COMPETENCE IN COMMUNICATION

User manual

netPI

NOIT-E-NPI3-51-EN-RE

Hilscher Gesellschaft für Systemautomation mbH
www.hilscher.com

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Table of contents

1 Introduction

1.1 About the user manual

This user manual describes the installation, configuration and functionality of the Edge Gateway NIOT-E-NPI3-51-RE-EN.

1.2 List of revisions

Revision	Date	Author	Change
1	2017-09-07	HH, RG	All sections created.

Table 1: List of revisions

1.3 Legal notes

Copyright

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Terms and conditions

Please read the notes about additional legal aspects on our netIOT web site under http://www.netiot.com/netiot/netiot-edge/terms-and-conditions/.

2 Brief description

netPI is a Raspberry Pi 3 architecture based platform for implementing Cloud, Internet of Things and Industry 4.0 customized Edge Automation projects safely over containerized software utilizing Docker.

The open source software „Docker“ by Docker, Inc. allows the user to execute own applications on the secured Linux operating system of the Edge Gateways while all protection mechanisms are fully preserved. The applications are executed in protected, isolated runtime environments. To accomplish this, Docker uses special techniques from virtualization of operating systems.

3 Device drawings

3.1 Positions of the interfaces

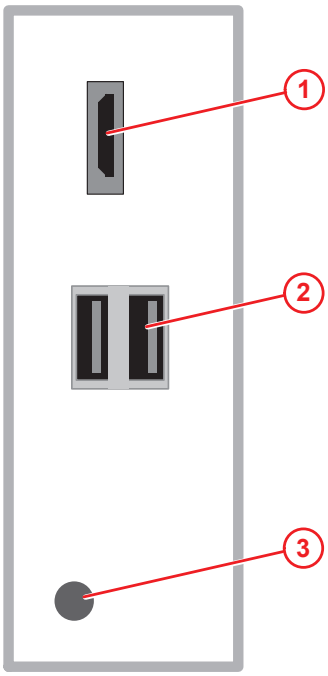


Figure 1: NIOT-E-NPI3-51-EN-RE (Top view)

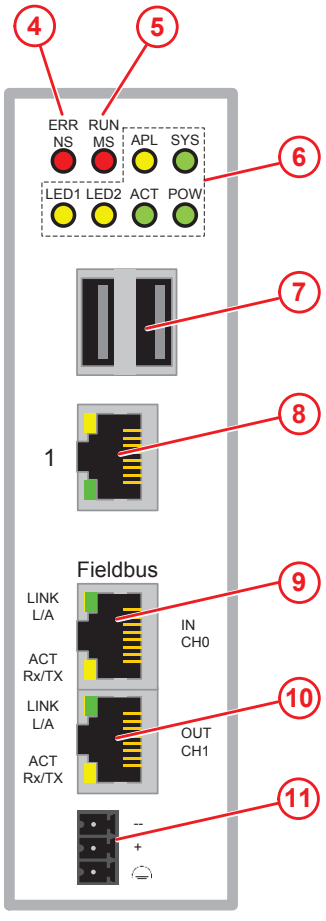


Figure 2: NIOT-E-NPI3-51-EN-RE (Front view)

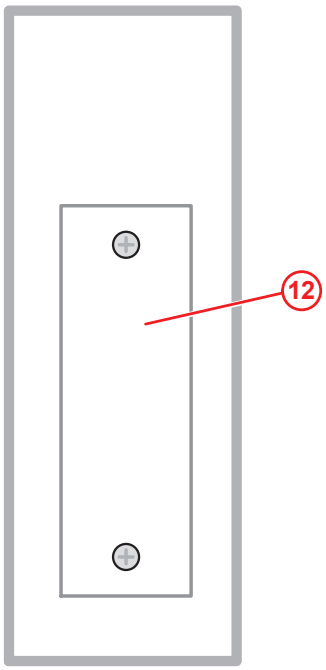


Figure 3: NIOT-E-NPI3-51-EN-RE (Bottom view)

3.2 Dimensions

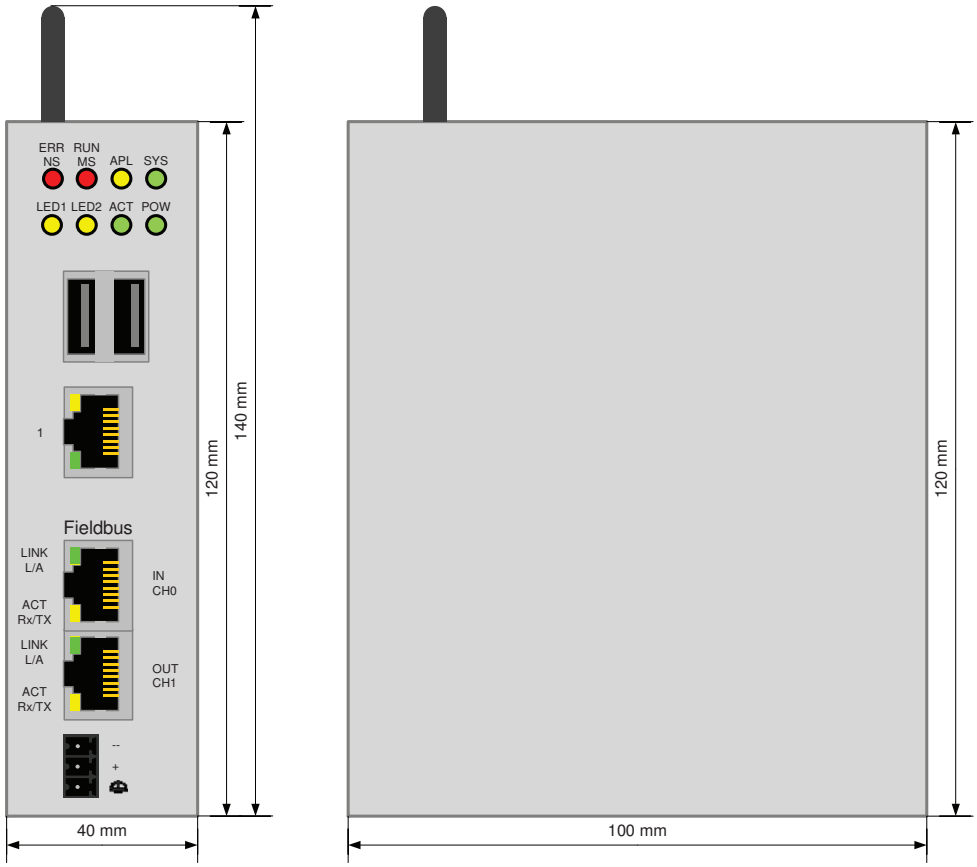


Figure 4: Dimensions

4 Connections and mounting

4.1 Mounting

Mount the Edge Gateway on a DIN rail onto the wall of the cabinet.

4.2 Power supply

DC 24V	Pin	Signal	Description
	-	GND	Ground (Reference potential)
	+	+24 V DC	+24 V DC
		FE	Functional earth

Table 2: Power supply connector NIOT-E-TPI51-EN-RE

4.3 LAN connectors

The Edge Gateway has one LAN connector for connecting it to the cloud network, positions (8) and (see section *Positions of the interfaces* [page 10]).

The MAC addresses of the LAN interfaces are printed on the device label.

Section *Configuring Ethernet communication (LAN)* [page 35] describes, how you can set the IP address parameters of the LAN interfaces.

4.4 Real-Time Ethernet connectors

The Edge Gateway has 2 RJ45-connectors to connect the fieldbus to a Real-Time Ethernet network, positions (9) and (10) (see section *Positions of the interfaces* [page 10]).

4.5 USB connectors

The Edge Gateway has 4 USB connectors (4 x USB 2.0), positions (2) and (7) (see section *Positions of the interfaces* [page 10]). You do not need the USB connectors for operation of the Edge Gateway. You need the USB connector if you connect a keyboard in order to change settings in the BIOS or if you do a firmware recovery with a USB stick.

4.6 Wi-Fi antennas

You can use the Edge Gateway for wireless network communication. The Edge Gateway supports 2 Wi-Fi operating modes: **Access Point** and **Client**. Operating mode Access Point allows the Edge Gateway to connect to a mobile device in order to configure the Edge Gateway from a mobile device.

Section WiFi describes how you activate the antennas and how to set the Wi-Fi operating mode.

4.7 HDMI connector

The Edge Gateway has an HDMI-connection for a monitor (position (1)) which is not required for the operation of the Edge Gateway.

5 LEDs

5.1 Positions of the LEDs on the gateway

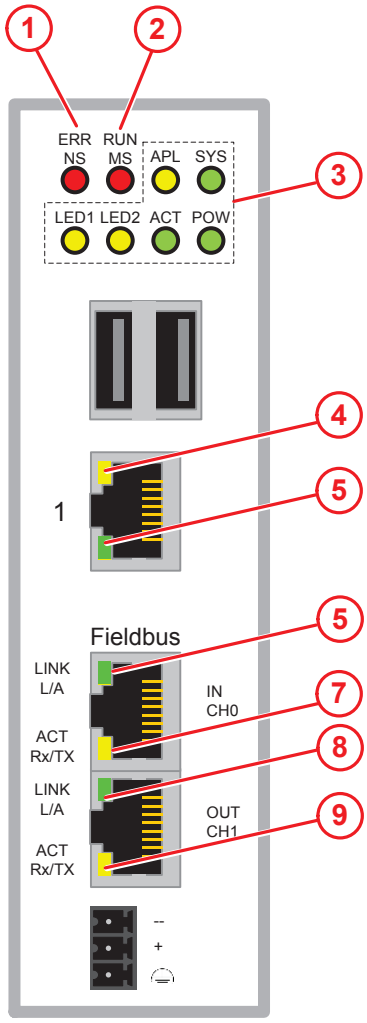


Figure 5: NIOT-E-NPI3-51-EN-RE LED positions

5.2 Gateway status LEDs

LEDs indicating communication status, system status, application status and voltage supply. The position of the LEDs is indicated by position (3) in section *Positions of the LEDs on the gateway* [▷ page 14].

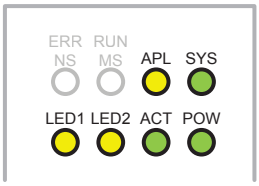


Figure 6: Gateway state LEDs

LED	Color	Meaning
ERR NS	● (red)/ ● (green)	LED communication status Real-Time-Ethernet. Name and function depends on used RTE protocol: PROFINET IO Device = **ERR** (Bus failure) EtherNet/IP Adapter = **NS**(Network status) See section See section *LEDs of the PROFINET IO Device interface* [▷ page 16] and section *LEDs of the EtherNet/IP Adapter interface* [▷ page 17].
RUN MS	● (red)/ ● (green)	LED communication status Real-Time-Ethernet. Name and function depends on used RTE protocol: PROFINET IO Device = **RUN** (System failure) EtherNet/IP Adapter = **MS** (Module status) See section *LEDs of the PROFINET IO Device interface* [▷ page 16] and section *LEDs of the EtherNet/IP Adapter interface* [▷ page 17].
APL	● (yellow)	Application status
SYS	● (yellow)/ ● (green)	System status
LED1	● (yellow)	GPIO12: can be programmed, currently not used.
LED2	● (yellow)	GPIO13: can be programmed, currently not used.
ACT	● (green)	Activity
POW	● (green)	Voltage supply is OK

Table 3: Description of gateway status LEDs

5.3 LEDs of the LAN interface

LEDs indicating state of the LAN communication. For the positions of the LAN LEDs, see positions (2) and (3) in section *Positions of the LEDs on the gateway* [page 14].

LED	Color	State	Meaning
LINK	**LED green**		
See position (3)	(green)	On	100 MBit MBit network connection
	(off)	off	10 MBit or no network connection
RX/TX	**LED yellow**		
See position (2)	(yellow)	Flickering (load dependent)	The device sends/receives frames
	(off)	off	The device does not send/receive frames.

Table 4: LEDs LAN interface NIOT-E-TPI51-EN-RE

5.4 LEDs of the PROFINET IO Device interface

LED	Color	State	Meaning
SF (System Failure)	**Duo LED red/green**		
Position in the device drawing: (2)	(off)	(Off)	No error
	(red)	Flashing (1 Hz, 3 s)	DCP signal service is initiated via the bus.
	(red)	On	Watchdog timeout; channel, generic or extended diagnosis present; system error
BF (Bus Failure)	**Duo LED red/green**		
Position in the device drawing: (1)	(off)	Off	No error
	(red)	Flashing (2 Hz)	No data exchange
	(red)	On	No configuration; or low speed physical link; or no physical link
LINK	**LED green**		
CH0 (6) , CH1 (7)	(green)	On	The device is linked to the Ethernet.
	(off)	Off	The device has no link to the Ethernet.
RX/TX	**LED yellow**		
CH0 (8) , CH1 (9)	(yellow)	Flickering (load dependent)	The device sends/receives Ethernet frames.
	(off)	Off	The device does not send/receive Ethernet frames.

Table 5: LED states for the PROFINET IO-Device protocol

LED state	Definition
Flashing (1 Hz, 3 s)	The indicator turns on and off for 3 seconds with a frequency of 1 Hz: “on” for 500 ms, followed by “off” for 500 ms.
Flashing (2 Hz)	The indicator turns on and off with a frequency of 2 Hz: “on” for 250 ms, followed by “off” for 250 ms.
Flickering (load dependent)	The indicator turns on and off with a frequency of approximately 10 Hz to indicate high Ethernet activity: "on" for approximately 50 ms, followed by "off" for 50 ms. The indicator turns on and off in irregular intervals to indicate low Ethernet activity.

Table 6: LED state definitions for the PROFINET IO-Device protocol

5.5 LEDs of the EtherNet/IP Adapter interface

LED	Color	State	Meaning
MS (module status) Position in the device drawing: (2)	**Duo LED red/green**		
	(green)	On	**Device operational:** The device is operating correctly.
	(green)	Flashing (1 Hz)	**Standby:** The device has not been configured.
	(red/green)	Flashing (1 Hz)	**Self-test:**The device is performing its power up testing.
	(red)	Flashing (1 Hz)	**Minor fault:** The device has detected a recoverable minor fault. E. g. an incorrect or inconsistent configuration can be considered as a minor fault.
	(red)	On	**Major fault:** The device has detected a non-recoverable major fault.
	(off)	Off	**No power:** The power supply to the device is missing.
NS (Network status) Position in the device drawing: (1)	**Duo LED red/green**		
	(green)	On	**Connected:** The device has at least one established connection (even to the Message Router).
	(green)	Flashing (1 Hz)	**No connections:**The device has no established connections, but has obtained an IP address.
	(red/green)	Flashing (1 Hz)	**Self-test:**The device is performing its power up testing.
	(red)	Flashing (1 Hz)	**Connection timeout:** One or more of the connections in which this device is the target have timed out. This status will be finished only if all timed out connections are reestablished or if the device is reset.
	(red)	On	**Duplicate IP:** The device has detected that its IP address is already in use.
	(off)	(Off)	**Not powered, no IP address:**The device does not have an IP address (or is powered off).
LINK CH0 (6) , CH1 (7)	**LED green**		
	(green)	On	The device is linked to the Ethernet.
	(off)	Off	The device has no link to the Ethernet.
ACT CH0 (8) , CH1 (9)	**LED yellow**		
	(yellow)	Flickering (load dependent)	The device sends/receives Ethernet frames.
	(off)	Off	The device does not send/receive Ethernet frames.

Table 7: LED states for the EtherNet/IP Adapter protocol

LED state	Definition
Flashing (1 Hz)	The indicator turns on and off with a frequency of 1 Hz: “on” for 500 ms, followed by “off” for 500 ms.
Flickering (load dependent)	The indicator turns on and off with a frequency of approximately 10 Hz to indicate high Ethernet activity: on for approximately 50 ms, followed by off for 50 ms. The indicator turns on and off in irregular intervals to indicate low Ethernet activity

Table 8: LED state definitions for the EtherNet/IP Adapter protocol

6 Commissioning the Edge Gateway

6.1 Establishing the IP address communication

An IP address is required to address the Edge Gateway in the LAN network.

The following figure shows the factory setting of the LAN interfaces and the assignment of the connections.

6.2 Using the web browser to establish a connection with the Edge Gateway

You have three possibilities to access the Edge Gateway:

1. by means of the host name (see section *Using the host name* [page 18])
2. by access via the Windows network (see section *Access to the Edge Gateway in the Windows network environment* [page 19]),
3. by using the IP address (see section Using the IP address).

6.2.1 Using the host name

The Edge Gateway has a host name you can use to access the device.

Where do you find the host name on the device?

The device is delivered (factory setting) with a label printed at its bottom. In the figure below the host name has a red frame.

Establishing a connection with the host name

➢ Enter the following address in the address line of your browser:
`https://<hostname>`
Example: For the device with the host name `NT0002A233E559` enter
`https://NT0002A233E559`

⇨ The Edge Gateway Manager opens.

You can now use the Edge Gateway manager to configure the device. For this purpose, read section *Edge Gateway manager web page* [page 21].

6.2.2 Access to the Edge Gateway in the Windows network environment

To be located easily in the network, the Edge Gateway uses the UPnP technology (Universal Plug and Play). This technology will display the Edge Gateway in the Windows network environment.

➢ To display all devices in the network, click on **Network** in the Windows Explorer.

↬ You will find the Edge Gateway under **Other Devices**:

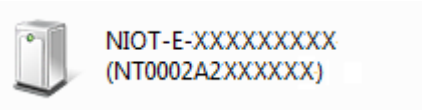


Figure 7: netIOT Edge Gateway in the Windows network

➢ Open the context menu of this entry and select **Properties**.

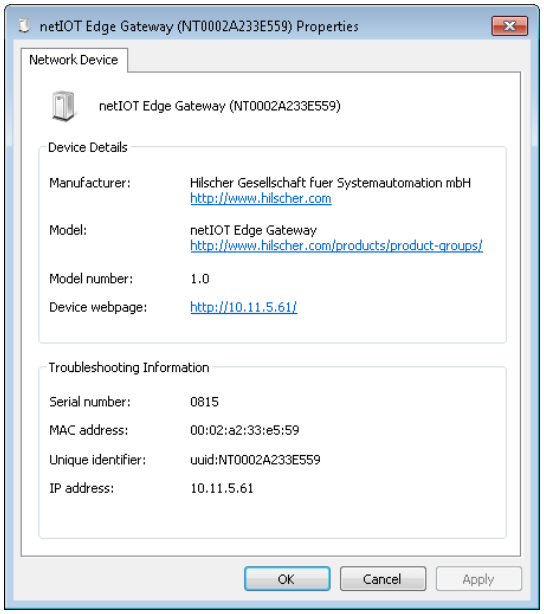


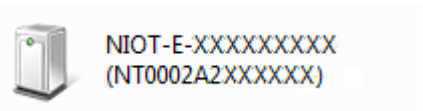
Figure 8: Properties of the Edge Gateway

↬ The menu provides information on the Edge Gateway, e.g. serial number, MAC address, host name or die IP address.

➢ Click on the link under Device web page.

⇨ The Edge Gateway manager opens.

➢ To open the Edge Gateway manager, you can also double-click on the device icon.



⇨ The Edge Gateway manager opens.

You can now use the Edge Gateway manager to configure the device. For this purpose, read section *Edge Gateway manager web page* [page 21].

7 Edge Gateway manager

7.1 Calling the Edge Gateway Manager

The Edge Gateway manager is a web page with tiles that allow rapid access to the applications integrated in the device or to external web pages.

The Edge Gateway uses the secured HTTPS protocol to access web pages stored in the Edge Gateway.

➢ To open the Edge Gateway manager, enter the following information in the address line of your browser:
`https://<Host name of the Edge Gateway>`
or
`https://<IP address of the Edge Gateway>`

⇨ Your browser displays the Edge Gateway manager.

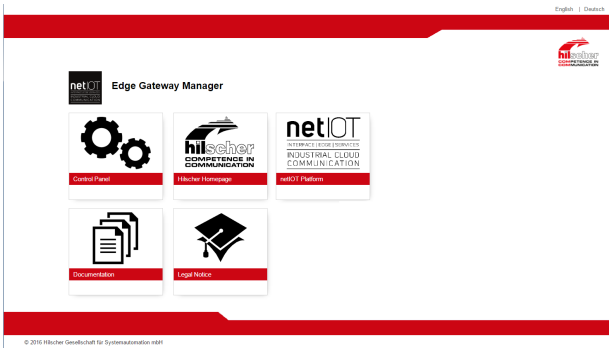


Figure 9: Edge Gateway Manager

Note:
Remember that the secured **HTTPS** protocol is used here, not the widely spread **HTTP** protocol.

7.2 Edge Gateway manager web page

The Edge Gateway manager displays tiles that allow rapid access to the applications integrated in the device or external web pages.

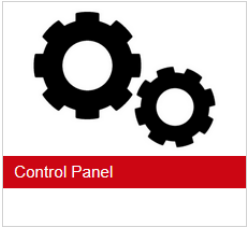
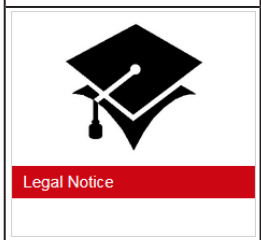
Icon	Function
	Opens the control panel of the Edge Gateway. The control panel configures the Edge Gateway and displays information on the system. Section *Control Panel* [page 22] describes the possibilities of configuration as well as the displayed information on the system.
	Opens the Docker management. See section *Isolated application execution with Docker* [page 48].
	Opens the Edge Gateway documentation stored in the device.
	Opens the homepage of the netIOT platform in the Internet. Requires a connection to the Internet.
	Opens the Hilscher homepage in the Internet. Requires a connection to the Internet.
	Opens legal information concerning the Edge Gateway. Requires a connection to the Internet.

Table 9: Starting applications with the Edge Gateway manager

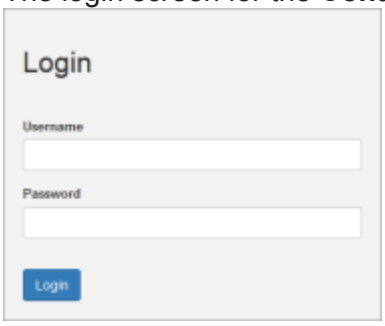
8 Control Panel

8.1 Opening the control panel

With the control panel you can configure the Edge Gateway and display device-specific information.

➢ Click the tile **Control Panel**.

➢ The login screen for the **Control Panel** is displayed.



➢ Enter your user name and your password.

➢ Click at **Login**.

⇨ The **Control Panel** will be displayed.

8.1.1 First login

Setting the administrator password when the control panel is called for the first time

The dialog box **Set Administrator Password** is displayed when the control panel is called for the first time.

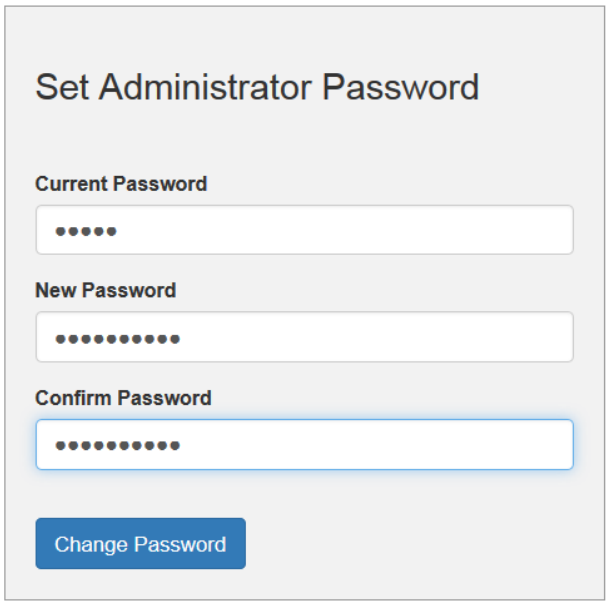
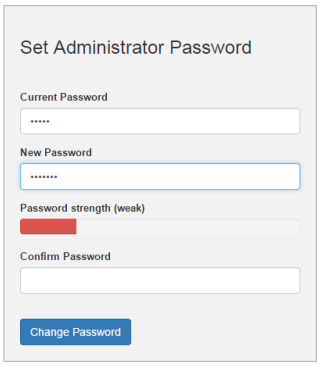
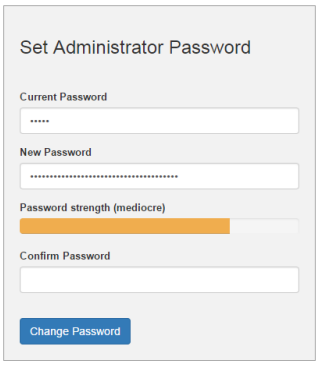
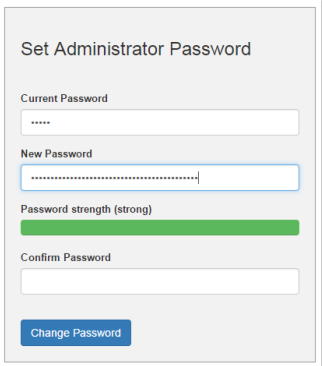


Figure 10: Edge Gateway Manager - Setting the administrator password

To set a new administrator password, proceed as follows:

➢ Enter the preset password under **Current Password**. With the first commissioning, the password is:
`admin`

➢ Now enter the new administrator password. The minimum allowed length of the administrator password amounts to 7 characters. For reasons of safety, Hilscher recommends using considerably more characters. A strong password should contain small and capital letters as well as numbers and special characters. In the dialog window additionally a password quality indicator is displayed. The window changes as follows depending on the quality of the specified password with respect to its safety level (weak, mediocre or strong): Weak password

Weak password	Mediocre password	Strong password
		

➢ If the specified password is indicated to be **strong** (display bar appears in green), click at .

⇨ Thus, the new administrator password for the user account **Admin** is set.

⇨ Now, you can work with the control panel as an administrator, you can create further users in the user management, and assign access rights. With the specified password you can work with the control panel as administrator.

Also see about this

User management [40]

8.1.2 Secure connection

Edge Gateways support web connections secured by SSH/TSL via `https://` accesses only.

By definition, a secure connection can provide an efficient protection only if a certificate proves that the server is secure. Only then can running transactions of the initiating browser and the server be considered as protected against interception and data theft.

This is why the browser at first inquires a certificate of verification from the server (Gateway). This certificate proves that the issuer has verified the security of the server. Each browser provides a preinstalled list of known authorized issuers of certificates.

Each time the certificate of the server arrives at the browser, the browser compares the issuer of the certificate with the issuers stored in the list of known authorized issuers of certificates.

If the issuer of the certificate is not listed, the browser will signal a certificate error and request the user's confirmation to continue because it assumes that the connection is insecure.

As standard, Edge Gateways contain a certificate issued by Hilscher that is not on the list of the known authorized issuers of certificates. Due to that, the browser signals an insecure connection and requests the confirmation to continue. When this confirmation has been given once, any future connections will be established without further requests.

Note:
In the control panel you can replace this certificate any time by the certificate of a known authorized issuer of certificates, see section *Uploading and installing own security certificates* [page 43]).

8.1.2.1 Connection without certificate with Microsoft Internet Explorer

Microsoft Internet Explorer: Edge Gateway Manager will not be displayed

If you use the Microsoft Internet Explorer and the following page is displayed, click the option **Continue to this web site (not recommended)**.

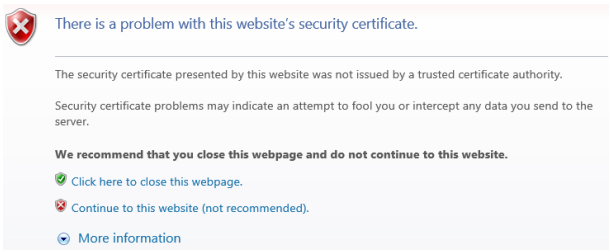


Figure 11: Security error message of the Internet Explorer

8.1.2.2 Connection without certificate with Firefox

If you use Firefox as a browser, a self-signed certificate will cause the following error message:

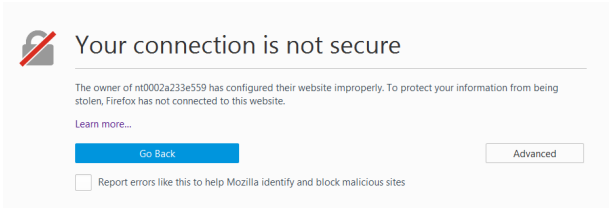


Figure 12: Security error message of the Firefox browser (1)

To avoid this message caused by a self-signed certificate, proceed as follows:

➢ To display the complete message, click **Advanced**.

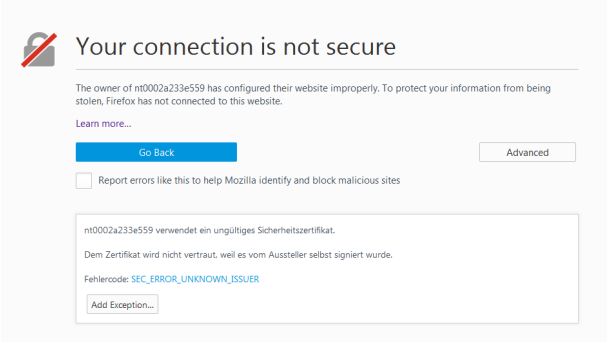


Figure 13: Security error message of the Firefox browser (2)

➢ To define an exceptional rule that enables the display of the user interface without repeated error messages, click **Add Exception**.

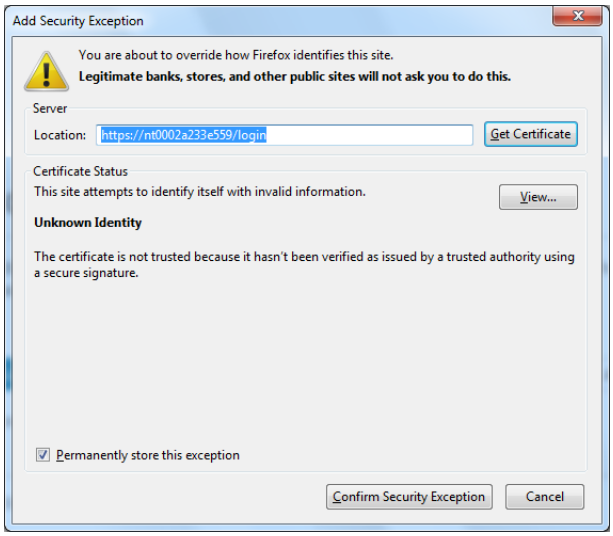


Figure 14: Firefox dialog box: Adding exceptional safety rule

- ➢ To save the setting permanently, check the box **Permanently store this exception**.
- ➢ To save the rule, click **Confirm Security Exception**.
- ⇨ When you open the control panel in future, security messages will no longer be displayed.

8.1.2.3 Connection without certificate with Google Chrome

If you use Google Chrome as web browser, you will get the following error message due to a self-signed certificate.

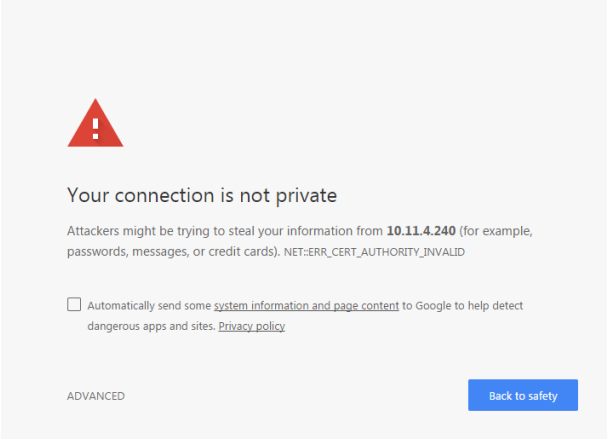


Figure 15: Security error message of Google Chrome (1)

Proceed as follows in order to avoid the following message, which is caused by a self-signed certificate,

- ➢ Click at **ADVANCED** to display the complete message.

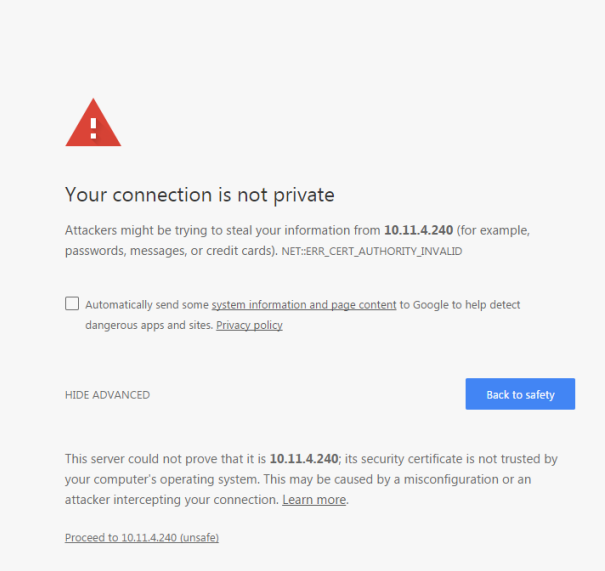


Figure 16: Security error message of Google Chrome (2)

➢ In order to continue, click at **Proceed to ... (unsafe)**.

⇨ The Control Panel is displayed.

8.2 Control Panel commands

8.2.1 Overview and main menu

The following figure displays the main menu of the Control Panel.

Figure 17: Main menu of the Control Panel

Menu	Submenu	Description	Details in section
System	Info Center	Displaying the system information, monitoring of the processor core temperature, and a system monitor for the usage of CPU, main memory, and SSD	*Displaying system information* [▷ page 29]
	Time	Settings of system time and time synchronization.	*Setting the system time* [▷ page 30]
	Reboot	Rebooting the Linux operating system of the Edge Gateway	*Rebooting the system* [▷ page 32]
	Shutdown	Shutting down the Linux operating system of the Edge Gateway	*System shutdown* [▷ page 32]
Package Manager	Packages	Managing the packages of the Linux-based operating system of the Edge Gateway.	*Packet management* [▷ page 33]
Network	LAN	Configuring the Ethernet interfaces to the field or cloud.	*Configuring Ethernet communication (LAN)* [▷ page 35]
	WiFi	Configuring the WiFi communication	WiFi
	Hostname	Displaying and configuring the host name identifying the Edge Gateway in the network.	*Hostname* [▷ page 36]
Services	Service List	Displaying, starting, and stopping the services of the Edge Gateway.	*Services* [▷ page 37]
User Management	Roles	Displaying and configuring the permissions for user roles.	*Managing user roles* [▷ page 40]
	Accounts	Displaying user accounts und assigning user roles.	*Managing user accounts* [▷ page 42]
Security	SSL Certificate	Installing the SSL safety certificate.	*Security certificates* [▷ page 42]
Help	Info	Displaying current software version.	*Help* [▷ page 46]
Session	User Profile	Displaying the permissions of the user.	*User profile* [▷ page 46]
	Logout	Logout	*Logout* [▷ page 47]

Table 10: Functional overview of the Control Panel

For the pages which can be invoked via the Control Panel, the following applies:

If for the selected page, no access right for reading is present, this has the following implications:

- No data are displayed. All important controls and displays of the page are grayed out respectively inactive.
- The error message **Permission denied** is displayed when accessing the page.

If there is read but no write access right present, this has the following implications:

- The error message **Permission denied** is displayed when trying to make a change.

8.2.2 System information and system time

8.2.2.1 Displaying system information

Open this page with **System** > **Info Center.** No access rights are required in order to open this page. This page shows e.g. the firmware version and the serial number of the Edge Gateway.

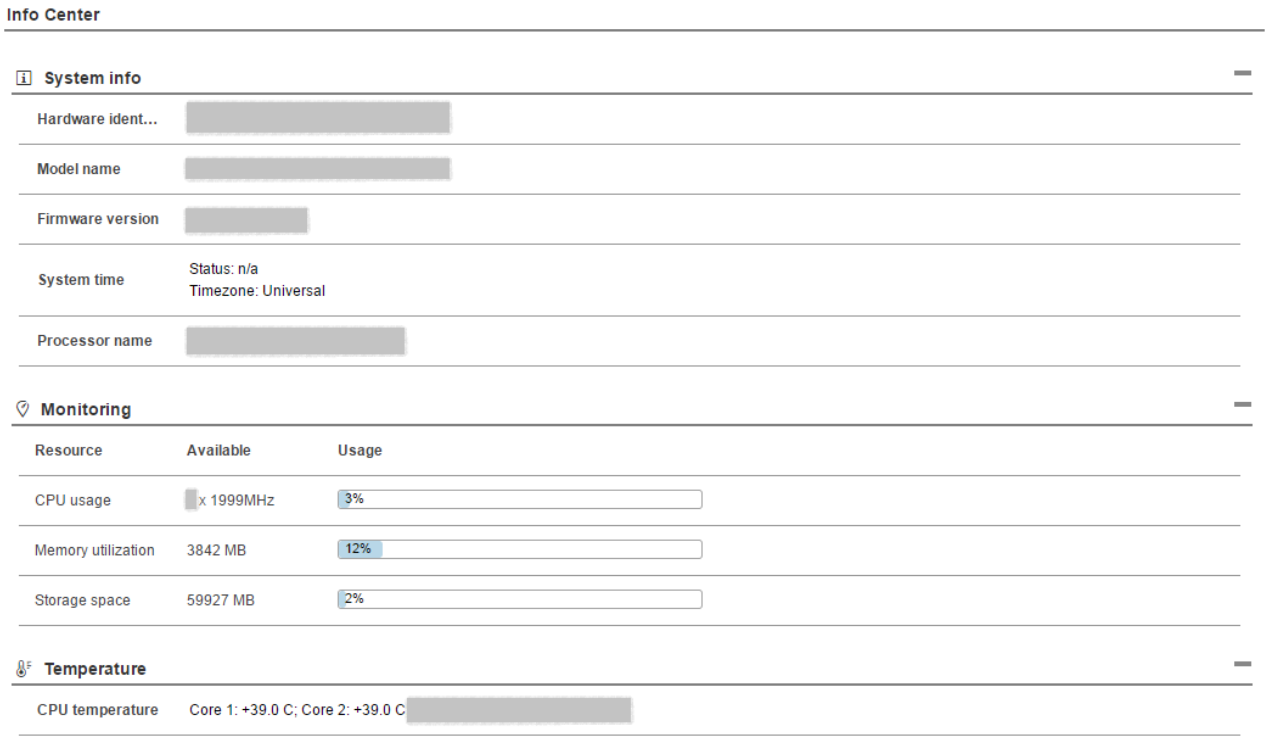


Figure 18: Page Info Center

The Info Center displays the following information:

System info	Description
Hardware ident.	Serial number of the Edge Gateway
Model name	Model designation of the Edge Gateway (NIOT-E-NPI3-51-RE-EN)
Firmware version	Complete version designation of the firmware stored in the Edge Gateway
System time	Synchronization status of the internal clock of the Edge Gateway. When the clock is synchronized via the network, the IP address and the name of the time server used for synchronization will be displayed. The user has to configure the time zone.
Processor name	Name of the microprocessor (CPU) installed in the Edge Gateway.

Table 11: Info Center: Area System info

Monitoring	Description
CPU usage	Number of microprocessor cores plus clock frequency and average utilization of each core in the Edge Gateway
Memory utilization	Size and average utilization of the main memory in the Edge Gateway
Storage space	Display of available memory and the memory that is currently utilized on the integrated Solid-State-Disk of the Edge Gateway

Table 12: Info Center: Area Monitoring

Temperature	Description
CPU temperature	Display of the temperature of each processor core in the Edge Gateway

Table 13: Info Center: Area Temperature

If the data of the area **Monitoring** cannot be read, this is grayed out.

8.2.2.2 Setting the system time

Open this page with **System** > **Time**.

In order to access this page you require the following access right:

Setting the system time

On this page, you can set the system time and the time zone this time relates to. You can set the system time in two ways:

Type	Selection	Method	Standard presetting
manually	Manual selection	by entering date and time	yes
automatically	NTP synchronized	by means of a time server	no.

Table 14: Setting the system time

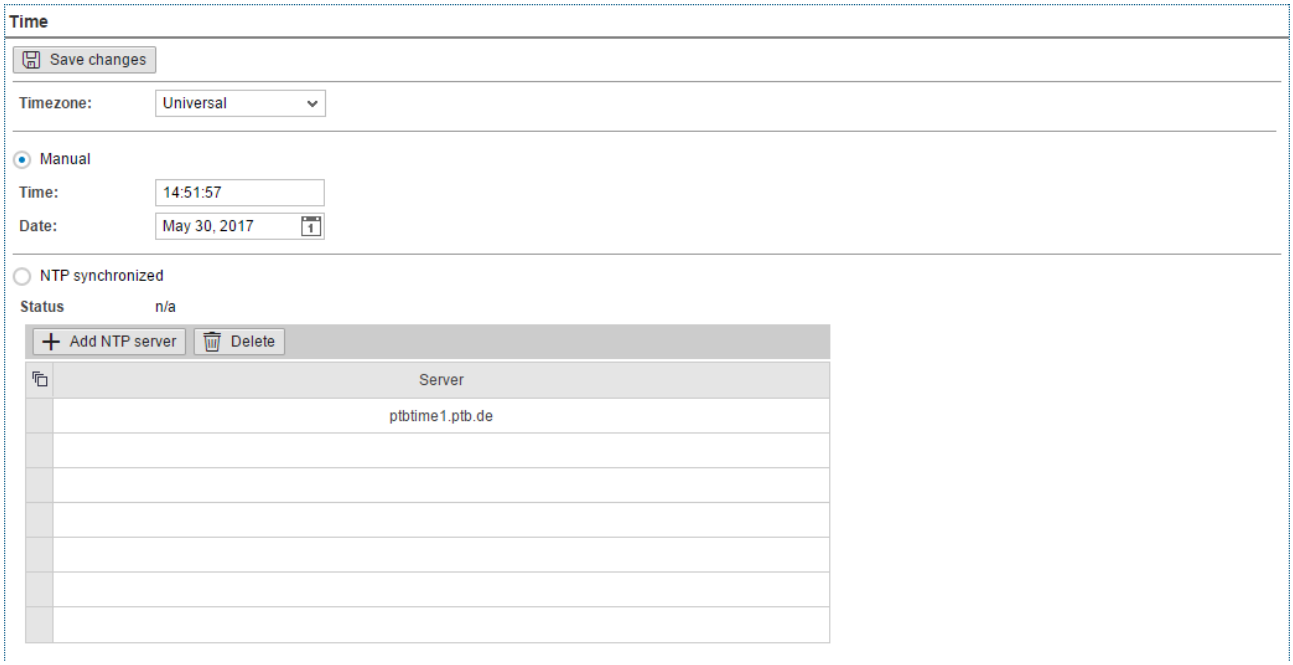


Figure 19: Time configuration page

Setting the system time manually

- ➢ Click the option **Manual**.
- ➢ Enter the time in the input field **Time** in the format `hh:mm:ss`.
- ➢ Set the date using the calendar input field **Date**.
- ➢ Click at Save changes.
- ⇨ The system time is set.

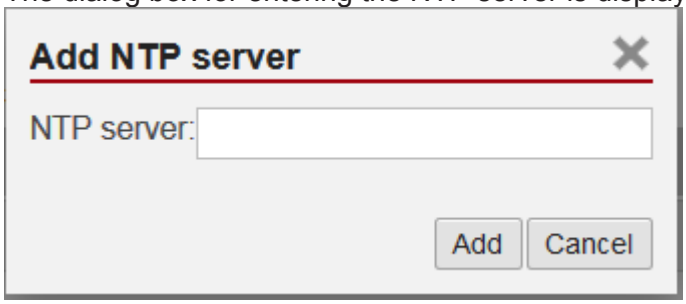
Setting the system time automatically using a time server

You can synchronize the time using a time server that uses the Network Time Protocol (NTP). Under **NTP synchronized** there is a list where you can enter such time servers. The list of NTP servers will be worked off from top to bottom until a server gives a valid answer and synchronization occurs.

➢ Click the option **NTP Synchronized**.

➢ Click **Add NTP server**.

➮ The dialog box for entering the NTP server is displayed.



➢ In the input field **NTP server** enter the address of a server which uses the NTP to synchronize the time:
E.g.: To add the server for time synchronization of the Physikalisch-Technische Bundesanstalt (the National Metrology Institute of Germany) to the list, enter the address `ptbtime1.ptb.de` in the input field **NTP server**.

➢ Click **Add**.

⇨ The system time is set via the NTP. As soon as the system time is set successfully, the following information will be displayed under **Status**:
`Synchronized to time server <IP address of the time server>:<Port number of the time server > (<NTP address of the time server>)`

Setting the time zone

With the selection list *Timezone* you can adjust the time zone to your local time in which the Edge Gateway is so that the set time can be interpreted correctly (e.g. summer time conversion). For this purpose, the selection list *Timezone* offers many setting options. The default value is *Universal*. For Central European Time set *CET*.

Take care of the following notes:

NOTICE

Effects of setting the system time

Once the system has been set, system services and Node-RED flows, which use the system time for synchronization, lose their reference time, i.e. they refer to the new time set.

Note:
For information on the NTP, see Wikipedia under https://en.wikipedia.org/wiki/Network_Time_Protocol (English) or https://de.wikipedia.org/wiki/Network_Time_Protocol (German). There you will also find links to lists of NTP servers for various countries.

8.2.2.3 Rebooting the system

You have to login as Administrator to use this function.

In order to reboot the system:

➢ Within the Control Panel select menu entry **System>Reboot**

⇳ The following safety query is displayed:

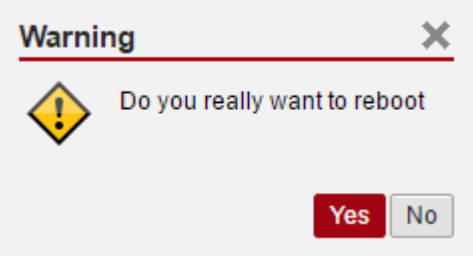


Figure 20: Reboot safety query

➢ If you really intend to reboot the system, answer to the safety query with Yes.

⇨ The Linux operating system of your Edge Gateway is shut down and then immediately restarted.

Note:
Take care of the consequences of shutting down and restarting for your network, if you reboot the Edge Gateway.

8.2.2.4 System shutdown

You have to login as Administrator to use this function.

In order to shut down the system:

➢ Within the Control Panel select menu entry **System>Shutdown**.

⇳ The following safety query is displayed:

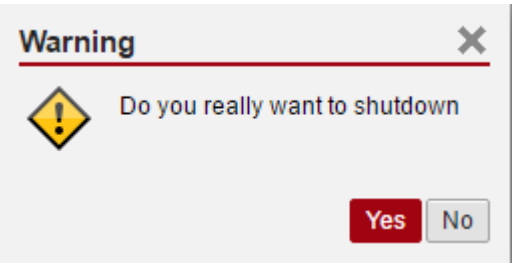


Figure 21: Warning for consequences of shutdown

➢ If you really intend to shut down the system, answer to the safety query with Yes.

⇨ The Linux operating system of your Edge Gateway is shut down.

Note:
Take care of the consequences for your network, if you shut down the Edge Gateway.

8.2.3 Packet management

8.2.3.1 Managing packets

Open this page with **Package Manager** > **Packages**.

In order to access this page you require the following access right:

Managing packets

This page contains the package management of the Linux-based operating system of the Edge Gateway. This page

- lists the installed packages including version,
- adds new packages or
- updates already installed packages.

Table of installed packages

The area *Packages* of the table *Installed* shows you the list of the installed packages.

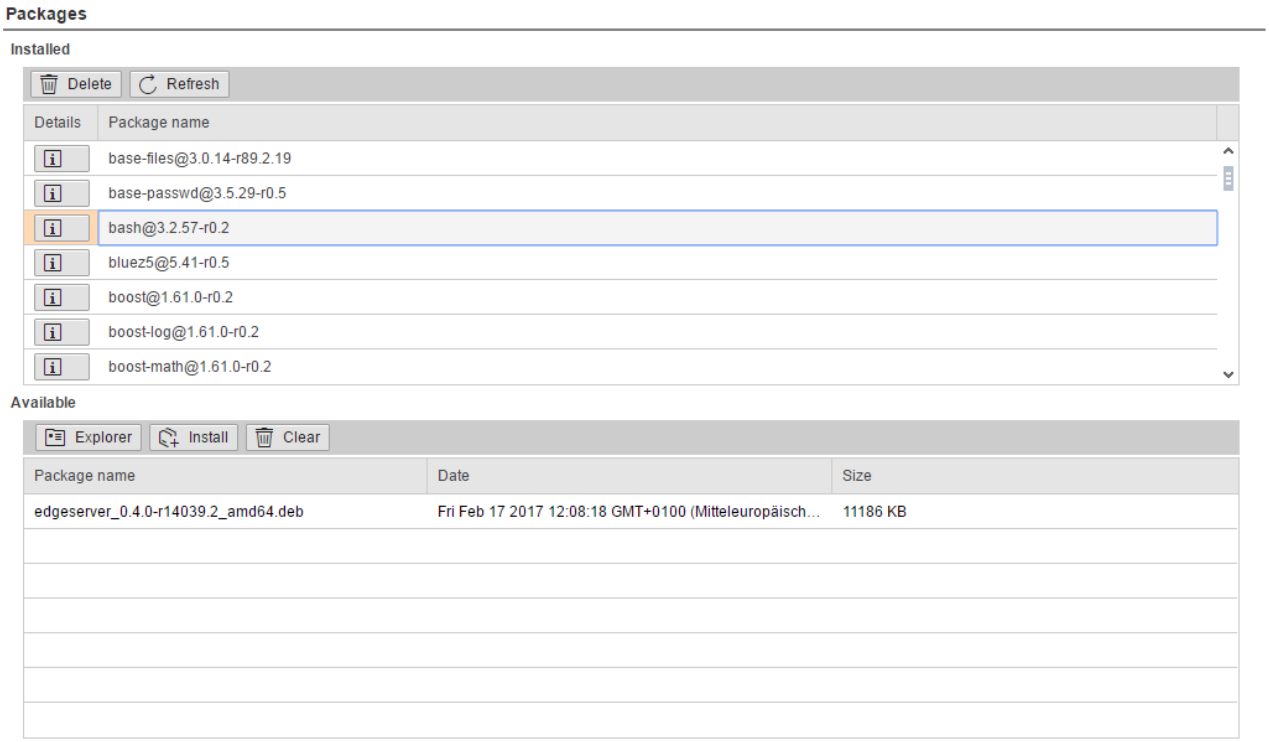


Figure 22: Packages installed

Each line of the list of the installed packages contains the name and version of a package. To display a summary of the contents of a package, click the button *Details*.

Deleting packages from the list of available packages

NOTICE

Risk of losing the data and the operational safety of the Edge Gateway

Delete packages only if you have profound knowledge of the operating system LINUX and if you are absolutely sure that the package in question can be deleted without any risk for the function of the Edge Gateway and its operating system.

➢ Select the package to be deleted in table Installed.

➢ Click at Delete.

⇨ The package is deleted from the Edge Gateway's file system. If the package file could be successfully deleted, the following message box is displayed:

Package(s) are successfully deleted

Table of available but not yet installed packages

The table *Available* displays the packages that are available for installation, but which are not yet installed. You first have to select and add the packages to be installed.

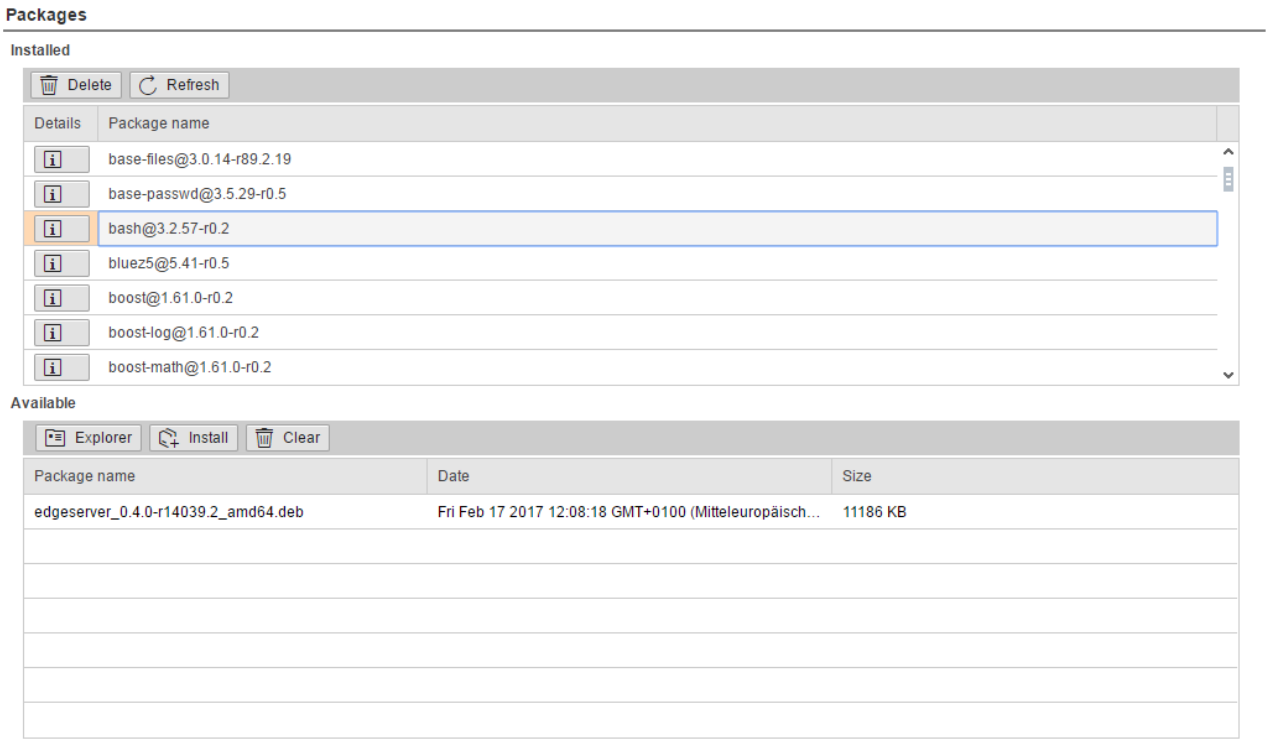


Figure 23: Table of the packages that are available for installation

Selecting and installing the package file

➢ Click at Explorer.

⇨ A dialog for file selection is displayed.

➢ Select the package file to be loaded. Debian package files have the ending `*.deb`.

Note:
You can find more information on the Debian packet file format in English at https://en.wikipedia.org/wiki/Deb_(file_format).

⇨ The package within the selected file is checked for correctness. If the Edge Gateway accepts the package, the name, creation date, and file size of the package will be displayed in a line of the table **Available**.

➢ Click at Install.

⇨ If the Edge Gateway accepts the file, it will be installed, removed from the table **Available**, and displayed in the table **Installed**.

⇨ If the package cannot be installed, the message dialog **Upload - Failed to install...** appears.

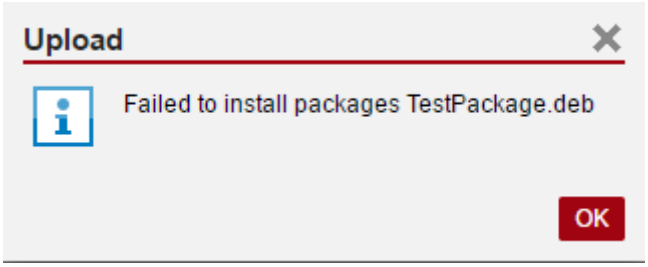


Figure 24: Message box "Upload - Failed to install packages..."

Delete package file from list of available but not yet installed files

➢ Select the package file to be deleted. Package files have the ending `.deb`.

➢ Click at Clear.

⇨ The line containing the package file to be deleted is removed from the list of available but not yet installed files.

8.2.4 Network

8.2.4.1 Configuring Ethernet communication (LAN)

Open this page with **Network** > **LAN**.

In order to access this page you require the following access right:

Access to LAN (Ethernet network)

On this page you configure the Ethernet interfaces `eth0`, `eth1` (both on the side of the cloud) and `cifx0` (on the side of the fieldbus). For each Ethernet interface you can configure how to set the IP address:

- The Edge Gateway is to obtain the IP address parameters automatically from a DHCP server: Option *DHCP*.
- The IP address parameters are manually entered by the user: Option *Fixed address*.

The IP address parameters include the IP address, the subnet mask, the Gateway address, and the IP addresses of the 1st and 2nd domain name server.

The default IP address of the LAN connection port 2 is `192.168.253.1` with the subnet mask `255.255.255.0`.

Column	Meaning
Name	displays the name of the LAN interface.
MAC address	displays the MAC address of the LAN interface.
Settings	Selecting the configuration method: Here you can select between • *DHCP* (IP address parameters automatically obtained from a DHCP server) or • *Fixed address* (IP address parameters entered by the user) If you enter the IP address manually, also always enter the subnet mask and the Gateway address.
Domain Name System	If you enter the IP address parameters manually, enter the IP address of the 1st and 2nd domain name server.

Table 15: Table LAN: Meaning of the columns

If you want to permanently save the changes you made, click at Save changes afterwards.

8.2.4.2 Hostname

Open this page with **Network** > **Hostname**.

In order to access this page you require the following access right:

Access to hostname of Edge Gateway

On this page you configure the host name.

The host name identifies the device via the WiFi or LAN network.

The default host name starts with the two letters "NT" followed by the LAN MAC address of the LAN connection port 1 of the Edge Gateway. Example `NT0002A233E559`. The default host name is printed on the label at the bottom of the Edge Gateway. With the host name you can access the Edge Gateway from your PC even without knowing the IP address of the Edge Gateway (also see *Using the web browser to establish a connection with the Edge Gateway* [page 18]).

If the Edge Gateway does not obtain an IP address from a DHCP server, the system cannot translate the host name and you cannot access the device.

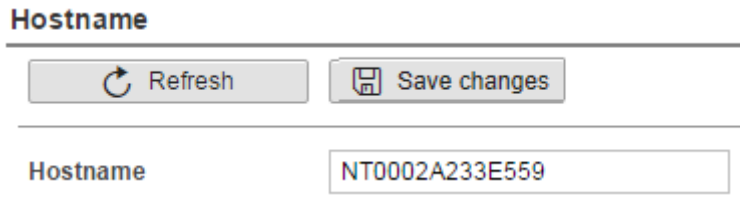


Figure 25: Hostname

Input field Hostname

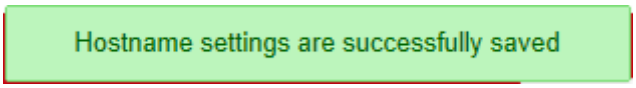
In order to specify the hostname, enter a string with arbitrary length consisting of ASCII characters into the input field **Hostname**.

Saving the host name

The hostname is saved by clicking at 

.

If storing the hostname has succeeded, the following message box is displayed:



8.2.5 Services

8.2.5.1 Starting, stopping and configuring services

Open this page with **Services** > **Service List**.

In order to access this page you require the following access right:

Configure Node-RED

Configure MQTT Broker

On this page you can

- display the list of the running services,
- display the operating status of each service,
- stop and start individual services,
- activate/deactivate Autostart, and
- download, upload and delete the flow of the Node-RED service.

The list of services is displayed at the left edge:

Figure 26: List of default services

For a quick overview, the operating status of each service is displayed in color.

Color	Operating status
green	The service is being executed.
yellow	The service is configured, but not executed.
red	The service is neither configured nor executed.
grey	Right for accessing this service is missing

Table 16: Operating statuses of the services

The following services can be started and stopped for any service:

Start a service

➢ In order to start a service, click at button Start

↬ A security query appears:

➢ Confirm it by clicking at **OK**.

⇨ The displayed operating state changes from *Stop* to *Running* . Simultaneously, the color of the icon left of the service you stopped, changes to yellow. Finally, the button Start is replaced by the button Stop.

Stop a running service

➢ In order to stop a currently running service, click at button Stop

↬ A security query appears:

➢ Confirm it by clicking at OK.

⇨ The displayed operating state changes from *Running* to *Stop*. Simultaneously, the color of the icon left of the service you stopped, changes to yellow. Finally, the button Stop is replaced by the button Start.

Activate autostart for a service

➢ In order to activate *Autostart* for a service, click at radio button **enabled**.

➢ Click at the button with the hook symbol .

↬ A security query box appears:

➢ Click at **OK**.

⇨ Autostart is activated.

Deactivate Autostart for a service

➢ In order to deactivate *Autostart* for a service, click at radio button **disabled**.

➢ Click at the button with the hook symbol.

↬ A security query appears:

➢ Click at **OK**.

⇨ Autostart is deactivated.

The following actions only apply to the NodeRED service:

Download of the current NodeRED Flow

In order to store the current NodeRED flow into a file on your computer:

➢ Click at Download.

↬ A message box depending from the used web browser (example shown in figure: Microsoft Internet Explorer) asks you whether you want to store the file containing the current NodeRED flow. The filename consists of `backup-flow_` and the current date in the format `JJJJ-MM-DD`.

➢ Select *Store (as)* and select the file path.

⇨ The NodeRED flow is stored for further use with the file name mentioned above within the selected path.

Upload of the current Node-RED Flow

Important:
Uploading a Node-RED flow overwrites the currently loaded flow beyond retrieval. If you might need the currently loaded flow in future, store it via *Download* prior to starting the upload.

➢ Click at Upload.

↬ A file selection dialog appears.

➢ Select the file with a stored Node-RED flow, which you want to upload.

↬ A security query informing about the risk of overwriting the current Node-RED flow appears:

➢ If you are sure no longer to need the current NodeRED flow, click at **OK**.

⇨ The selected flow is uploaded now. This overwrites the previously loaded flow. The message *Node-RED flow has been overridden* is displayed.

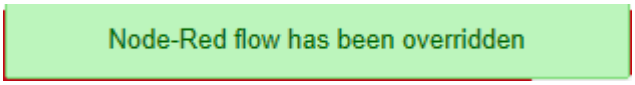


Figure 27: Message at overwriting of current NodeRED flow

Deleting the current Node-RED flow

➢ Click at Delete.

↬ The following security request is displayed:

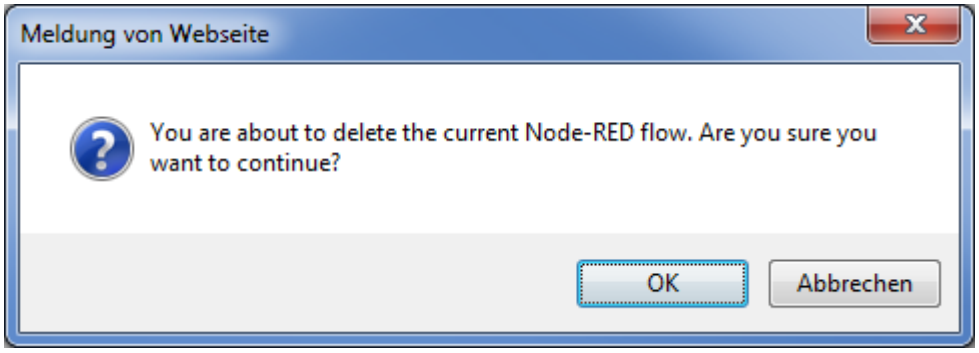


Figure 28: Security request at deletion of current NodeRED flow.

➢ Click at **OK**.

⇨ The current Node-RED flow is deleted. Afterwards, there is no chance to restore this flow anyway.

Undo last deploy in Node-RED

➢ Click on Undo deploy.

↬ A security query warns for danger of data loss due to undo of deploy.

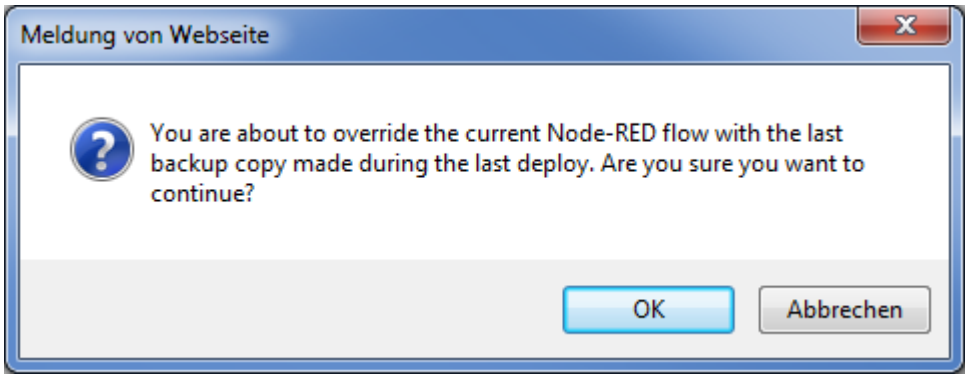


Figure 29: Security query for Undo last deploy

➢ If you are really sure that you want to undo the last deploy, then click on **OK**.

⇨ The last deploy is undone.

Note:
For further information about Deploy in Node-RED, see section Menu Deploy.

8.2.6 User management

The administrator manages users by means of two configuration pages:

- User roles (determining new roles and assigning access rights) and
- User accounts (adding, processing, and deleting).

Defining a user account is accomplished by assigning a predefined role to the user.

8.2.6.1 Managing user roles

Open this page with **User Management** > **Roles**.

On this page, you can determine roles and assign access rights onto resources to these roles.

The roles *Administrator* and *View* are standard and cannot be deleted.

Figure 30: Page for configuring roles

An access right is set per resource. Each configuration page of the control panel which contains settable device parameters is a resource. Access via REST-API (see Functions of the Edge Server) is also a resource.

An access right can be assigned to the following single resources:

Access right / Resource	Access to resource accomplished via menu entry	Usage
System		
Setting the system time	System >Time	*Setting the system time* [page 30]
Packet management		
Managing packets	Package Manager > Packages	*Managing packets* [page 33]
Network access		
Access to LAN (Ethernet network)	Network > LAN	*Configuring Ethernet communication (LAN)* [page 35]
Access onto WiFI (wireless network)	Network > WiFi	Configuring wireless communication (WiFi)
Access onto hostname of Edge Gateway	Network > Hostname	*Hostname* [page 36]
Access onto Field network (Ethernet network)	Network > Field	
Services		
Configure Node-RED	Services > Node-RED	*Starting, stopping and configuring services* [page 37]
Configure MQTT Broker	Services > MQTT Broker	*Starting, stopping and configuring services* [page 37]
Security		
Install security certificates	Security > SSL/TLS Certicate	*Uploading and installing own security certificates* [page 43]
Edge Server		
Access via REST-API	Edge Server (REST API)	Functions of the Edge Server

Table 17: Access rights onto resources

Each resource may obtain one of the following access rights:

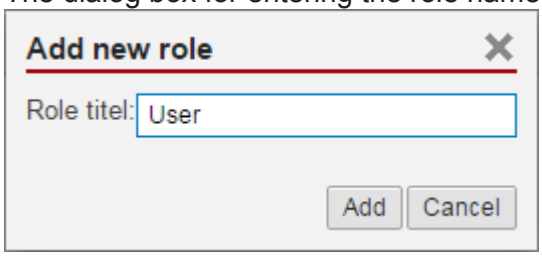
Access rights onto resource	Checkbox
No access	*None*
Read access only	*Read*
Read and write access	*Read, Write*

Table 18: Access rights to resources

Adding a new role

➢ Click at 

⇨ The dialog box for entering the role name is displayed.



➢ Enter a name for the role, e.g. **User**.

➢ Click **Add**.

⇨ The role is added.

Setting the access rights of a role

➢ Click a role.

⇨ The resources and access rights for this role will be displayed.

➢ Assign the access right per resource.

➢ Click at 

The following figure shows the access rights of the administrator.

Also see about this

Uploading and installing own security certificates [43]

8.2.6.2 Managing user accounts

Open this page with **User Management** > **Accounts**.

On this page you can

- add
- process
- delete user accounts.

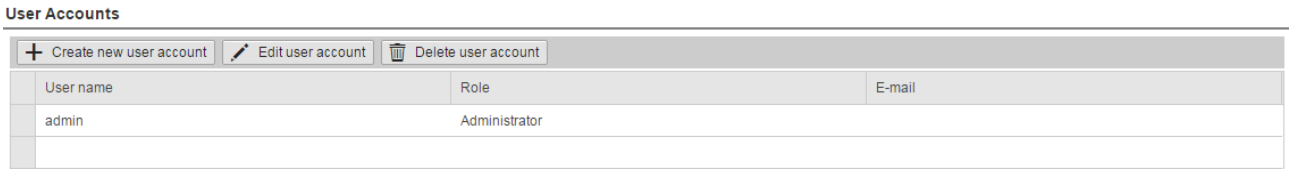


Figure 31: User account page

Each user account has a user name, a password, and an assigned role.

8.2.7 Security certificates

The menu *Security* offers you the possibility to display the contents of security certificates and to upload and install these.

It looks like:

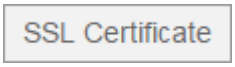


Figure 32: Security submenu

On selection of menu entry *SSL certificate* the page *SSL certificate* is opened.

In order to access this page you require the following access right:

Install security certificates

This page *SSL certificate* displays information about the currently used security certificate. You also can upload and install a new security certificate here (File extension `*.pem`, file size <=0.5 MB).

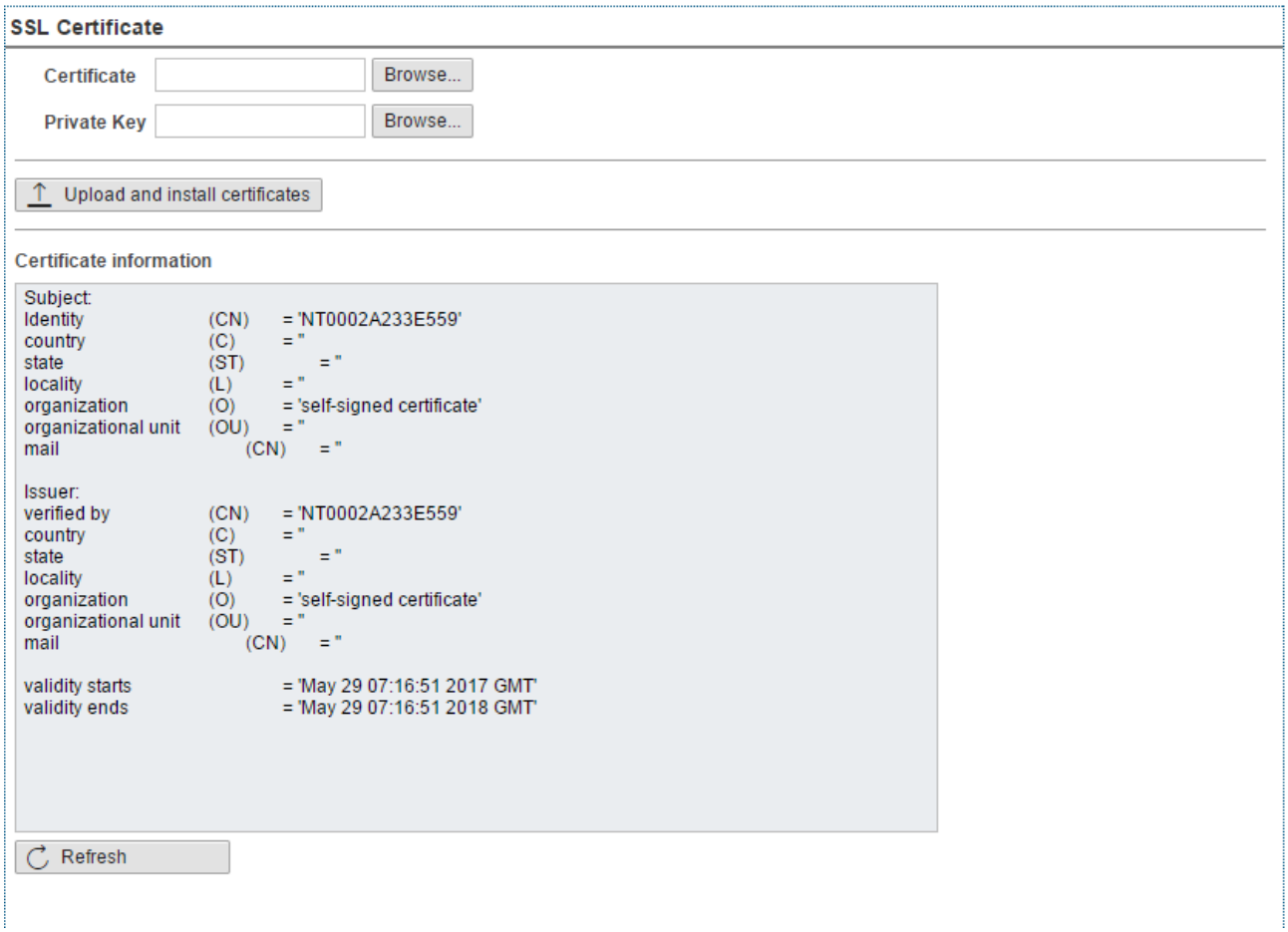


Figure 33: Page SSL Certificate

8.2.7.1 Uploading and installing own security certificates

In the upper area of page *SSL Certificate* you can select an own security certificate including the private key that is associated with the certificate.

Figure 34: SSL Certificate – Upload area

Uploading and installing the certificate

1. In order to upload and install the certificate, proceed as follows:
   - ➢ Select your certificate to be uploaded and installed with the *Browse* button right of the field *Certificate*.
   - ➢ Select the private key associated with your certificate with the *Browse* button right of the field *Private Key*.

Note:
The expected file type for security certificates and private keys is `*.pem` (Privacy enhanced electronic mail format). You can find more information about this file format in Wikipedia at https://en.wikipedia.org/wiki/Privacy-enhanced_Electronic_Mail.

   - ➢ Click at *Upload and install certificates*.
   - ⇨ The security certificate is uploaded and installed.

8.2.7.2 Information about the currently loaded security certificate

In the lower area of page *SSL Certificate* information concerning the currently loaded security certificate is displayed.

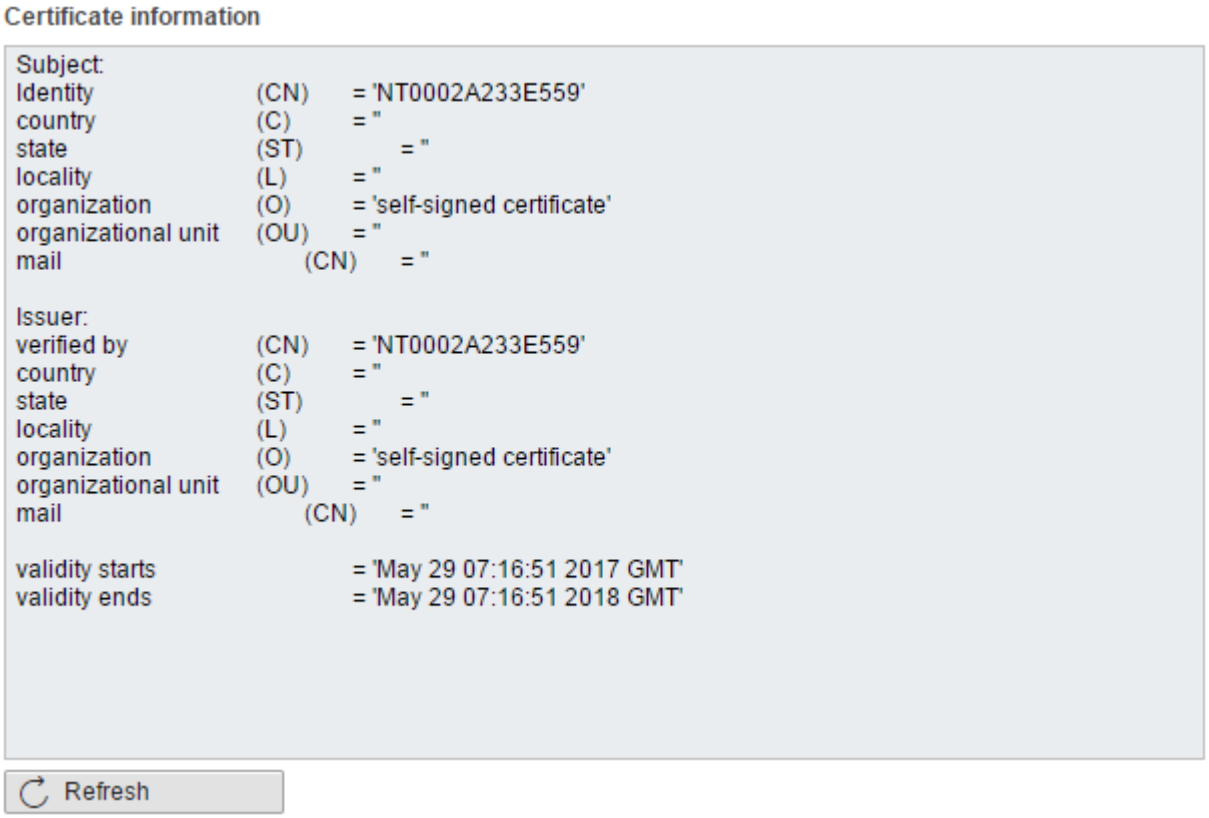


Figure 35: SSL Certificate – Info area

The single lines have the following meanings:

Information about the security certificate

Line	Abbreviation	Meaning
Identity /verified by	CN	Identity/verified by
country	C	Country
state	ST	State
locality	L	Locality
organization	O	Organization
Organization unit	OU	Organization unit
mail	CN	E-mail address
Validity starts	-	Start of validity duration of certificate
Validity ends	-	End of validity duration of certificate

In factory-new state the Edge Gateway contains a self-signed certificate. You should replace this by an own certificate that you can upload and install in the way described above (see *Uploading and installing own security certificates* [page 43]).

8.2.8 Help

Open this page with **Help**> **Info**. No access rights are required in order to open this page.

This page displays the firmware version of the Edge Gateway.

Figure 36: Info page

8.2.9 Session

8.2.9.1 User profile

Open this page with **Session**> **User Profile**. No access rights are required in order to open this page.

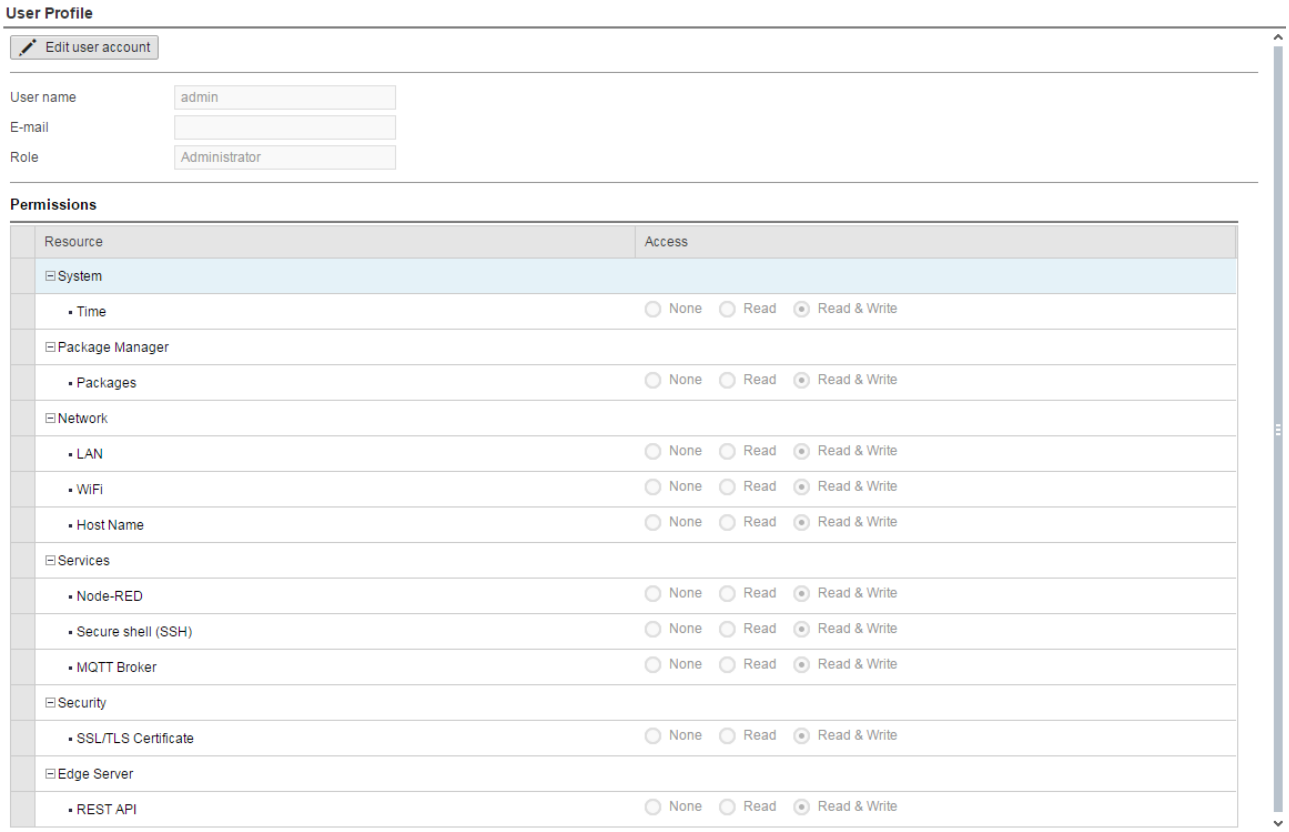


Figure 37: User profile page

On this page you can

- display the access rights of your user account,
- change your E-mail address, and
- change your password.

Changing the e-mail address

➢ Click at Edit user account.

➧ The dialog **Edit user account** is displayed.

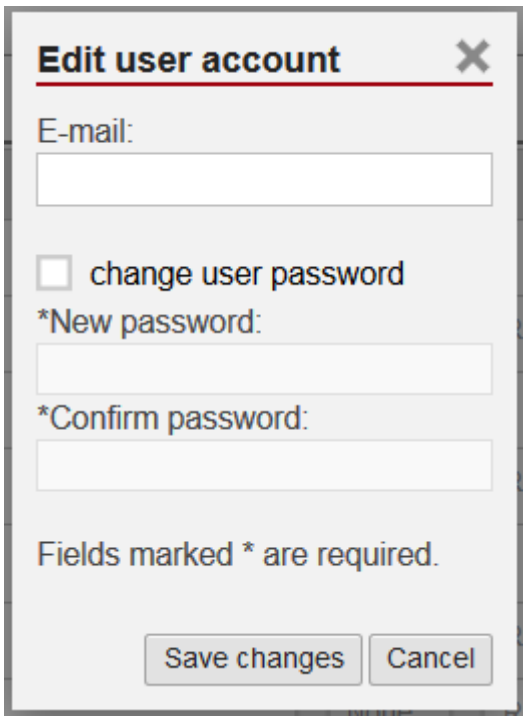


Figure 38: Dialog "Edit user account"

➢ Specify your e-mail address at the input field **E-mail**.

➢ Click at Save changes.

⇨ The specified e-mail address is stored.

Changing the password

➢ Click at Edit user account.

➧ The dialog **Edit user account** is displayed (see figure above).

➢ Check **change user password**.

➢ Click at Save changes.

➢ Specify your password at the input field **New Password**.

➢ In order to confirm your input, specify your password again at the input field **Confirm Password**.

⇨ The changed password is stored.

8.2.9.2 Logout

To log out from the Edge Gateway, use **Session**> **Logout**. No access rights are required to select this menu entry. Prior to accessing the Edge Gateway again, a new login (Specifying user name and password) is necessary.

9 Isolated application execution with Docker

The Edge Gateway enables the user to execute his own applications within the protected Linux operating system. A software platform becomes necessary to allow the execution of said applications without simultaneously opening the possibility of evading the safety mechanisms of the Linux operating system. For that purpose, the Edge Gateway uses the open-source software "Docker" from Docker Inc. (https://www.docker.com/).

In order to work with Docker, read and write access rights at Docker UI are required. You can check whether you have the required access rights via the menu entry *User profile* [page 46]. Granting read and right access rights requires administrator rights and is described in section *Managing user roles* [page 40].

Note:
For more information on Docker, see the documentation of the Docker organization under https://docs.docker.com/.

9.1 Working with Docker via the web GUI

This section describes

- how to operate Docker via the portainer.io interface of the browser
- how to run additional software on the Edge Gateway with Docker (using the web server NGINX as an example).

9.1.1 The portainer.io interface

Tasks of the portainer.io interface

The portainer.io interface serves:

- to add new containers
- to provide functions for controlling the code execution such as *Start*, *Stop*, *Kill*, *Restart*, *Pause*, *Resume*, and *Remove*
- to configure the containers.

Starting the portainer.io interface for working with the containers

To start the portainer.io interface, proceed as follows:

➢ Open the Edge Gateway Manager, if it is not already open.
For this purpose see *Calling the Edge Gateway Manager* [page 20]

➢ Click the tile *Docker Management* in the *Edge Gateway Manager.*.

Figure 39: Tile Docker in the Edge Gateway Manager

The portainer.io login screen will be displayed. In the field **Username**, *admin* is already entered. This is the only predefined user name.

➢ Enter the password for the user name *admin*. This password is set in the user management of the Edge Gateway Manager, see *User management* [page 40].

The start page "Dashboard" of the user interface portainer.io will be displayed.

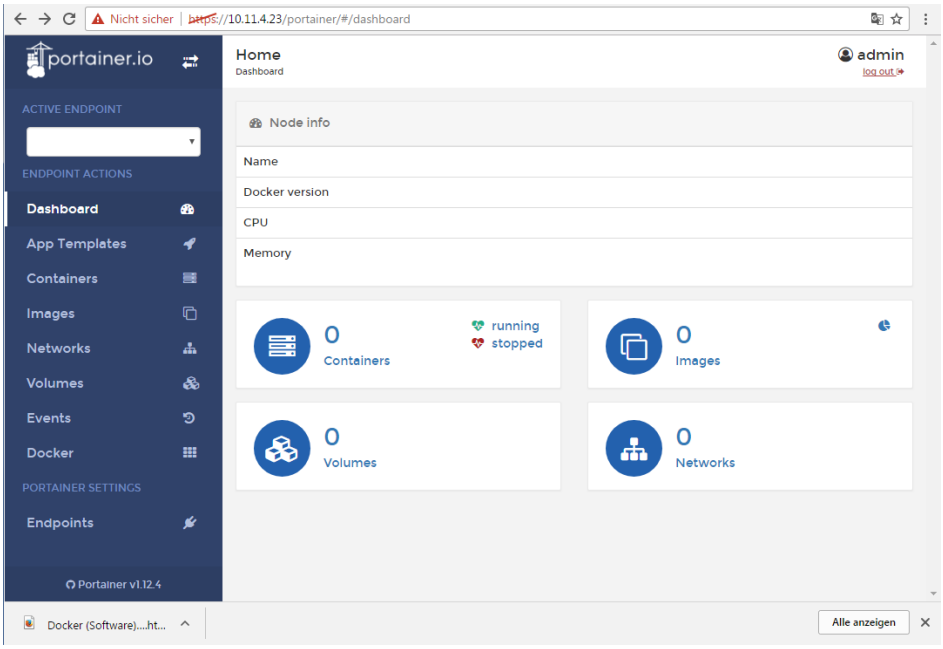


Figure 40: View of portainer.io dashboard

➢ Click **Containers** in the menu on the left or **Containers** on the page "Dashboard".

⇨ The page "Container list" will be displayed. This list contains the names and statuses of all currently known containers and provides the functions for controlling the code execution.

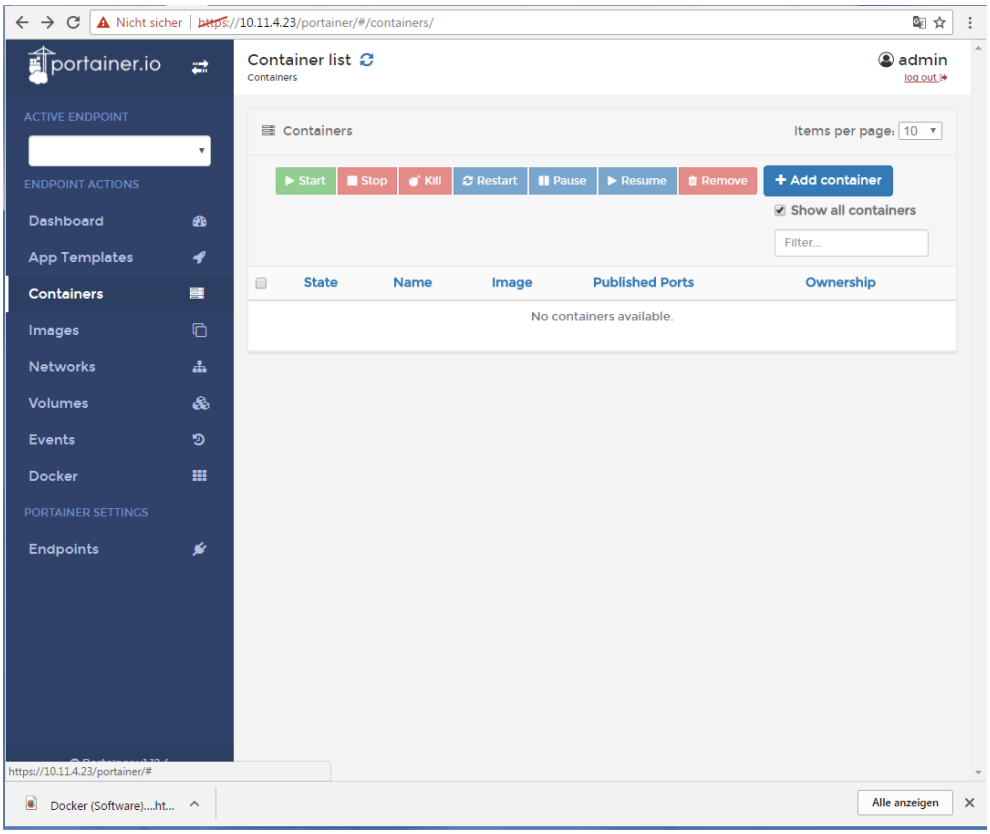


Figure 41: Container list (portainer.io)

Functions for working with containers

Docker provides the following functions for controlling the code execution:

Icon	Function	Meaning
▶ Start	Start	Starting a container
■ Stop	Stop	Stopping a container
Kill	Kill	Aborting the execution of a container
Restart	Restart	Repeated starting of a container
Pause	Pause	Interrupting the execution of a container temporarily
▶ Resume	Resume	Continuing the execution of a container after an interruption
Remove	Remove	Deleting a container

Table 19: Functions for working with containers

10 Decommissioning, dismounting and disposal

10.1 Putting the device out of operation

NOTICE

Danger of Unsafe System Operation!

To prevent personal injury or property damage, make sure that the removal of the device from your plant during operation will not affect the safe operation of the plant.

- ➢ Disconnect all communication cables from the device.
- ➢ Disconnect the power supply plug.
- ➢ Remove the device from the DIN top hat rail. .

10.2 Removing device from top hat rail

- ➢ Before dismounting the Edge Gateway from the top hat rail, first remove the power supply cable and all data cables from the device.
- ➢ Put a screw driver into the slot of the latch at the bottom of the device.
- ➢ To disengage the lock of the hook, pull down the latch with the screw driver.
- ➢ Take the device off the top hat rail.

10.3 Disposal of waste electronic equipment

Important notes from the European Directive 2002/96/EU “Waste Electrical and Electronic Equipment (WEEE)”

Waste electronic equipment

This product must not be treated as household waste.

This product must be disposed of at a designated waste electronic equipment collecting point.

Waste electronic equipment may not be disposed of as household waste. As a consumer, you are legally obliged to dispose of all waste electronic equipment according to national and local regulations.

11 Technical data

11.1 Technical data NIOT-E-NPI3-51-EN-RE

Parameter	Value
Part number	1321.500
Application	For IoT purpose.
Operating system	PROFINET IO EtherNet/IP
Operating system	Security Enhanced Linux
CPU	1.2 GHz Broadcom BCM2837
LAN interface	1 x 10/100 Mbit, Microchip LAN9514
Fieldbus (Real-Time Ethernet) interface	2 x 10/100 Mbit, Hilscher netX51
Memory	1 GB DDR3 RAM, 4 GB SD memory
Real-time clock	Yes, maintenance free
Wi-Fi	802.11bgn
Bluetooth	V4.1
Display connection	HDMI
USB	4 x USB 2.0 (500 mA)
Serial interface	-
Power supply	19.2 V DC … 28 V DC
Current (at 24 V DC)	Tbd
Operating temperature	0 °C ... + 60 °C
Dimensionen (H x W x L)	120 x 40 x 100 mm

Table 20: Technical datd NIOT-E-TPI51-EN-RE

12 FCC authorization

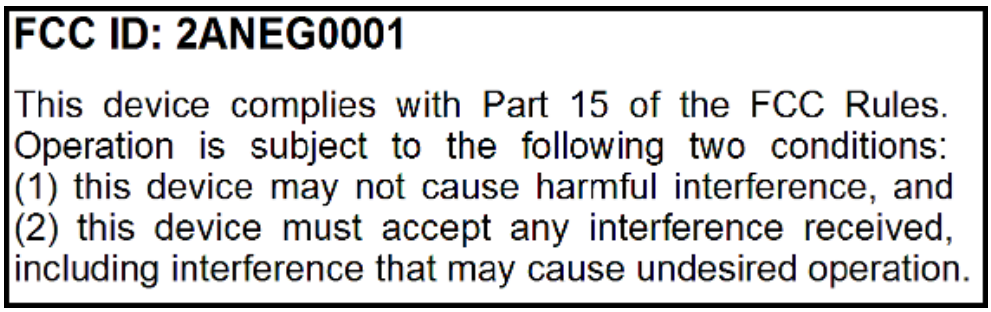


Figure 42: FCC label

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator and your body. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

List of figures

List of tables

Contacts

HEADQUARTERS

Germany

Hilscher Gesellschaft für
Systemautomation mbH
Rheinstrasse 15
D-65795 Hattersheim
Phone: +49 (0) 6190 9907-0
Fax: +49 (0) 6190 9907-50
E-Mail: info@hilscher.com

Support

Phone: +49 (0) 6190 9907-99
E-Mail: de.support@hilscher.com

SUBSIDIARIES

China

Hilscher Systemautomation (Shanghai) Co. Ltd.
200010 Shanghai
Phone: +86 (0) 21-6355-5161
E-Mail: info@hilscher.cn

Support

Phone: +86 (0) 21-6355-5161
E-Mail: cn.support@hilscher.com

France

Hilscher France S.a.r.l.
69500 Bron
Phone: +33 (0) 4 72 37 98 40
E-Mail: info@hilscher.fr

Support

Phone: +33 (0) 4 72 37 98 40
E-Mail: fr.support@hilscher.com

India

Hilscher India Pvt. Ltd.
Pune
Phone: +91 8888 750 777
E-Mail: info@hilscher.in

Italy

Hilscher Italia S.r.l.
20090 Vimodrone (MI)
Phone: +39 02 25007068
E-Mail: info@hilscher.it

Support

Phone: +39 02 25007068
E-Mail: it.support@hilscher.com

Japan

Hilscher Japan KK
Tokyo, 160-0022
Phone: +81 (0) 3-5362-0521
E-Mail: info@hilscher.jp

Support

Phone: +81 (0) 3-5362-0521
E-Mail: jp.support@hilscher.com

Korea

Hilscher Korea Inc.
Seongnam, Gyeonggi, 463-400
Phone: +82 (0) 31-789-3715
E-Mail: info@hilscher.kr

Switzerland

Hilscher Swiss GmbH
4500 Solothurn
Phone: +41 (0) 32 623 6633
E-Mail: info@hilscher.ch

Support

Phone: +49 (0) 6190 9907-99
E-Mail: ch.support@hilscher.com

USA

Hilscher North America, Inc.
Lisle, IL 60532
Phone: +1 630-505-5301
E-Mail: info@hilscher.us

Support

Phone: +1 630-505-5301
E-Mail: us.support@hilscher.com