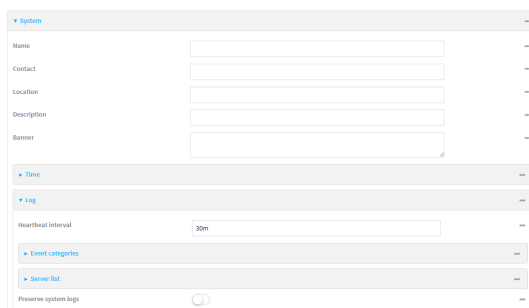
1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



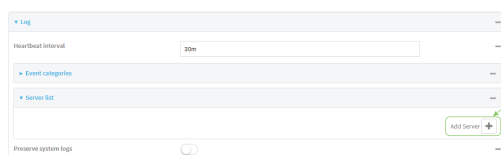
The **Configuration** window is displayed.



3. Click **System > Log**.



4. Add and configure a remote syslog server:
  - a. Click to expand **Server list**.
  - b. For **Add Server**, click **+**.





The log server configuration window is displayed.

Log servers are enabled by default. To disable, click to toggle off **Enable**.

- c. Type the host name or IP address of the **Server**.
  - d. Select the event categories that will be sent to the server. By default, all event categories are enabled. You can disable logging for error, informational, and status event categories by clicking to toggle off the category.
  - e. For **Syslog egress port**, type the port number to use for the syslog server. The default is **514**.
  - f. For **Protocol**, select the IP protocol to use for communication with the syslog server. Available options are **TCP** and **UDP**. The default is **UDP**.
5. Click **Apply** to save the configuration and apply the change.

## Command line

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the command line, type **config** to enter configuration mode:

```
> config
(config)>
```

3. (Optional) To configure remote syslog servers:
  - a. Add a remote server:

```
(config)> add system log remote end
(config system log remote 0)>
```

- b. Enable the server:

```
(config system log remote 0)> enable true
(config system log remote 0)>
```

- c. Set the host name or IP address of the server:

```
(config system log remote 0)> server hostname
(config system log remote 0)>
```

- d. The event categories that will be sent to the server are automatically enabled when the server is enabled.

- To disable informational event messages:

---

```
(config system log remote 0)> info false
(config system log remote 0)>
```

---

- To disable status event messages:

---

```
(config system log remote 0)> status false
(config system log remote 0)>
```

---

- To disable informational event messages:

---

```
(config system log remote 0)> error false
(config system log remote 0)>
```

---

4. Set the port number to use for the syslog server:

---

```
(config system log remote 0)> port value
(config system log remote 0)>
```

---

where *value* is any integer between **1** and **65535**. The default is **514**.

5. Set the IP protocol to use for communication with the syslog server:

---

```
(config system log remote 0)> protocol value
(config system log remote 0)>
```

---

where *value* is either **tcp** or **udp**. The default is **udp**.

6. Save the configuration and apply the change:

---

```
(config)> save
Configuration saved.
>
```

---

7. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Configure options for the event and system logs

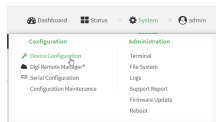
The default configuration for event and system logging is:

- The heartbeat interval, which determines the amount of time to wait before sending a heartbeat event if no other events have been sent, is set to 30 minutes.
- All event categories are enabled.

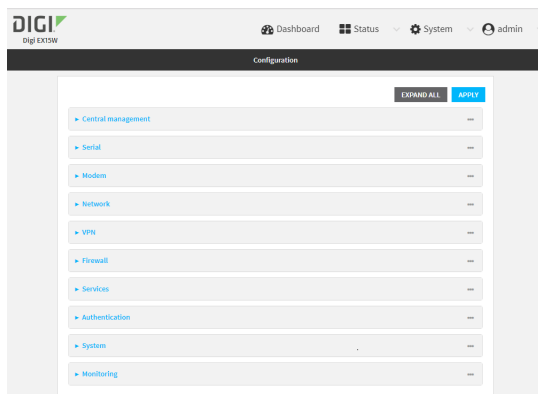
To change or disable the heartbeat interval, or to disable event categories, and to perform other log configuration:



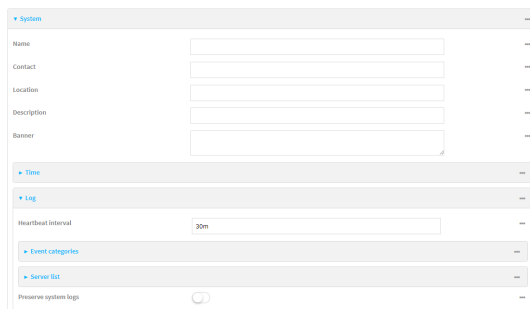
1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



The **Configuration** window is displayed.



3. Click **System > Log**.



4. (Optional) To change the **Heartbeat interval** from the default of 30 minutes, type a new value. The heartbeat interval determines the amount of time to wait before sending a heartbeat event if no other events have been sent.

Allowed values are any number of weeks, days, hours, minutes, or seconds, and take the format **number{w|d|h|m|s}**.

For example, to set **Heartbeat interval** to ten minutes, enter **10m** or **600s**.

To disable the **Heartbeat interval**, enter **0s**.

5. (Optional) To disable event categories, or to enable them if they have been disabled:
  - a. Click to expand **Event Categories**.
  - b. Click an event category to expand.
  - c. Depending on the event category, you can enable or disable informational events, status events, and error events. Some categories also allow you to set the **Status interval**, which is the time interval between periodic status events.

6. (Optional) See [Configure syslog servers](#) for information about configuring remote syslog servers to which log messages will be sent.
7. Enable **Preserve system logs** to save the current session's system log after a reboot. By default, the EX15 device erases system logs each time the device is powered off or rebooted.

---

**Note** You should only enable **Preserve system logs** temporarily to debug issues. Once you are finished debugging, immediately disable **Preserve system logs** to avoid unnecessary wear to the flash memory.

---

8. Click **Apply** to save the configuration and apply the change.



## Command line

1. Log into the EX15 command line as a user with full Admin access rights. Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the command line, type **config** to enter configuration mode:

```
> config
(config)>
```

3. (Optional) To change the heartbeat interval from the default of 30 minutes, set a new value. The heartbeat interval determines the amount of time to wait before sending a heartbeat event if no other events have been sent.

```
(config)> system log heartbeat_interval value
(config)>
```

where *value* is any number of weeks, days, hours, minutes, or seconds, and takes the format **number{w|d|h|m|s}**.

For example, to set **the heartbeat interval** to ten minutes, enter either **10m** or **600s**:

```
(config)> system log heartbeat_interval 600s
(config)>
```

To disable the heartbeat interval, set the value to **0s**

4. Enable preserve system logs functionality to save the current session's system log after a reboot. By default, the EX15 device erases system logs each time the device is powered off or rebooted.

---

**Note** You should only enable **Preserve system logs** temporarily to debug issues. Once you are finished debugging, immediately disable **Preserve system logs** to avoid unnecessary wear to the flash memory.

---

---

```
(config)> system log persistent true
(config)>
```

---

5. (Optional) To disable event categories, or to enable them if they have been disabled:
  - a. Use the question mark (?) to determine available event categories:

---

```
(config)> system log event ?
```

---

Event categories: Settings to enable individual event categories.

Additional Configuration

```

arping ARP ping
config Configuration
dhcpserver DHCP server
firmware Firmware
location Location
modem Modem
netmon Active recovery
network Network interfaces
openvpn OpenVPN
portal Captive portal
remote Remote control
restart Restart
serial Serial
sms SMS commands
speed Speed
stat Network statistics
user User
wireless WiFi
wol Wake-On-LAN
```

---

```
(config)> system log event
```

---

- b. Depending on the event category, you can enable or disable informational events, status events, and error events. Some categories also allow you to set the status interval, which is the time interval between periodic status events. For example, to configure DHCP server logging:
      - i. Use the question mark (?) to determine what events are available for DHCP server logging configuration:

---

```
(config)> system log event dhcpserver ?
```

---

```
...
```

DHCP server: Settings for DHCP server events. Informational events are generated when a lease is obtained or released. Status events report the current list of leases.

---

| Parameters      | Current Value |                             |
|-----------------|---------------|-----------------------------|
| -----           |               |                             |
| info            | true          | Enable informational events |
| status          | true          | Enable status events        |
| status_interval | 30m           | Status interval             |

```
(config)> system log event dhcpserver
```

- ii. To disable informational messages for the DHCP server:

```
(config)> system log event dhcpserver info false
(config)>
```

- iii. To change the status interval:

```
(config)> system log event dhcpserver status_interval value
(config)>
```

where *value* is any number of weeks, days, hours, minutes, or seconds, and takes the format **number{w|d|h|m|s}**.

For example, to set **the status interval** to ten minutes, enter either **10m** or **600s**:

```
(config)> system log event dhcpserver status_interval 600s
(config)>
```

6. (Optional) See [Configure syslog servers](#) for information about configuring remote syslog servers to which log messages will be sent.
7. Save the configuration and apply the change:

```
(config)> save
Configuration saved.
>
```

8. Type **exit** to exit the Admin CLI.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Analyze network traffic

The EX15 device includes a network analyzer tool that captures data traffic on any interface and decodes the captured data traffic for diagnostics. You can capture data traffic on multiple interfaces at the same time and define capture filters to reduce the captured data. You can capture up to 10 MB of data traffic in two 5 MB files per interface.

To perform a more detailed analysis, you can download the captured data traffic from the device and view it using a third-party application.

---

**Note** Data traffic is captured to RAM and the captured data is lost when the device reboots unless you save the data to a file. See [Save captured data traffic to a file](#).

---

This section contains the following topics:

|                                                         |     |
|---------------------------------------------------------|-----|
| Configure packet capture for the network analyzer ..... | 756 |
| Example filters for capturing data traffic .....        | 760 |
| Capture packets from the command line .....             | 761 |
| Stop capturing packets .....                            | 762 |
| Show captured traffic data .....                        | 763 |
| Save captured data traffic to a file .....              | 764 |
| Download captured data to your PC .....                 | 765 |
| Clear captured data .....                               | 766 |

## Configure packet capture for the network analyzer

To use the network analyzer, you must create one or more packet capture configuration.

### Required configuration items

- The interface used by this packet capture configuration.

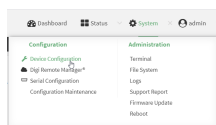
### Additional configuration items

- The filter expression for this packet capture configuration.
- Schedule the analyzer to run based on a specified event or at a particular time:
  - The events or time that will trigger the analyzer to run, using this capture configuration.
  - The amount of time that the analyzer session will run.
  - The frequency with which captured events will be saved.

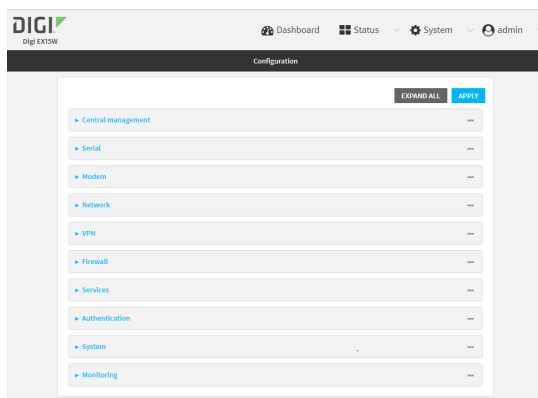
To configure a packet capture configuration:

### WebUI

1. Log into the EX15 WebUI as a user with full Admin access rights.
2. On the menu, click **System**. Under **Configuration**, click **Device Configuration**.



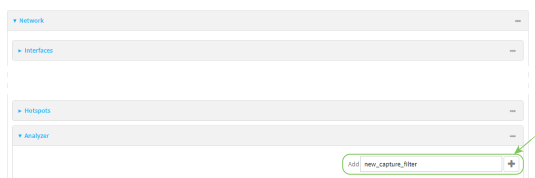
The **Configuration** window is displayed.



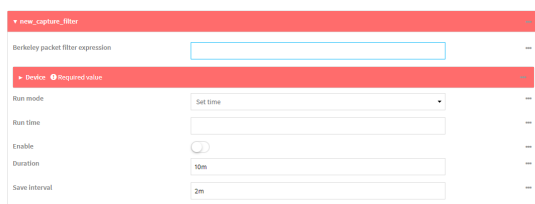
3. Click **Network > Analyzer**.



4. For **Add Capture settings**, type a name for the capture filter and click **+**.



The new capture filter configuration is displayed.



5. Add one or more interface to the capture filter:
  - a. Click to expand **Device**.
  - b. Click **+** to add an interface to the capture setting instance.



- c. For **Duration**, type the amount of time that the scheduled analyzer session will run.  
Allowed values are any number of weeks, days, hours, minutes, or seconds, and take the format **number{w|d|h|m|s}**.  
For example, to set **Duration** to ten minutes, enter **10m** or **600s**.
  - d. For **Save interval**, type the frequency with which captured events will be saved.  
Allowed values are any number of weeks, days, hours, minutes, or seconds, and take the format **number{w|d|h|m|s}**.  
For example, to set **Save interval** to ten minutes, enter **10m** or **600s**.
8. Click **Apply** to save the configuration and apply the change.



## Command line

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the command line, type **config** to enter configuration mode:

```
> config
(config)>
```

3. Add a new capture filter:

```
(config)> add network analyzer name
(config network analyzer name)>
```

4. Add an interface to the capture filter:

```
(config network analyzer name)> add device end device
(config network analyzer name)>
```

Determine available devices and the proper syntax.

To determine available devices and proper syntax, use the space bar autocomplete feature:

```
(config network analyzer name)> add device end <space>
/network/device/lan /network/device/loopback
/network/device/wan /network/bridge/lan
/network/wifi/ap/digi_ap /network/interface/aview
/network/interface/defaultip /network/interface/defaultlinklocal
/network/interface/lan /network/interface/loopback
/network/interface/modem /network/interface/wan
(config network analyzer name)> add interface end /network/
```

Repeat to add additional interfaces.

5. (Optional) Set a filter for the capture filter:

---

```
(config network analyzer name)> filter value
(config network analyzer name)>
```

---

where *value* is a filter using Berkeley Packet Filter (BPF) syntax. Values that contain spaces must be enclosed in double quotes (").

See [Example filters for capturing data traffic](#) for examples of filters using BPF syntax.

6. (Optional) Schedule the analyzer to run, using this capture filter, based on a specified event or at a particular time:
  - a. Enable scheduling for this capture filter:

---

```
(config network analyzer name)> schedule enable true
(config network analyzer name)>
```

---

- b. Set the mode that will be used to run the capture filter:

---

```
(config network analyzer name)> when mode
(config network analyzer name)>
```

---

where *mode* is one of the following:

- **boot**: The script will run once each time the device boots.
- **interval**: The script will start running at the specified interval, within 30 seconds after the configuration change is saved. If **interval** is selected, set the interval:

---

```
(config add network analyzer name)> on_interval value
(config add network analyzer name)>
```

---

where *value* is any number of weeks, days, hours, minutes, or seconds, and takes the format **number{w|d|h|m|s}**.

For example, to set **on\_interval** to ten minutes, enter either **10m** or **600s**:

---

```
(config network analyzer name)> on_interval 600s
(config network analyzer name)>
```

---

- **set\_time**: Runs the script at a specified time of the day. If **set\_time** is set, set the time that the script should run, using the format *HH:MM*:

---

```
(config network analyzer name)> run_time HH:MM
(config network analyzer name)>
```

---

- **maintenance\_time**: The script will run during the system maintenance time window.

- c. Set the amount of time that the scheduled analyzer session will run:

---

```
(config network analyzer name)> duration value
(config network analyzer name)>
```

---

where *value* is any number of weeks, days, hours, minutes, or seconds, and takes the format **number{w|d|h|m|s}**.

For example, to set **duration** to ten minutes, enter either **10m** or **600s**:

---

```
(config network analyzer name)> save_interval 600s
(config network analyzer name)>
```

---

- d. Set the frequency with which captured events will be saved:

---

```
(config network analyzer name)> save_interval value
(config network analyzer name)>
```

---

where *value* is any number of weeks, days, hours, minutes, or seconds, and takes the format **number{w|d|h|m|s}**.

For example, to set **save\_interval** to ten minutes, enter either **10m** or **600s**:

---

```
(config network analyzer name)> save_interval 600s
(config network analyzer name)>
```

---

7. Save the configuration and apply the change:

---

```
(config)> save
Configuration saved.
>
```

---

8. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Example filters for capturing data traffic

The following are examples of filters using Berkeley Packet Filter (BPF) syntax for capturing several types of network data. See <https://biot.com/capstats/bpf.html> for detailed information about BPF syntax.

### Example IPv4 capture filters

- Capture traffic to and from IP host 192.168.1.1:

---

```
ip host 192.168.1.1
```

---

- Capture traffic from IP host 192.168.1.1:

---

```
ip src host 192.168.1.1
```

---

- Capture traffic to IP host 192.168.1.1:

---

```
ip dst host 192.168.1.1
```

---

- Capture traffic for a particular IP protocol:

---

```
ip proto protocol
```

---

where *protocol* is a number in the range of **1** to **255** or one of the following keywords: **icmp**, **icmp6**, **igmp**, **pim**, **ah**, **esp**, **vrp**, **udp**, or **tcp**.

- Capture traffic to and from a TCP port 80:

```
ip proto tcp and port 80
```

- Capture traffic to UDP port 53:

```
ip proto udp and dst port 53
```

- Capture traffic from UDP port 53:

```
ip proto udp and src port 53
```

- Capture to and from IP host 10.0.0.1 but filter out ports 22 and 80:

```
ip host 10.0.0.1 and not (port 22 or port 80)
```

### **Example Ethernet capture filters**

- Capture Ethernet packets to and from a host with a MAC address of 00:40:D0:13:35:36:

```
ether host 00:40:D0:13:35:36
```

- Capture Ethernet packets from host 00:40:D0:13:35:36:

```
ether src 00:40:D0:13:35:36:
```

- Capture Ethernet packets to host 00:40:D0:13:35:36:

```
ether dst 00:40:D0:13:35:36
```

## **Capture packets from the command line**

You can start packet capture at the command line with the [analyzer start](#) command. Alternatively, you can schedule the network analyzer to run based on a specified event or at a particular time. See [Configure packet capture for the network analyzer](#) for information about scheduling packet capturing. Additional analyzer commands allow you to:

- [Stop capturing packets.](#)
- [Save captured data traffic to a file.](#)
- [Clear captured data.](#)

### **Required configuration items**

- A configured packet capture. See [Configure packet capture for the network analyzer](#) for packet capture configuration information.

To start packet capture from the command line:



### **Command line**

1. Log into the EX15 command line as a user with Admin access.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. Type the following at the Admin CLI prompt:

---

```
> analyzer start name capture_filter
>
```

---

where *capture\_filter* is the name of a packet capture configuration. See [Configure packet capture for the network analyzer](#) for more information.

To determine available packet capture configurations, use the **?**:

---

```
> analyzer start name ?
```

name: Name of the capture filter to use.

Format:

test\_capture

capture\_ping

---

```
> analyzer start name
```

---

You can capture up to 10 MB of data traffic in two 5 MB files per interface.

---

**Note** Data traffic is captured to RAM and the captured data is lost when the device reboots unless you save the data to a file. See [Save captured data traffic to a file](#).

---

## Stop capturing packets

You can stop packet capture at the command line with the [analyzer stop](#) command.

To stop packet capture from the command line:

### Command line

1. Log into the EX15 command line as a user with Admin access.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. Type the following at the Admin CLI prompt:

---

```
> analyzer stop name capture_filter
>
```

---

where *capture\_filter* is the name of a packet capture configuration. See [Configure packet capture for the network analyzer](#) for more information.

To determine available packet capture configurations, use the **?**:

---

```
> analyzer stop name ?
```

name: Name of the capture filter to use.

Format:

---

```
test_capture
capture_ping
```

```
> analyzer stop name
```

---

## Show captured traffic data

To view captured data traffic, use the `show analyzer` command. The command output show the following information for each packet:

- The packet number.
- The timestamp for when the packet was captured.
- The length of the packet and the amount of data captured.
- Whether the packet was sent or received by the device.
- The interface on which the packet was sent or received.
- A hexadecimal dump of the packet of up to 256 bytes.
- Decoded information of the packet.

To show captured data traffic:

### Command line

1. Log into the EX15 command line as a user with Admin access.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.

2. Type the following at the Admin CLI prompt:

---

```
> show analyzer name capture_filter
```

```
Packet 1 : Feb-26-2021 8:04:23.287682, Length 60 bytes (Captured Length 60 bytes)
```

```
Received on interface eth1
```

```
00 40 ff 80 01 20 b4 b6 86 21 b5 73 08 00 45 00 .@... .. .!.s..E.
00 28 3d 36 40 00 80 06 14 bc 0a 0a 4a 82 0a 0a .(=6@... J..
4a 48 cd ae 00 16 a4 4b ff 5f ee 1f d8 23 50 10 JH.....K ._...#P.
08 02 c7 40 00 00 00 00 00 00 00 00 00 00 00 ...@....
```

#### Ethernet Header

```
Destination MAC Addr : 00:40:D0:13:35:36
Source MAC Addr : fb:03:53:05:11:2f
Ethernet Type : IP (0x0800)
```

#### IP Header

```
IP Version : 4
Header Length : 20 bytes
ToS : 0x00
Total Length : 40 bytes
ID : 15670 (0x3d36)
```

---

---

```

 Flags : Do not fragment
 Fragment Offset : 0 (0x0000)
 TTL : 128 (0x80)
 Protocol : TCP (6)
 Checksum : 0x14bc
 Source IP Address : 10.10.74.130
 Dest. IP Address : 10.10.74.72
 TCP Header
 Source Port : 52654
 Destination Port : 22
 Sequence Number : 2756443999
 Ack Number : 3995064355
 Data Offset : 5
 Flags : ACK
 Window : 2050
 Checksum : 0xc740
 Urgent Pointer : 0
 TCP Data
 00 00 00 00 00 00

>

```

---

where *capture\_filter* is the name of a packet capture configuration. See [Configure packet capture for the network analyzer](#) for more information.

To determine available packet capture configurations, use the **?**:

---

```

> show analyzer name ?

name: Name of the capture filter to use.
Format:
 test_capture
 capture_ping

> show analyzer name

```

---

## Save captured data traffic to a file

Data traffic is captured to RAM and when the device reboots, the data is lost. To retain the captured data, first save the data to a file and then upload the file to a PC.

To save captured traffic data to a file, use the [analyzer save](#) command:

### Command line

1. Log into the EX15 command line as a user with Admin access.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. Type the following at the Admin CLI prompt:

---

```

> analyzer save filename filename name capture_filter
>

```

---



where:

- *filename* is the name of the file that the captured data will be saved to.

Determine filenames already in use:

Use the tab autocomplete feature to determine filenames that are currently in use:

---

```
> analyzer save name <tab>
test1_analyzer_capture test2_analyzer_capture
> analyzer save name
```

---

- *capture\_filter* is the name of a packet capture configuration. See [Configure packet capture for the network analyzer](#) for more information.

To determine available packet capture configurations, use the **?**:

---

```
> analyzer save name ?

name: Name of the capture filter to use.
Format:
 test_capture
 capture_ping

> analyzer save name
```

---

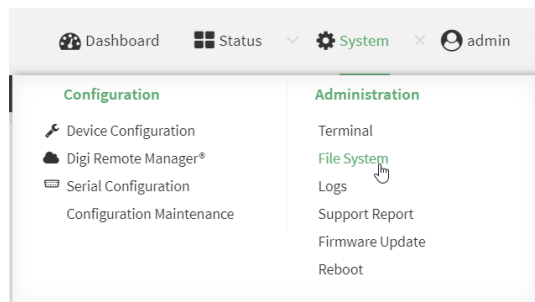
The file is stored in the **/etc/config/analyzer** directory. To transfer the file to your PC, see [Download captured data to your PC](#).

## Download captured data to your PC

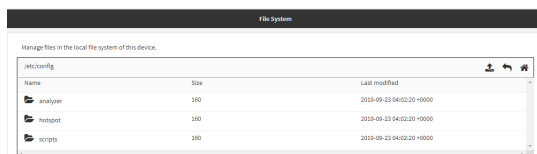
After saving captured data to a file (see [Save captured data traffic to a file](#)), you can download the file from the WebUI or from the command line by using the **scp** (secure copy file) command.

### WebUI

1. Log into the EX15 WebUI as a user with Admin access.
2. On the menu, click **System**. Under **Administration**, click **File System**.



The **File System** page appears.



3. Highlight the **analyzer** directory and click to open the directory.
4. Select the saved analyzer report you want to download and click (download).

### Command line

1. Log into the EX15 command line as a user with Admin access.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. Type **scp** to use the Secure Copy program to copy the file to your PC:

---

```
> scp host hostname-or-ip user username remote remote-path local local-path
to remote
```

---

where:

- *hostname-or-ip* is the hostname or ip address of the remote host.
- *username* is the name of the user on the remote host.
- *remote-path* is the location on the remote host where the file will be copied.
- *local-path* is the path and filename on the EX15 device.

For example:

To download the traffic saved in the file **/etc/config/analyzer/eth0.pcpng** to a PC with the IP **192.168.210.2**, for a user named **maria**, to the **/home/maria** directory:

---

```
> scp host 192.168.210.2 user maria remote /home/maria local
/etc/config/analyzer/eth0.pcpng to remote
```

---

```
maria@192.168.210.2's password:
```

```
eth0.pcpng 100% 11KB 851.3KB/s 00:00
```

---

## Clear captured data

To clear captured data traffic in RAM, use the **analyzer clear** command:

### Command line

1. Log into the EX15 command line as a user with Admin access.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. Type the following at the Admin CLI prompt:

---

```
> analyzer clear name capture_filter
>
```

---

where *capture\_filter* is the name of a packet capture configuration. See [Configure packet capture for the network analyzer](#) for more information.

To determine available packet capture configurations, use the **?**:

---

```
> analyzer clear name ?
```

name: Name of the capture filter to use.

Format:

test\_capture

capture\_ping

```
> analyzer clear name
```

---

---

**Note** You can remove data traffic saved to a file using the [rm](#) command.

---

## Use the ping command to troubleshoot network connections

Use the [ping](#) command to troubleshoot connectivity problems.

### Ping to check internet connection

To check your internet connection:

1. Log into the EX15 command line as a user with Admin access.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the Admin CLI prompt, type the ping command followed by the host name or IP address of the server to be pinged:

---

```
> ping 8.8.8.8
PING 8.8.8.8 (8.8.8.8) 56(84) bytes of data.
64 bytes from 8.8.8.8: icmp_seq=1 ttl=54 time=11.1 ms
64 bytes from 8.8.8.8: icmp_seq=2 ttl=54 time=10.8 ms
64 bytes from 8.8.8.8: icmp_seq=3 ttl=54 time=10.7 ms
...
>
```

---

3. Type **exit** to exit the Admin CLI.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

### Stop ping commands

To stop pings when the number of pings to send (the **count** parameter) has been set to a high value, enter **Ctrl+C**.

## Use the traceroute command to diagnose IP routing problems

Use the **traceroute** command to diagnose IP routing problems. This command traces the route to a remote IP host and displays results. The **traceroute** command differs from [ping](#) in that traceroute shows where the route fails, while ping simply returns a single error on failure.

See the [traceroute](#) command description for command syntax and examples. The **traceroute** command has several parameters. Only **host** is required.

- **host**: The IP address of the destination host.
- **bypass**: Send directly to a host on an attached network.
- **debug**: Enable socket level debugging.
- **dontfragment**: Do not fragment probe packets.
- **first\_ttl**: Specifies with what TTL to start. (Default: 1)
- **gateway**: Route the packet through a specified gateway.
- **icmp**: Use ICMP ECHO for probes.
- **interface**: Specifies the interface.

- **ipchecksums**: Calculate ip checksums.
- **max\_ttl**: Specifies the maximum number of hops. (Default: 30)
- **nomap**: Do not map IP addresses to host names
- **nqueries**: Sets the number of probe packets per hop. (Default: 3)
- **packetlen**: Total size of the probing packet. (Default: -1)
- **pausesecs**: Minimal time interval between probes (Default: 0)
- **port**: Specifies the destination port. (Default: -1)
- **src\_addr**: Chooses an alternative source address.
- **tos**: Set Type of Service. (Default: -1)
- **verbose**: Verbose output.
- **waittime**: Max wait for a response to a probe. (Default: 5)

### Example

This example shows using **traceroute** to verify that the EX15 device can route to host **8.8.8.8** ([www.google.com](http://www.google.com)) through the default gateway. The command output shows that **15** routing hops were required to reach the host:

1. Log into the EX15 command line as a user with Admin access.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the Admin CLI prompt, use the **traceroute** command to view IP routing information:

---

```
> traceroute 8.8.8.8
traceroute to 8.8.8.8 (8.8.8.8), 30 hops max, 52 byte packets
 1 192.168.8.1 (192.168.8.1) 0 ms 0 ms 0 ms
 2 10.10.10.10 (10.10.10.10) 0 ms 2 ms 2 ms
 3 * 10.10.8.23 (10.10.8.23) 1 ms 1 ms
 4 96.34.84.22 (96.34.84.22) 1 ms 1 ms 1 ms
 5 96.34.81.190 (96.34.81.190) 2 ms 2 ms 2 ms
 6 * * *
 7 96.34.2.12 (96.34.2.12) 11 ms 11 ms 11 ms
 8 * * *
 9 8.8.8.8 (8.8.8.8) 11 ms 11 ms 11 ms
>
```

---

By entering a **whois** command on a Unix device, the output shows that the route is as follows:

1. **192/8**: The local network of the EX15 device.
2. **192.168.8.1**: The local network gateway to the Internet.
3. **96/8**: Charter Communications, the network provider.
4. **216/8**: Google Inc.

### Stop the traceroute process

To stop the traceroute process, enter **Ctrl-C**.

## Regulatory guide

---

### FCC

THIS EQUIPMENT HAS BEEN TESTED AND FOUND TO COMPLY WITH THE LIMITS FOR A CLASS A DIGITAL DEVICE, PURSUANT TO PART 15 OF THE FCC RULES. THESE LIMITS ARE DESIGNED TO PROVIDE REASONABLE PROTECTION AGAINST HARMFUL INTERFERENCE WHEN THE EQUIPMENT IS OPERATED IN A COMMERCIAL ENVIRONMENT. THIS EQUIPMENT GENERATES, USES, AND CAN RADIATE RADIO FREQUENCY ENERGY AND, IF NOT INSTALLED AND USED IN ACCORDANCE WITH THE INSTRUCTION MANUAL, MAY CAUSE HARMFUL INTERFERENCE TO RADIO COMMUNICATIONS. OPERATION OF THIS EQUIPMENT IN A RESIDENTIAL AREA IS LIKELY TO CAUSE HARMFUL INTERFERENCE IN WHICH CASE THE USER WILL BE REQUIRED TO CORRECT THE INTERFERENCE AT HIS OWN EXPENSE. INDUSTRY CANADA - CAN ICES-3(A)/NMB-3(A) THIS PRODUCT IS INTENDED FOR OPERATION IN A COMMERCIAL OR INDUSTRIAL ENVIRONMENT AND SHOULD NOT BE USED IN A RESIDENTIAL ENVIRONMENT. THIS PRODUCT HAS BEEN TESTED AND FOUND TO COMPLY WITH THE REQUIREMENTS OF: ICES-003 - INFORMATION TECHNOLOGY EQUIPMENT - LIMITS AND METHODS OF MEASUREMENT ISSUE 5, AUGUST 2012.

### European Union

THIS PRODUCT MAY CAUSE INTERFERENCE IF USED IN RESIDENTIAL AREAS. SUCH USE MUST BE AVOIDED UNLESS THE USER TAKES SPECIAL MEASURES TO REDUCE ELECTROMAGNETIC EMISSIONS TO PREVENT INTERFERENCE TO THE RECEPTION OF RADIO AND TELEVISION BROADCASTS.

### Supported Countries

FOR A FULL LIST OF CERTIFIED COUNTRIES GO VISIT: [www.digi.com/legal/terms](http://www.digi.com/legal/terms)

## End user license agreement

---

To view the end user license agreement, visit: [www.digi.com/legal/terms](http://www.digi.com/legal/terms)

## Command line interface

---

This chapter contains the following topics:

|                                                                   |     |
|-------------------------------------------------------------------|-----|
| Access the command line interface .....                           | 772 |
| Log in to the command line interface .....                        | 772 |
| Exit the command line interface .....                             | 773 |
| Execute a command from the web interface .....                    | 773 |
| Display help for commands and parameters .....                    | 774 |
| Auto-complete commands and parameters .....                       | 776 |
| Available commands .....                                          | 777 |
| Use the scp command .....                                         | 778 |
| Display status and statistics using the show command .....        | 779 |
| Device configuration using the command line interface .....       | 780 |
| Execute configuration commands at the root Admin CLI prompt ..... | 781 |
| Configuration mode .....                                          | 783 |
| Command line reference .....                                      | 795 |

## Access the command line interface

You can access the EX15 command line interface using an SSH connection, a telnet connection, or a serial connection. You can use an open-source terminal software, such as PuTTY or TeraTerm, to access the device through one of these mechanisms.

You can also access the command line interface in the WebUI by using the **Terminal**, or the Digi Remote Manager by using the **Console**.

To access the command line, your device must be configured to allow access, and you must log in as a user who has been configured for the appropriate access. For further information about configuring access to these services, see:

- WebUI: [Configure the web administration service](#)
- SSH: [Configure SSH access](#)
- Telnet: [Configure telnet access](#)

## Log in to the command line interface

### Command line

1. Connect to the EX15 device by using a serial connection, SSH or telnet, or the **Terminal** in the WebUI or the **Console** in the Digi Remote Manager. See [Access the command line interface](#) for more information.
  - For serial connections, the default configuration is:
    - **115200** baud rate
    - **8** data bits
    - **no** parity
    - **1** stop bit
    - **no** flow control
  - For SSH and telnet connections, the default IP address of the device is **192.168.210.1** on the .
2. At the login prompt, enter the username and password of a user with Admin access:

---

```
login: admin
Password: *****
```

---

The default username is **admin**. The default unique password for your device is printed on the device label.

3. Depending on the device configuration, you may be presented with another menu, for example:

---

Access selection menu:

```
a: Admin CLI
s: Shell
q: Quit
```

---

Select access or quit [admin] :

---



Type **a** or **admin** to access the EX15 command line.

You will now be connected to the Admin CLI:

---

```
Connecting now, 'exit' to disconnect from Admin CLI ...
```

---

```
>
```

---

See [Command line interface](#) for detailed instructions on using the command line interface.

## Exit the command line interface

### Command line

1. At the command prompt, type **exit**.

---

```
> exit
```

---

2. Depending on the device configuration, you may be presented with another menu, for example:

---

```
Access selection menu:
```

```
 a: Admin CLI
 s: Shell
 q: Quit
```

---

```
Select access or quit [admin] :
```

---

Type **q** or **quit** to exit.

## Execute a command from the web interface

1. Log into the EX15 WebUI as a user with Admin access.
2. At the main menu, click **Terminal**. The device console appears.

---

```
EX15 login:
```

---

3. Log into the EX15 command line as a user with Admin access.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.

The Admin CLI prompt appears.

---

```
>
```

---

## Display help for commands and parameters

### The help command

When executed from the root command prompt, **help** displays information about autocomplete operations, how to move the cursor on the EX15 command line, and other keyboard shortcuts:

---

```
> help
```

---

```
Commands

? Show commands help
<Tab> Tab completion, displays all valid commands to complete command,
 if only one command is possible, it is used
<Space> Like tab except shortest prefix is used if command is valid
<Enter> Enter an input. If quoting then a new line is created instead. If
 the input is invalid then characters will be deleted until a
 prefix for a valid command is found.

Ctrl + A Move cursor to start of line
Ctrl + E Move cursor to end of line
Ctrl + W Delete word under cursor until start of line or [\'," ,\,/,.]
Ctrl + R If the current input is invalid then characters will be deleted
 until a prefix for a valid command is found.

Ctrl + left Jump cursor left until start of line or [\'," ,\,/,.]
Ctrl + right Jump cursor right until start of line or [\'," ,\,/,.]
```

---

```
>
```

---

### The question mark (?) command

When executed from the root command prompt, **?** displays available commands:

---

```
> ?
```

---

```
Commands

config View and modify the configuration
exit Exit the CLI
analyzer Analyzer commands.
cp Copy a file or directory.
help Show CLI editing and navigation commands.
ls List a directory.
mkdir Create a directory.
modem Modem commands.
more View a file.
mv Move a file or directory.
ping Ping a host.
reboot Reboot the system.
rm Remove a file or directory.
scp Copy a file or directory over SSH.
show Show instance statistics.
system System commands.

traceroute Print the route packets trace to network host.
update Update firmware.
```

---

---

>

---

## Display help for individual commands

When included with a command name, both **?** and **help** provide further information about the command. For example:

1. To display further information about the **show** command, type either **show ?** or **show help**:

---

```
> show ?
```

```
Commands
```

```

arp Show ARP tables
cloud Show drm statistics
config Show config deltas.
dhcp-lease Show DHCP leases.
event Show event list
ipsec Show IPsec statistics.
log Show syslog.
manufacture Show manufacturer information.
modbus-gateway Show modbus gateway status & statistics
modem Show modem statistics.
network Show network interface statistics.
openvpn Show OpenVPN statistics.
route Show IP routing information.
serial Show serial statistics.
system Show system statistics.
version Show firmware version.
```

```
> show
```

---

## Use the Tab key or the space bar to display abbreviated help

When executed from the root command prompt, pressing the **Tab** key or the space bar displays an abbreviated list of available commands:

Similar behavior is available with any command name:

---

```
> config network interface <space>
.. ... defaultip defaultlinklocal lan
loopback
> config network interface
```

---

## Auto-complete commands and parameters

When entering a command and parameter, press the **Tab** key to cause the command line interface to auto-complete as much of the command and parameter as possible. Typing the space bar has similar behavior. If multiple commands are available that will match the entered text, auto-complete is not performed and the available commands are displayed instead.

Auto-complete applies to these command elements only :

- Command names. For example, typing **net<Tab>** auto-completes the command as **network**.
- Parameter names. For example:
  - **ping hostname int<Tab>** auto-completes the parameter as **interface**.
  - **system b<Tab>** auto-completes the parameter as **backup**.
- Parameter values, where the value is one of an enumeration or an on/off type; for example:

---

```
(config)> serial port1 enable t<Tab>
```

---

auto-completes to

---

```
(config)> serial port1 enable true
```

---

Auto-complete does not function for:

- Parameter values that are string types.
- Integer values.
- File names.
- Select parameters passed to commands that perform an action.

## Available commands

The following commands are available from the Admin CLI prompt:

| Command           | Description                                                                                                                                                                                                                                                                                                                                                                                      |
|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>config</b>     | Used to view and modify the configuration.<br><br>See <a href="#">Device configuration using the command line interface</a> for more information about using the <b>config</b> command.                                                                                                                                                                                                          |
| <b>exit</b>       | Exits the CLI.                                                                                                                                                                                                                                                                                                                                                                                   |
| <b>cp</b>         | Copies a file or directory.                                                                                                                                                                                                                                                                                                                                                                      |
| <b>help</b>       | Displays: <ul style="list-style-type: none"> <li>■ CLI editing and navigation commands, when executed from the root of the Admin CLI prompt.</li> <li>■ Available commands, syntax diagram, and parameter information, when executed in conjunction with another command.</li> </ul> See <a href="#">Display help for commands and parameters</a> for information about the <b>help</b> command. |
| <b>ls</b>         | Lists the contents of a directory.                                                                                                                                                                                                                                                                                                                                                               |
| <b>mkdir</b>      | Creates a directory.                                                                                                                                                                                                                                                                                                                                                                             |
| <b>modem</b>      | Executes modem commands.                                                                                                                                                                                                                                                                                                                                                                         |
| <b>more</b>       | Displays the contents of a file.                                                                                                                                                                                                                                                                                                                                                                 |
| <b>mv</b>         | Moves a file or directory.                                                                                                                                                                                                                                                                                                                                                                       |
| <b>ping</b>       | Pings a remote host using Internet Control Message Protocol (ICMP) Echo Request messages.                                                                                                                                                                                                                                                                                                        |
| <b>reboot</b>     | Reboots the EX15 device.                                                                                                                                                                                                                                                                                                                                                                         |
| <b>rm</b>         | Removes a file.                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>scp</b>        | Uses the secure copy protocol (SCP) to transfer files between the EX15 device and a remote host.<br><br>See <a href="#">Use the scp command</a> for information about using the <b>scp</b> command.                                                                                                                                                                                              |
| <b>show</b>       | Displays information about the device and the device's configuration.<br><br>See <a href="#">Display status and statistics using the show command</a> for more information about the show command.                                                                                                                                                                                               |
| <b>system</b>     | Issues commands related to system functionality.                                                                                                                                                                                                                                                                                                                                                 |
| <b>traceroute</b> | Sends and tracks route packets to a destination host.                                                                                                                                                                                                                                                                                                                                            |
| <b>update</b>     | Updates the device firmware.                                                                                                                                                                                                                                                                                                                                                                     |

---

**Note** For commands that operate on the EX15's file system, such as the **cp**, **ls**, and **mkdir** commands, see [File system](#) for information about the file system, including how to copy, move and delete files and directories.

---

## Use the scp command

The **scp** command uses Secure Copy Protocol (SCP) to transfer files between the EX15 device and a remote host.

### Required configuration items

- The hostname or IP address of the remote host.
- The username and password of the user on the remote host.
- Whether the file is being copied to the EX15 device from a remote host, or to the remote host from the EX15 device.
  - If the file is being copied to the EX15 device from a remote host:
    - The path and filename of the file on the remote host that will be copied to the EX15 device.
    - The location on the EX15 device where the file will be copied.
  - If the file is being copied to a remote host from the EX15 device:
    - The path and filename of the file on the EX15 device that will be copied to the remote host.
    - The location on the remote host where the file will be copied.

### Copy a file from a remote host to the EX15 device

To copy a file from a remote host to the EX15 device, use the **scp** command as follows:

---

```
> scp host hostname-or-ip user username remote remote-path local local-path to local
```

---

where:

- *hostname-or-ip* is the hostname or ip address of the remote host.
- *username* is the name of the user on the remote host.
- *remote-path* is the path and filename of the file on the remote host that will be copied to the EX15 device.
- *local-path* is the location on the EX15 device where the copied file will be placed.

For example:

To copy firmware from a remote host with an IP address of 192.168.4.1 to the /etc/config directory on the EX15 device, issue the following command:

---

```
> scp host 192.168.4.1 user admin remote /home/admin/bin/EX15-21.2.39.67.bin
local /etc/config/scripts to local
admin@192.168.4.1's password: adminpwd
EX15-21.2.39.67.bin 100% 36MB 11.1MB/s 00:03
>
```

---

### Transfer a file from the EX15 device to a remote host

To copy a file from the EX15 device to a remote host, use the `scp` command as follows:

---

```
> scp host hostname-or-ip user username remote remote-path local local-path to
remote
```

---

where:

- *hostname-or-ip* is the hostname or ip address of the remote host.
- *username* is the name of the user on the remote host.
- *remote-path* is the location on the remote host where the file will be copied.
- *local-path* is the path and filename on the EX15 device.

For example:

To copy a support report from the EX15 device to a remote host at the IP address of 192.168.4.1:

1. Use the **system support-report** command to generate the report:

---

```
> system support-report /var/log/
Saving support report to /var/log/support-report-0040D0133536-21-02-26-
8:04:23.bin
Support report saved.
>
```

---

2. Use the **scp** command to transfer the report to a remote host:

---

```
> scp host 192.168.4.1 user admin remote /home/admin/temp/ local
/var/log/support-report-00:40:D0:13:35:36-21-02-26-8:04:23.bin to remote
admin@192.168.4.1's password: adminpwd
support-report-0040D0133536-21-02-26-8:04:23.bin
>
```

---

## Display status and statistics using the show command

The EX15 **show** command display status and statistics for various features.

For example:

### show config

The `show config` command displays all the configuration settings for the device that have been changed from the default settings. This is a particularly useful when troubleshooting the device.

---

```
> show config

auth tacacs+ service "login"
auth user admin password
"$2a$05$WlJQhquI7BgSytkpobKhaeLPtWraGANBcr`EaJX/wJv63JENW/H0u"
add auth user test
add auth user test group end "admin"
add auth user test group end "serial"
auth user test password
"$2a$05$RdGYz1sLKbWrqe6cZjlsd.otg03JZR6n9939XV6EYWUSP0tMAz05W"
network interface lan ipv4 type "dhcp"
```

---

```

network interface lan zone "external"
network interface modem modem apn 0 apn "00000.000"
network interface modem modem apn_lock "true"
schema version "445"

```

```
>
```

## show system

The [show system](#) command displays system information and statistics for the device, including CPU usage.

```
> show system
```

```

Model : Digi EX15
Serial Number : EX15-000065
SKU : EX15
Hostname : EX15
MAC : DF:DD:E2:AE:21:18

Hardware Version : 50001947-01 1P
Firmware Version : 21.2.39.67
Alt. Firmware Version : 21.2.39.67
Bootloader Version : 19.7.23.0-15f936e0ed

Current Time : Fri, 26 Feb 2021 8:04:23 +0000
CPU : 1.4%
Uptime : 6 days, 6 hours, 21 minutes, 57 seconds (541317s)
Temperature : 40C

```

```
>
```

## show network

The [show network](#) command displays status and statistics for network interfaces.

```
> show network
```

| Interface        | Proto | Status | Address                         |
|------------------|-------|--------|---------------------------------|
| defaultip        | IPv4  | up     | 192.168.210.1/24                |
| defaultlinklocal | IPv4  | up     | 169.254.100.100/16              |
| lan              | IPv4  | up     | 192.168.2.1                     |
| lan              | IPv6  | up     | 0:0:0:0:0:ffff:c0a8:301         |
| loopback         | IPv4  | up     | 127.0.0.1/8                     |
| wan              | IPv4  | up     | 192.168.3.1/24                  |
| wan              | IPv6  | up     | fd00:2704::240:ffff:fe80:120/64 |

```
>
```

## Device configuration using the command line interface

The **config** command allows for device configuration from the command line. All configuration tasks that can be performed by using the WebUI can also be performed by using the **config** command.

There are two ways to invoke the **config** command from the CLI:



- Execute the **config** command and parameters at the root prompt. See [Execute configuration commands at the root Admin CLI prompt](#) for more information.
- Enter configuration mode by executing the **config** command without any parameters. See [Configuration mode](#) for more information.

## Execute configuration commands at the root Admin CLI prompt

You can execute the **config** command at the root Admin CLI prompt with any appropriate parameters. When the **config** command is used in this way, changes to the device's configuration are automatically saved when the command is executed.

For example, to disable the SSH service from the root prompt, enter the following command:

---

```
> config service ssh enable false
>
```

---

The EX15 device's ssh service is now disabled.

---

**Note** When the **config** command is executed at the root prompt, certain configuration actions that are available in configuration mode cannot be performed. This includes validating configuration changes, canceling and reverting configuration changes, and performing actions on elements in lists. See [Configuration mode](#) for information about using configuration mode.

---

## Display help for the config command from the root Admin CLI prompt

Display additional configuration commands, as well as available parameters and values, by entering the question mark (?) character after the **config** command.

1. For example:

---

```
> config ?
```

---

Will display the following help information:

---

```
> config ?
```

Additional Configuration

```

application Custom scripts
auth Authentication
cloud Central management
firewall Firewall
monitoring Monitoring
network Network
serial Serial
service Services
system System
vpn VPN
```

Run "config" with no arguments to enter the configuration editing mode.

---

---

```
> config
```

---

2. You can then display help for the additional configuration commands. For example, to display help for the **config service** command:

---

```
> config service ?
Services
```

```
Additional Configuration
```

---

|                |                          |
|----------------|--------------------------|
| dns            | DNS                      |
| mdns           | Service Discovery (mDNS) |
| multicast      | Multicast                |
| ntp            | NTP                      |
| remote_control | Remote control           |
| snmp           | SNMP                     |
| ssh            | SSH                      |
| telnet         | Telnet                   |
| web_admin      | Web administration       |

```
> config service
```

---

3. Next, display help for the **config service ssh** command:

---

```
> config service ssh ?
```

```
SSH: An SSH server for managing the device.
```

| Parameters | Current Value |             |
|------------|---------------|-------------|
| enable     | true          | Enable      |
| key        | [private]     | Private key |
| port       | 22            | Port        |

```
Additional Configuration
```

---

|      |                     |
|------|---------------------|
| acl  | Access control list |
| mdns |                     |

```
> config service ssh
```

---

4. Lastly, display the allowed values and other information for the **enable** parameter:

---

```
> config service ssh enable ?
```

```
Enable: Enable the service.
Format: true, false, yes, no, 1, 0
Default value: true
Current value: true
```

```
> config service ssh enable
```

---

## Configuration mode

Configuration mode allows you to perform multiple configuration tasks and validate the changes prior to saving them. You can cancel all changes without saving them at any time. Configuration changes do not take effect until the configuration is saved.

### Enable configuration mode

To enable configuration mode, at the root prompt, enter the **config** command without any parameters:

---

```
> config
(config)>
```

---

When the command line is in configuration mode, the prompt will change to include **(config)**, to indicate that you are currently in configuration mode.

### Enter configuration commands in configuration mode

There are two ways to enter configuration commands while in configuration mode:

- Enter the full command string from the config prompt.  
For example, to disable the ssh service by entering the full command string at the config prompt:

---

```
(config)> service ssh enable false
(config)>
```

---

- Execute commands by moving through the configuration schema.  
For example, to disable the ssh service by moving through the configuration and then executing the **enable false** command:

1. At the **config** prompt, enter **service** to move to the **service** node:

---

```
(config)> service
(config service)>
```

---

2. Enter **ssh** to move to the **ssh** node:

---

```
(config service)> ssh
(config service ssh)>
```

---

3. Enter **enable false** to disable the **ssh** service:

---

```
(config service ssh)> enable false
(config service ssh)>
```

---

See [Move within the configuration schema](#) for more information about moving within the configuration.

### Save changes and exit configuration mode

To save changes that you have made to the configuration while in configuration mode, use **save**. The save command automatically validates the configuration changes; the configuration will not be saved if it is not valid. Note that you can also validate configuration changes at any time while in

configuration mode by using the **validate** command.

---

```
(config)> save
Configuration saved.
>
```

---

After using **save** to save changes to the configuration, you will automatically exit configuration mode. To return to configuration mode, type **config** again.

## Exit configuration mode without saving changes

You can discard any unsaved configuration changes and exit configuration mode by using the **cancel** command:

---

```
(config)> cancel
>
```

---

After using **cancel** to discard unsaved changes to the configuration, you will automatically exit configuration mode.

## Configuration actions

In configuration mode, configuration actions are available to perform tasks related to saving or canceling the configuration changes, and to manage items and elements in lists. The commands can be listed by entering a question mark (?) at the **config** prompt.

The following actions are available:

| Configuration actions | Description                                                                                                                                                   |
|-----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>cancel</b>         | Discards unsaved configuration changes and exits configuration mode.                                                                                          |
| <b>save</b>           | Saves configuration changes and exits configuration mode.                                                                                                     |
| <b>validate</b>       | Validates configuration changes.                                                                                                                              |
| <b>revert</b>         | Reverts the configuration to default settings. See <a href="#">The revert command</a> for more information.                                                   |
| <b>show</b>           | Displays configuration settings.                                                                                                                              |
| <b>add</b>            | Adds a named element, or an element in a list. See <a href="#">Manage elements in lists</a> for information about using the <b>add</b> command with lists.    |
| <b>del</b>            | Deletes a named element, or an element in a list. See <a href="#">Manage elements in lists</a> for information about using the <b>del</b> command with lists. |
| <b>move</b>           | Moves elements in a list. See <a href="#">Manage elements in lists</a> for information about using the <b>move</b> command with lists.                        |

## Display command line help in configuration mode

Display additional configuration commands, as well as available parameters and values, by entering the question mark (?) character at the **config** prompt. For example:

1. Enter **?** at the **config** prompt:

---

```
(config)> ?
```

---

This will display the following help information:

---

```
(config)> ?
```

---

Additional Configuration

|             |                    |
|-------------|--------------------|
| application | Custom scripts     |
| auth        | Authentication     |
| cloud       | Central management |
| firewall    | Firewall           |
| monitoring  | Monitoring         |
| network     | Network            |
| serial      | Serial             |
| service     | Services           |
| system      | System             |
| vpn         | VPN                |

```
(config)>
```

---

2. You can then display help for the additional configuration commands. For example, to display help for the **config service** command, use one of the following methods:

- At the **config** prompt, enter **service ?**:

---

```
(config)> service ?
```

---

- At the **config** prompt:

- a. Enter **service** to move to the **service** node:

---

```
(config)> service
(config service)>
```

---

- b. Enter **?** to display help for the **service** node:

---

```
(config service)> ?
```

---

Either of these methods will display the following information:

---

```
config> service ?
```

---

Services

Additional Configuration

---

|     |     |
|-----|-----|
| dns | DNS |
|-----|-----|

---

---

|                |                          |
|----------------|--------------------------|
| mdns           | Service Discovery (mDNS) |
| multicast      | Multicast                |
| ntp            | NTP                      |
| remote_control | Remote control           |
| snmp           | SNMP                     |
| ssh            | SSH                      |
| telnet         | Telnet                   |
| web_admin      | Web administration       |

---

```
(config)> service
```

---

3. Next, to display help for the **service ssh** command, use one of the following methods:

- At the **config** prompt, enter **service ssh ?**:

```
(config)> service ssh ?
```

---

- At the **config** prompt:

- a. Enter **service** to move to the **service** node:

```
(config)> service
(config service)>
```

---

- b. Enter **ssh** to move to the **ssh** node:

```
(config service)> ssh
(config service ssh)>
```

---

- c. Enter **?** to display help for the **ssh** node:

```
(config service ssh)> ?
```

---

Either of these methods will display the following information:

```
(config)> service ssh ?
```

---

SSH: An SSH server for managing the device.

| Parameters | Current Value |             |
|------------|---------------|-------------|
| -----      |               |             |
| enable     | true          | Enable      |
| key        | [private]     | Private key |
| port       | 22            | Port        |

Additional Configuration

---

|      |                     |
|------|---------------------|
| acl  | Access control list |
| mdns |                     |

```
(config)> service ssh
```

---

4. Lastly, to display allowed values and other information for the **enable** parameter, use one of the following methods:

- At the **config** prompt, enter **service ssh enable ?**:

---

```
(config)> service ssh enable ?
```

---

- At the **config** prompt:

- a. Enter **service** to move to the **service** node:

---

```
(config)> service
(config service)>
```

---

- b. Enter **ssh** to move to the **ssh** node:

---

```
(config service)> ssh
(config service ssh)>
```

---

- c. Enter **enable ?** to display help for the **enable** parameter:

---

```
(config service ssh)> enable ?
(config service ssh)>
```

---

Either of these methods will display the following information:

---

```
(config)> service ssh enable ?
```

```
Enable: Enable the service.
Format: true, false, yes, no, 1, 0
Default value: true
Current value: true
```

---

```
(config)> service ssh enable
```

---

## Move within the configuration schema

You can perform configuration tasks at the CLI by moving within the configuration.

- Move forward one node in the configuration by entering the name of an Additional Configuration option:

1. At the **config** prompt, type **service** to move to the **service** node:

---

```
(config)> service
(config service)>
```

---

2. Type **ssh** to move to the **ssh** node:

---

```
(config service)> ssh
(config service ssh)>
```

---

3. Type **acl** to move to the **acl** node:

---

```
(config service ssh)> acl
(config service ssh acl)>
```

---

4. Type **zone** to move to the **zone** node:

---

```
(config service ssh acl)> zone
(config service ssh acl zone)>
```

---

You can also enter multiple nodes at once to move multiple steps in the configuration:

---

```
(config)> service ssh acl zone
(config service ssh acl zone)>
```

---

- Move backward one node in the configuration by entering two periods (..):

---

```
(config service ssh acl zone)> ..
(config service ssh acl)>
```

---

You can also move back multiples nodes in the configuration by typing multiple sets of two periods:

---

```
(config service ssh acl zone)>
(config service)>
```

---

- Move to the root of the config prompt from anywhere within the configuration by entering three periods (...):

---

```
(config service ssh acl zone)> ...
(config)>
```

---

## Manage elements in lists

While in configuration mode, you can use the **add**, **del**, and **move** action commands to manage elements in a list. When working with lists, these actions require an index number to identify the list item that will be acted on.

### Add elements to a list

When used with parameters that contains lists of elements, the **add** command is used to add an element to the list.

For example, to add an authentication method:

1. Display current authentication method by using the **show** command:

---

```
(config)> show auth method
0 local
(config)>
```

---

2. Add an authentication method by using the **add index\_item** command. For example:

- To add the TACACS+ authentication method to the beginning of the list, use the index number **0**:

---

```
(config)> add auth method 0 tacacs+
(config)> show auth method
0 tacacs+
```

---



---

```
1 local
(config)>
```

---

- To add the TACACS+ authentication method to the end of the list, use the **end** keyword:

---

```
(config)> add auth method end tacacs+
(config)> show auth method
0 local
1 tacacs+
(config)>
```

---

### The end keyword

As demonstrated above, the **end** keyword is used to add an element to the end of a list. Additionally, the **end** keyword is used to add an element to a list that does not have any elements.

For example, to add an authentication group to a user that has just been created:

1. Use the **show** command to verify that the user is not currently a member of any groups:

---

```
(config)> show auth user new-user group
(config)>
```

---

2. Use the **end** keyword to add the admin group to the user's configuration:

---

```
(config)> add auth user new-user group end admin
(config)>
```

---

3. Use the **show** command again to verify that the admin group has been added to the user's configuration:

---

```
(config)> show auth user new-user group
0 admin
(config)>
```

---

### Delete elements from a list

When used with parameters that contains lists of elements, the **del** command is used to delete an element in the list.

For example, to delete an authentication method:

1. Use the **show** command to display current authentication method configuration:

---

```
(config)> show auth method
0 local
1 tacacs+
2 radius
(config)>
```

---

2. Delete one of the authentication methods by using the **del index\_number** command. For example:

- a. To delete the local authentication method, use the index number **0**:

---

```
(config)> del auth method 0
(config)>
```

---

- b. Use the **show** command to verify that the local authentication method was removed:

---

```
(config)> show auth method
0 tacacs+
1 radius
(config)>
```

---

### ***Move elements within a list***

Use the **move** command to reorder elements in a list.

For example, to reorder the authentication methods:

1. Use the **show** command to display current authentication method configuration:

---

```
(config)> show auth method
0 local
1 tacacs+
2 radius
(config)>
```

---

2. To configure the device to use TACACS+ authentication first to authenticate a user, use the **move index\_number\_1 index\_number\_2** command:

---

```
(config)> move auth method 1 0
(config)>
```

---

3. Use the **show** command again to verify the change:

---

```
(config)> show auth method
0 tacacs+
1 local
2 radius
(config)>
```

---

## **The revert command**

The **revert** command is used to revert changes to the EX15 device's configuration and restore default configuration settings. The behavior of the revert command varies depending on where in the configuration hierarchy the command is executed, and whether the optional **path** parameter is used. After executing the revert command, you must save the configuration changes by using the **save** command. You can also discard the configuration changes by using the **cancel** command.



**CAUTION!** The **revert** command reverts all changes to the default configuration, not only unsaved changes.

---

### ***Revert all configuration changes to default settings***

To discard all configuration changes and revert to default settings, use the **revert** command at the config prompt without the optional **path** parameter:

1. At the config prompt, enter **revert**:

---

```
(config)> revert
(config)>
```

---

2. Set the password for the admin user prior to saving the changes:

---

```
(config)> auth user admin password pwd
(config)>
```

---

3. Save the configuration and apply the change:

---

```
(config)> save
Configuration saved.
>
```

---

4. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

### ***Revert a subset of configuration changes to the default settings***

There are two methods to revert a subset of configuration changes to the default settings.

- Enter the **revert** command with the **path** parameter. For example, to revert all changes to the authentication methods configuration:

1. Enter the **revert** command with the **path** set to **auth method**:

---

```
(config)> revert auth method
(config)>
```

---

2. Save the configuration and apply the change:

---

```
(config)> save
Configuration saved.
>
```

---

3. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

- Move to the location in the configuration and enter the **revert** command without the **path** parameter. For example:

1. Change to the auth method node:

---

```
(config)> auth method
(config auth method)>
```

---

2. Enter the **revert** command:

---

```
(config auth method)> revert
(config auth method)>
```

---

3. Save the configuration and apply the change:

---

```
(config auth method)> save
Configuration saved.
>
```

---

4. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

- You can also use a combination of both of these methods:

1. Change to the **auth** node:

---

```
(config)> auth
(config auth)>
```

---

2. Enter the **revert** command with the **path** set to **method**:

---

```
(config auth)> revert method
(config auth)>
```

---

3. Save the configuration and apply the change:

---

```
(config auth)> save
Configuration saved.
>
```

---

4. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Enter strings in configuration commands

For string parameters, if the string value contains a space, the value must be enclosed in quotation marks. For example, to assign a descriptive name for the device using the **system** command, enter:

---

```
(config)> system description "Digi EX15"
```

---

## Example: Create a new user by using the command line

In this example, you will use the EX15 command line to create a new user, provide a password for the user, and assign the user to authentication groups.

1. Log into the EX15 command line as a user with full Admin access rights.  
Depending on your device configuration, you may be presented with an **Access selection menu**. Type **admin** to access the Admin CLI.
2. At the command line, type **config** to enter configuration mode:

---

```
> config
(config)>
```

---

3. At the config prompt, create a new user with the username **user1**:

- Method one: Create a user at the root of the config prompt:

---

```
(config)> add auth user user1
(config auth user user1)>
```

---

- Method two: Create a user by moving through the configuration:

- a. At the config prompt, enter **auth** to move to the **auth** node:

---

```
(config)> auth
(config auth)>
```

---

- b. Enter **user** to move to the **user** node:

---

```
(config auth)> user
(config auth user)>
```

---

- c. Create a new user with the username **user1**:

---

```
(config auth user)> add user1
(config auth user user1)>
```

---

4. Configure a password for the user:

---

```
(config auth user user1)> password pwd1
(config auth user user1)>
```

---

5. List available authentication groups:

---

```
(config auth user user1)> show group
```

```
admin
 acl
 admin
 enable true
 nagios
 enable false
 openvpn
 enable false
 no tunnels
 portal
 enable false
 no portals
 serial
 enable false
 no ports
 shell
 enable false
```

```
serial
 acl
 admin
```

---

---

```
 enable true
nagios
 enable false
openvpn
 enable false
 no tunnels
portal
 enable false
 no portals
serial
 enable true
 ports
 0 port1
shell
 enable false
(config auth user user1)>
```

---

6. Add the user to the admin group:

---

```
(config auth user user1)> add group end admin
(config auth user user1)>
```

---

7. Save the configuration and apply the change:

---

```
(config auth user user1)> save
Configuration saved.
>
```

---

8. Type **exit** to exit the Admin CLI.

Depending on your device configuration, you may be presented with an **Access selection menu**. Type **quit** to disconnect from the device.

## Command line reference

|                                                    |     |
|----------------------------------------------------|-----|
| analyzer .....                                     | 796 |
| cp .....                                           | 797 |
| help .....                                         | 798 |
| ls .....                                           | 799 |
| mkdir .....                                        | 800 |
| modem .....                                        | 801 |
| modem puk status [imei STRING] [name STRING] ..... | 806 |
| modem scan [imeiSTRING] [nameSTRING] .....         | 807 |
| more .....                                         | 809 |
| mv .....                                           | 810 |
| ping .....                                         | 811 |
| reboot .....                                       | 813 |
| rm .....                                           | 814 |
| scp .....                                          | 815 |
| show .....                                         | 816 |
| ssh .....                                          | 824 |
| system .....                                       | 826 |
| traceroute .....                                   | 830 |

## **analyzer**

Analyzer commands.

### ***analyzer clear name STRING***

Clears the traffic captured by the analyzer.

#### **Parameters**

##### ***name***

Name of the capture filter to use.

Syntax: STRING

### ***analyzer save filename STRING name STRING***

Saves the current captured traffic to a file.

#### **Parameters**

##### ***filename***

The filename to save captured traffic to. The file will be saved to the device's /etc/config/analyzer directory.

Syntax: STRING

##### ***name***

Name of the capture filter to use.

Syntax: STRING

### ***analyzer start name STRING***

Start a capture session of packets on this devices interfaces.

#### **Parameters**

##### ***name***

Name of the capture filter to use.

Syntax: STRING

### ***analyzer stop name STRING***

Stops the traffic capture session.

#### **Parameters**

##### ***name***

Name of the capture filter to use.

Syntax: STRING



**cp**

cp commands.

***[force] SOURCE DESTINATION***

Copy a file or directory.

**Parameters*****source***

The source file or directory to copy.

Syntax: STRING

***destination***

The destination path to copy the source file or directory to.

Syntax: STRING

***force***

Do not ask to overwrite the destination file if it exists.

Syntax: BOOLEAN

Default: False

Optional: True

## **help**

Show CLI editing and navigation commands.

### ***Parameters***

None

**ls**

Directory listing command.

***ls [show-hidden] PATH***

List a directory.

**Parameters*****path***

List files and directories under this path.

Syntax: STRING

***show-hidden***

Show hidden files and directories. Hidden filenames begin with '.'.

Syntax: BOOLEAN

Default: False

Optional: True

## **mkdir**

### ***mkdir PATH***

Create a directory. Parent directories are created as needed.

#### **Parameters**

##### ***path***

The directory path to create.

Syntax: STRING

## modem

Modem commands.

### ***modem at [imei STRING] [name STRING] CMD***

Send an AT command to the modem and display the response.

#### **Parameters**

##### ***cmd***

The AT command string.

Syntax: STRING

##### ***imei***

The IMEI of the modem to execute this CLI command on.

Syntax: STRING

Optional: True

##### ***name***

The configured name of the modem to execute this CLI command on.

Syntax: STRING

Optional: True

### ***modem at-interactive [imei STRING] [name STRING]***

Start an AT command session on the modem's AT serial port.

#### **Parameters**

##### ***imei***

The IMEI of the modem to execute this CLI command on.

Syntax: STRING

Optional: True

##### ***name***

The configured name of the modem to execute this CLI command on.

Syntax: STRING

Optional: True

## ***modem firmware***

Commands for interacting with cellular modem firmware. See [Update cellular module firmware](#) for further information about using the modem firmware commands.

### ***firmware check [imei STRING] [name STRING]***

Inspect /opt/[MODEM\_MODEL]/Custom\_Firmware/ directory for new modem firmware file.

**Parameters****imei**

The IMEI of the modem to execute this CLI command on

Optional: True

Type: string

**name**

The configured name of the modem to execute this CLI command on

Optional: True

Ref: /network/modem

Type: string

**firmware list [imei *STRING*] [name *STRING*]**

List modem firmware files found in the /opt/[MODEM\_MODEL]/ directory.

**Parameters****imei**

The IMEI of the modem to execute this CLI command on

Optional: True

Type: string

**name**

The configured name of the modem to execute this CLI command on

Optional: True

Ref: /network/modem

Type: string

**firmware ota**

Commands for performing FOTA (firmware-over-the-air) interactions with cellular modem.

**ota check [imei *STRING*] [name *STRING*]**

Query the Digi firmware server for the latest remote modem firmware version.

**Parameters****imei**

The IMEI of the modem to execute this CLI command on

Optional: True

Type: string

**name**

The configured name of the modem to execute this CLI command on

Optional: True

Ref: /network/modem

Type: string

***ota list [imei STRING] [name STRING]***

Query the Digi firmware server for a list of modem firmware versions.

**Parameters*****imei***

The IMEI of the modem to execute this CLI command on

Optional: True

Type: string

***name***

The configured name of the modem to execute this CLI command on

Optional: True

Ref: /network/modem

Type: string

***ota update [imei STRING] [name STRING] [version STRING]***

Perform FOTA (firmware-over-the-air) update. The modem will be updated to the latest modem firmware image unless a specific firmware version is specified.

**Parameters*****imei***

The IMEI of the modem to execute this CLI command on

Optional: True

Type: string

***name***

The configured name of the modem to execute this CLI command on

Optional: True

Ref: /network/modem

Type: string

***version***

Firmware version name

Optional: True

Type: string

***firmware update [imei STRING] [name STRING] [version STRING]***

Update modem firmware using local firmware file. The modem will be updated to the firmware specified in the /opt/[MODEM\_MODEL]/Custom\_Firmware/ directory unless a specific firmware version is specified.

**Parameters*****imei***

The IMEI of the modem to execute this CLI command on

Optional: True

Type: string

#### **name**

The configured name of the modem to execute this CLI command on

Optional: True

Ref: /network/modem

Type: string

#### **version**

Firmware version name

Optional: True

Type: string

### ***modem pin***

PIN commands.

#### **pin change [imei *STRING*] [name *STRING*] OLD-PIN NEW-PIN**

Change the SIM's PIN code. Warning: Attempting to use an incorrect PIN code may PUK lock the SIM.

#### ***Parameters***

##### **old-pin**

The SIM's PIN code.

Syntax: STRING

##### **new-pin**

The PIN code to change to.

Syntax: STRING

##### **imei**

The IMEI of the modem to execute this CLI command on.

Syntax: STRING

Optional: True

##### **name**

The configured name of the modem to execute this CLI command on.

Syntax: STRING

Optional: True

#### **pin disable [imei *STRING*] [name *STRING*] PIN**

Disable the PIN lock on the SIM card that is active in the modem. Warning: Attempting to use an incorrect PIN code may PUK lock the SIM.

#### ***Parameters***

##### **pin**

The SIM's PIN code.



Syntax: STRING

**imei**

The IMEI of the modem to execute this CLI command on.

Syntax: STRING

Optional: True

**name**

The configured name of the modem to execute this CLI command on.

Syntax: STRING

Optional: True

**pin enable [imei *STRING*] [name *STRING*] PIN**

Enable the PIN lock on the SIM card that is active in the modem. The SIM card will need to be unlocked before each use. Warning: Attempting to use an incorrect PIN code may PUK lock the SIM.

**Parameters****pin**

The SIM's PIN code.

Syntax: STRING

**imei**

The IMEI of the modem to execute this CLI command on.

Syntax: STRING

Optional: True

**name**

The configured name of the modem to execute this CLI command on.

Syntax: STRING

Optional: True

**pin status [imei *STRING*] [name *STRING*]**

Print the PIN lock status and the number of PIN enable/disable/unlock attempts remaining. The SIM will be PUK locked when there are no remaining retries

**Parameters****imei**

The IMEI of the modem to execute this CLI command on.

Syntax: STRING

Optional: True

**name**

The configured name of the modem to execute this CLI command on.

Syntax: STRING

Optional: True

**pin unlock [imei *STRING*] [name *STRING*] PIN**

Temporarily unlock the SIM card with a PIN code. Set the PIN field in the modem interface's configuration to unlock the SIM card automatically before use. Warning: Attempting to use an incorrect PIN code may PUK lock the SIM.

**Parameters****pin**

The SIM's PIN code.

Syntax: STRING

**imei**

The IMEI of the modem to execute this CLI command on.

Syntax: STRING

Optional: True

**name**

The configured name of the modem to execute this CLI command on.

Syntax: STRING

Optional: True

**modem puk**

PUK commands.

**puk status [imei *STRING*] [name *STRING*]**

Print the PUK status and the number of PUK unlock attempts remaining.

**Parameters****modem puk status [imei *STRING*] [name *STRING*]**

Print the PUK status and the number of PUK unlock attempts remaining.

**imei**

The IMEI of the modem to execute this CLI command on.

Syntax: STRING

Optional: True

**name**

The configured name of the modem to execute this CLI command on.

Syntax: STRING

Optional: True

**puk unlock [imei *STRING*] [name *STRING*] PUK NEW-PIN**

Unlock the SIM with a PUK code from the SIM provider.

**Parameters****puk**

The SIM's PUK code.

Syntax: STRING

**new-pin**

The PIN code to change to.

Syntax: STRING

**imei**

The IMEI of the modem to execute this CLI command on.

Syntax: STRING

Optional: True

**name**

The configured name of the modem to execute this CLI command on.

Syntax: STRING

Optional: True

***modem reset [imei STRING] [name STRING]***

Reset the modem hardware (reboot it). This can be useful if the modem has stopped responding to the network or is behaving inconsistently.

**Parameters*****imei***

The IMEI of the modem to execute this CLI command on.

Syntax: STRING

Optional: True

***name***

The configured name of the modem to execute this CLI command on.

Syntax: STRING

Optional: True

***modem scan [imeiSTRING] [nameSTRING]******imei***

The IMEI of the modem to execute this CLI command on.

Syntax: STRING

Optional: True

***name***

The configured name of the modem to execute this CLI command on.

Syntax: STRING

Optional: True

***modem sim-slot [imei STRING] [name STRING] SLOT***

Show or change the modem's active SIM slot. This applies only to modems with multiple SIM slots.

**Parameters**

***slot***

The SIM slot to change to.

Syntax: (1|2|show)

***imei***

The IMEI of the modem to execute this CLI command on.

Syntax: STRING

Optional: True

***name***

The configured name of the modem to execute this CLI command on.

Syntax: STRING

Optional: True

## **more**

### ***path***

The file to view.

Syntax: STRING

**mv**

Move a file or directory.

***mv [force] SOURCE DESTINATION***

**Parameters*****source***

The source file or directory to move.

Syntax: STRING

***destination***

The destination path to move the source file or directory to.

Syntax: STRING

***force***

Do not ask to overwrite the destination file if it exists.

Syntax: BOOLEAN

Default: False

Optional: True

## ping

Ping a host using ICMP echo.

***ping [broadcast|ipv6] [count INTEGER] [interface STRING] [size INTEGER] [source STRING] HOST***

### Parameters

#### ***host***

The name or address of the remote host to send ICMP ping requests to. If broadcast is enabled, can be the broadcast address.

Syntax: STRING

#### ***broadcast***

Enable broadcast ping functionality

Syntax: BOOLEAN

Default: False

Optional: True

#### ***count***

The number of ICMP ping requests to send before terminating.

Syntax: INT

Minimum: 1

Default: 100

#### ***interface***

The network interface to send ping packets from when the host is reachable over a default route. If not specified, the system's primary default route will be used.

Syntax: STRING

Optional: True

#### ***ipv6***

If a hostname is defined as the value of the 'host' parameter, use the hosts IPV6 address.

Syntax: BOOLEAN

Default: False

Optional: True

#### ***size***

The number of bytes sent in the ICMP ping request.

Syntax: INT

Minimum: 0

Default: 56

***source***

The ping command will send a packet with the source address set to the IP address of this interface, rather than the address of the interface the packet is sent from.

Syntax: STRING

Optional: True



## **reboot**

Reboot the system.

### ***Parameters***

None

**rm**

Remove a file or directory.

***rm [force] PATH*****Parameters*****path***

The path to remove.

Syntax: STRING

***force***

Force the file to be removed without asking.

Syntax: BOOLEAN

Default: False

Optional: True

**scp**

Copy a file or directory over SSH.

***scp host STRING local STRING [port INTEGER] remote STRING to STRING user STRING***

**Parameters*****host***

The name or address of the remote host.

Syntax: STRING

***local***

The file to copy to or from on the local device.

Syntax: STRING

***port***

The SSH port to use to connect to the remote host.

Syntax: INT

Maximum: 65535

Minimum: 1

Default: 22

***remote***

The file to copy to or from on the remote host.

Syntax: STRING

***to***

Copy the file from the local device to the remote host, or from the remote host to the local device.

Syntax: (remote|local)

***user***

The username to use when connecting to the remote host.

Syntax: STRING

**show**

Show instance status and statistics.

***show analyzer name STRING***

Show packets from a specified analyzer capture.

**Parameters*****name***

Name of the capture filter to use.

Syntax: STRING

***show arp [ipv4|ipv6|verbose]***

Show ARP tables, if no IP version is specified IPv4 and IPv6 will be displayed.

**Parameters*****ipv4***

Display IPv4 routes. If no IP version is specified IPv4 and IPv6 will be displayed

Syntax: BOOLEAN

Default: False

Optional: True

***ipv6***

Display IPv6 routes. If no IP version is specified IPv4 and IPv6 will be displayed

Syntax: BOOLEAN

Default: False

Optional: True

***verbose***

Display more information (less concise, more detail).

Syntax: BOOLEAN

Default: False

Optional: True

***show cloud***

Show Digi Remote Manager status and statistics.

**Parameters**

None

***show config***

Show changes made to default configuration.

**Parameters**

None

***show dhcp-lease [all|verbose]***

Show DHCP leases.

**Parameters*****all***

Show all leases (active and inactive (not in etc/config/dhcp.\*lease)).

Syntax: BOOLEAN

Default: False

Optional: True

***verbose***

Display more information (less concise, more detail).

Syntax: BOOLEAN

Default: False

Optional: True

***show event [number INTEGER] [table STRING]***

Show event list (high level).

**Parameters*****number***

Number of lines to retrieve from log.

Syntax: INT

Minimum: 1

Default: 20

***table***

Type of event log to be displayed (status, error, info).

Syntax: (status|error|info)

Optional: True

***show hotspot [ip STRING] [name STRING]***

Show hotspot statistics.

**Parameters*****ip***

IP address of a specific client, to limit the status display to only this client.

Syntax: STRING

Optional: True

***name***

The configured instance name of the hotspot.

Syntax: STRING

Optional: True

***show ipsec [all] [tunnel STRING]***

Show IPsec status statistics.

**Parameters*****all***

Display all tunnels including disabled tunnels.

Syntax: BOOLEAN

Default: False

Optional: True

***tunnel***

Display more details and config data for a specific IPsec tunnel.

Syntax: STRING

Optional: True

***verbose***

Display status of one or all tunnels in plain text.

Syntax: BOOLEAN

Default: False

Optional: True

***show location [geofence]***

Show location information.

**Parameters*****geofence***

Shows the status of any configured geofences.

***show log [filter STRING] [number INTEGER]***

Show system log (low level).

**Parameters*****filter***

Filters for type of log message displayed (critical, warning, info, debug). Note, filters from the number of messages retrieved not the whole log (this can be very time consuming). If you require more messages of the filtered type, increase the number of messages retrieved using 'number'.

Syntax: (critical|warning|debug|info)

Optional: True

***number***

Number of lines to retrieve from log.

Syntax: INT

Minimum: 1

Default: 20

***show manufacture [verbose]***

Show manufacturer information.

**Parameters*****verbose***

Display more information (less concise, more detail).

Syntax: BOOLEAN

Default: False

Optional: True

***show modbus-gateway [verbose]***

Show Modbus gateway status and statistics.

***verbose***

Display more information.

Syntax: BOOLEAN

Default: False

Optional: True

***show modem [verbose] [imei STRING] [name STRING]***

Show modem status and statistics.

**Parameters*****imei***

The IMEI of the modem to execute this CLI command on.

Syntax: STRING

Optional: True

***name***

The configured name of the modem to execute this CLI command on.

Syntax: STRING

Optional: True

***verbose***

Display more information (less concise, more detail).

Syntax: BOOLEAN

Default: False

Optional: True

***show nemo [name STRING]***

Show NEMO status and statistics.

**Parameters**

***name***

The name of a specific NEMO instance.

***show network [all|verbose] [interface STRING]***

Show network interface status and statistics.

**Parameters**

***all***

Display all interfaces including disabled interfaces.

Syntax: BOOLEAN

Default: False

Optional: True

***interface***

Display more details and config data for a specific network interface.

Syntax: STRING

Optional: True

***verbose***

Display more information (less concise, more detail).

Syntax: BOOLEAN

Default: False

Optional: True

***show openvpn***

Show OpenVPN status and statistics.

***openvpn client [all] [name STRING]***

Show OpenVPN client status statistics.

**Parameters**

***all***

Display all clients including disabled clients.

Syntax: BOOLEAN

Default: False

Optional: True



**name**

Display more details and config data for a specific OpenVPN client.

Syntax: STRING

Optional: True

**openvpn server [all] [name *STRING*]**

Show OpenVPN server status and statistics.

**Parameters****all**

Display all servers including disabled servers.

Syntax: BOOLEAN

Default: False

Optional: True

**name**

Display more details and config data for a specific OpenVPN server.

Syntax: STRING

Optional: True

***show route [ipv4|ipv6|verbose]***

Show IP routing information.

**Parameters*****ipv4***

Display IPv4 routes.

Syntax: BOOLEAN

Default: False

Optional: True

***ipv6***

Display IPv6 routes.

Syntax: BOOLEAN

Default: False

Optional: True

***verbose***

Display more information (less concise, more detail).

Syntax: BOOLEAN

Default: False

Optional: True

***show scripts***

Show scheduled system scripts

**Parameters**

None

***show serial PORT***

Show serial status and statistics.

**Parameters*****port***

Display more details and config data for a specific serial port.

Syntax: STRING

Optional: True

***show system [verbose]***

Show system status and statistics.

**Parameters*****verbose***

Display more information (disk usage, etc)

Syntax: BOOLEAN

Default: False

Optional: True

***show usb***

Show USB information.

**Parameters**

None

***show version [verbose]***

Show firmware version.

**Parameters*****verbose***

Display more information (build date)

Syntax: BOOLEAN

Default: False

Optional: True

***show vrrp [all|verbose] [name STRING]***

Show VRRP status and statistics.

**Parameters*****all***

Display all VRRP instances including disabled instances.

Syntax: {True|False}

Type: boolean

***name***

Display more details and configuration data for a specific VRRP instance.

Optional: True

Type: string

***verbose***

Display all VRRP status and statistics including disabled instances.

Syntax: {True|False}

Type: boolean

***show web-filter***

Show web filter status and statistics.

**Parameters**

None

***show wifi***

Show Wi-Fi status and statistics.

**wifi ap [*all*] [*name STRING*]**

Display details for Wi-Fi access points.

**Parameters*****all***

Display all Wi-Fi access points including disabled Wi-Fi access points.

Syntax: BOOLEAN

Default: False

Optional: True

***name***

Display more details for a specific Wi-Fi access point.

Syntax: STRING

Optional: True

**wifi client [*all*] [*name STRING*]**

Display details for Wi-Fi client mode connections.

**Parameters****all**

Display all Wi-Fi clients including disabled Wi-Fi client mode connections.

Syntax: BOOLEAN

Default: False

Optional: True

**name**

Display more details for a specific Wi-Fi client mode connection.

Syntax: STRING

Optional: True

***show wifi-scanner***

Show Wi-Fi scanner information.

**wifi-scanner log**

Show output log for the last update interval.

**Parameters**

None

**ssh**

Use SSH protocol to log into a remote server.

***ssh [command STRING] host STRING [port INTEGER] user STRING***

**Parameters*****command***

The command that will be automatically executed once the SSH session to the remote host is established.

Optional: True

Type: string

***host***

The hostname or IP address of the remote host

Syntax: {hostname|IPv4\_address|IPv6\_address}

Type: string

***port***

The SSH port to use to connect to the remote host.

Default: 22

Maximum: 65535

Minimum: 1

Syntax: {Integer}

Type: integer

***user***

The username to use when connecting to the remote host.

Type: string

## system

System commands.

### ***system backup [passphrase STRING] type STRING PATH***

Save the device's configuration to a file. Archives are full backups including generated SSH keys and dynamic DHCP lease information. Command backups are a list of CLI commands required to build the device's configuration.

#### **Parameters**

##### ***passphrase***

Encrypt the archive with a passphrase.

Syntax: STRING

Optional: True

Depends on: **type** equals 'archive'

##### ***type***

The type of backup file to create. Archives are full backups including generated SSH keys and dynamic DHCP lease information. CLI configuration backups are a list of CLI commands used to build the device's configuration.

Syntax: (cli-config|archive)

Default: archive

##### ***path***

The file path to save the backup to.

Syntax: STRING

### ***system disable-cryptography***

Erase the device's configuration and reboot into a limited mode with no cryptography available. The device's shell will be accessible over Telnet (port 23) at IP address 192.168.210.1. To return the device to normal operation, perform the configuration erase procedure with the device's ERASE button twice consecutively.

#### **Parameters**

None

### ***system duplicate-firmware***

Duplicate the running firmware to the alternate partition so that the device will always boot the same firmware version.

#### **Parameters**

None

### ***system factory-erase***

Erase the device to restore to factory defaults. All configuration and automatically generated keys will be erased.

**Parameters**

None

***system firmware update file STRING***

Update the current firmware image. Upon reboot the new firmware will be run.

**Parameters*****file***

Firmware filename and path.

Type: string

***system restore [passphrase STRING] PATH***

Restore the device's configuration from a backup archive or CLI commands file.

**Parameters*****path***

The path to the backup file.

Syntax: STRING

***passphrase***

Decrypt the archive with a passphrase.

Syntax: STRING

Optional: True

***system script stop SCRIPT***

Stop an active running script. Scripts scheduled to run again will still run again (disable a script to prevent it from running again).

**Parameters*****script***

Script to stop.

Syntax: STRING

***system serial clear PORT***

Clears the serial log.

**Parameters*****port***

Serial port.

Type: string

***system serial save PORT FILENAME***

Saves the current serial log to a file.

**Parameters*****port***

Serial port.

Type: string

***filename***

The filename to save the serial log. The file will be saved to the device's /etc/config/serial directory.

Type: string

***system serial show PORT***

Displays the serial log on the screen.

**Parameters*****port***

Serial port.

Type: string

***system serial start [size INTEGER] PORT***

Start logging data on a serial port.

**Parameters*****size***

Maximum size of serial log.

Default: 65536

Syntax: {*Integer*}

Type: integer

***port***

Serial port.

Type: string

***system serial stop PORT***

Start logging data on a serial port.

**Parameters*****port***

Serial port.

Type: string

***system support-report PATH***

Save a support report to a file and include with support requests.



### **Parameters**

#### ***path***

The file path to save the support report to.

Syntax: STRING

## traceroute

Print the route packets trace to network host.

***traceroute [bypass|debug|dontfragment|icmp|ipv6|nomap] [first\_ttl INTEGER] [gateway STRING] [interface STRING] [max\_ttl INTEGER] [nqueries INTEGER] [packetlen INTEGER] [pausesecs INTEGER] [port INTEGER] [src\_addr STRING] [tos INTEGER] [waittime INTEGER] HOST***

### Parameters

#### ***bypass***

Bypass the normal routing tables and send directly to a host on an attached network.

Syntax: BOOLEAN

Default: False

Optional: True

#### ***debug***

Enable socket level debugging.

Syntax: BOOLEAN

Default: False

Optional: True

#### ***dontfragment***

Do not fragment probe packets.

Syntax: BOOLEAN

Default: False

Optional: True

#### ***first\_ttl***

Specifies with what TTL to start.

Syntax: INT

Minimum: 1

Default: 1

#### ***gateway***

Tells traceroute to add an IP source routing option to the outgoing packet that tells the network to route the packet through the specified gateway

Syntax: STRING

Optional: True

#### ***icmp***

Use ICMP ECHO for probes.

Syntax: BOOLEAN

Default: False

Optional: True

**interface**

Specifies the interface through which traceroute should send packets. By default, the interface is selected according to the routing table.

Syntax: STRING

Optional: True

**ipv6**

If a hostname is defined as the value of the 'host' parameter, use the hosts IPV6 address.

Syntax: BOOLEAN

Default: False

Optional: True

**max\_ttl**

Specifies the maximum number of hops (max time-to-live value) traceroute will probe.

Syntax: INT

Minimum: 1

Default: 30

**nomap**

Do not try to map IP addresses to host names when displaying them.

Syntax: BOOLEAN

Default: False

Optional: True

**nqueries**

Sets the number of probe packets per hop. A value of -1 indicated

Syntax: INT

Minimum: 1

Default: 3

**packetlen**

Total size of the probing packet. Default 60 bytes for IPv4 and 80 for Ipv6. A value of -1 specifies that the default value will be used.

Syntax: INT

Minimum: -1

Default: -1

**pausesecs**

Minimal time interval between probes

Syntax: INT

Minimum: 0

Default: 0

**port**

Specifies the destination port base traceroute will use (the destination port number will be incremented by each probe). A value of -1 specifies that no specific port will be used.

Syntax: INT  
Minimum: -1  
Default: -1

**src\_addr**

Chooses an alternative source address. Note that you must select the address of one of the interfaces. By default, the address of the outgoing interface is used.

Syntax: STRING  
Optional: True

**tos**

For IPv4, set the Type of Service (ToS) and Precedence value. Useful values are 16 (low delay) and 8 (high throughput). Note that in order to use some TOS precedence values, you have to be super user. For IPv6, set the Traffic Control value. A value of -1 specifies that no value will be used.

Syntax: INT  
Minimum: -1  
Default: -1

**waittime**

Determines how long to wait for a response to a probe.

Syntax: INT  
Minimum: 1  
Default: 5

**host**

The host that we wish to trace the route packets for.

Syntax: STRING

# Antenna notes and solutions

---

This chapter contains the following topics:

|                               |     |
|-------------------------------|-----|
| Antenna terminology .....     | 833 |
| Physical specifications ..... | 833 |
| Antennas tested by Digi ..... | 833 |

## Antenna terminology

Electronics require antennas to convert data into RF signals (and vice versa). They are coupled with radio transmitters and/or receivers to process the information that is carried over cellular bands. Antenna design and functionality has evolved over time:

- **Internal antennas:** An antenna can be concealed within the casing of a device, as seen with most smart phones. Internal antennas are potentially more prone to interference due to the close grouping of electrical components.
- **External antennas:** Situating antennas further away from the rest of the circuit board can help alleviate interference due to electrical components by maximizing a device's natural reach. Instead of sitting inside the device directly next to the modem or transceiver, they screw into place using SMA connectors and protrude from the equipment (think "rabbit ears").
- **MIMO:** Multiple-Input and Multiple-Output (MIMO) technology expands the throughput capacity of a transceiver by leveraging multiple antennas to simultaneously convert RF signals into data (or vice versa), providing faster transfer speeds as a result. Think of it (loosely) as Carrier Aggregation for antennas—once again combining individual lanes into a single, coordinated superhighway. Networks must leverage MIMO antenna transmission to be technically considered 4G.

## Physical specifications

Many Digi devices use industry-standard female SMA connectors to affix antennas to the internal cellular radio. External antennas improve clarity when compared to internal antennas, which are prone to electromagnetic interference.

An extension coaxial cable can also enhance the reach of a device; however, that cabling causes attenuation—or a degradation in signal quality—due to the distance the signal travels. Significant attenuation typically begins at 30 feet of cabling.

Certain Digi products are designed to provide the ability to place the unit where reception is best (moving the radio is always preferred). This allows the device to capture optimal Radio Frequency (RF) before converting it to IP packets and transmit data via Ethernet cabling, an approach that yields increased performance and cost savings over coax cabling.

Digi can also provide a battery pack for site surveys, creative mounting options, and a (passive) Power-over-Ethernet (PoE) injector to provide an efficient, flexible deployment at the lowest possible cost. Most Digi clients will not require third-party antennas unless deploying without PoE. It is always preferred to mount a PoE unit on an external wall via Ethernet and use the shortest coax cable required to run the external antenna to the outside of a building.



**CRITICAL NOTE:** Test the signal strength outside of the building to ensure you have cellular coverage in the area prior to any cabling work. **Tip:** Use the site survey battery to do this.

---

## Antennas tested by Digi

---

**Note** Antenna information has been compiled by Digi to assist clients in finding and sourcing an antenna solution to best meet their application and business needs. The information on availability and pricing is for planning purposes only and may vary. Clients should test and validate their own

---

applications prior to selecting an antenna for their project.

These antennas are omni-directional—that is, they offer the ability to send/receive signals from any direction. Directional antennas may improve RF sensitivity, but they will require an expert knowledge to find a specific cellular tower and maintain the ongoing fine-tuning that may be required to keep the antenna positioned properly. Due to the challenges of directional antennas, Digi typically focuses on MIMO omni-directional models.

## Extra-small IoT paddle antennas



**Manufacturer:** [Taoglas Antennas Solutions](#)

**Product:** [TG.08.0113](#) and the [Product Datasheet](#)

**MSRP:** \$12 per antenna (\$24 for a pair)

**Note** Use two antennas for full MIMO Operation.

### Deployment notes

This antenna is recommended for consideration when a project requires antennas with a small form factor (for example, digital signage, small enclosures, rack mounted, in-vehicle, and so on). The performance of these antennas is surprisingly good considering the size. Although testing has shown they may slightly under perform compared to the antennas included with your unit, these smaller antennas may provide the perfect balance between form factor and performance in your IoT application.

## Large external MIMO antenna (outdoor rated)



**Manufacturer:** [EAD](#)

**Product:** [LMO7270](#) and the [Product Datasheet](#)

**MSRP:** \$129 with dual 5M coax cabling

#### Deployment notes

This is a hardened antenna designed to be mounted outdoors. This is a MIMO antenna with two short pig tail connectors and the overall dimensions are 187 mm in height and 106 mm at the base. Digi typically provides this antenna with a kit including dual coax cables at 5M in length. If you are using this antenna with a Digi PoE (for example, the Digi 6300-CX) we typically recommend you mount the unit on the inside and run the 5M cables to the outside. In this way, you save costs and eliminate attenuation (signal loss) by running Ethernet as far as possible and minimize the coax cable length. Digi testing of this antenna reveals performance gain.

### Flat MIMO antenna #1



**Manufacturer:** [Taoglas Antennas Solutions](#)

**Product:** [Gemini LMA100](#) and the [Product Datasheet](#)

**MSRP:** \$99 with dual 5M cables

#### Deployment notes

This is an easy-to-use MIMO antenna. It offers a low-profile form factor that accommodates simple mounting. This model is manufactured by Taoglas and showed solid RF performance in our testing. The antenna has a square shape, sized at 164 mm x 164 mm x 36.5 mm. The antenna cabling is built into the antenna, and typically reaches only one meter, but it can be built (sized) to order (lead time can take up to 8 weeks). This antenna typically includes a stand that can be used instead of mounting. The pricing above is based on 5M cables (~15 feet) and the antenna is rated for indoor and outdoor use.

### Flat MIMO antenna #2



**Manufacturer:** [Mobile Mark](#)

**Product:** [PNM2-LTE](#) and the [Product Datasheet](#)

**MSRP:** PNM2-LTE-1C1C-WHT-180 (includes Cabling @ 15 feet) \$176.40

#### Deployment notes

This is an additional easy-to-use MIMO antenna with a low-profile form factor and simple mounting. This model is manufactured by Mobile Mark and showed solid RF performance in our testing. With a square form factor of 146 mm x 146 mm x 18 mm, the antenna cabling is built into the antenna and can be sized to order (typically lead time from the manufacturer is 2 weeks).

### Paddle extender



#### Deployment notes

This unique product (termed *the paddle extender*) is designed to move the standard LTE antennas to a more optimal spot to obtain better RF connectivity. A typical use can may be where the unit is installed in a metal enclosure or rack (think of a data center or digital signage enclosure). The paddle antennas can be mounted to the top SMA connector, escaping the limitations of having to stay affixed to the device's chassis. Remote mounting is then simplified thanks to the paddle extender's magnetic base (diameter of 48mm [1.9 inches]). The length of the cable 50cm (19.7 inches).