



Industrial Ethernet Switches and Media Converters USER MANUAL



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Industrial Unmanaged and Managed Ethernet Switches and Media Converters

USER MANUAL



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HARDWARE



CHAPTER 1

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Introduction

The Purpose of this User's Manual

Thank you for purchasing our *Stride*™ Industrial Ethernet Switches and Media Converters. This manual describes *AutomationDirect.com*'s *Stride* industrial Ethernet switches and media converters, their specifications, included components, and provides you with important information for installation, connectivity and setup. The manual shows you how to install, wire and use the products.

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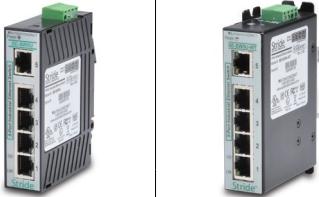



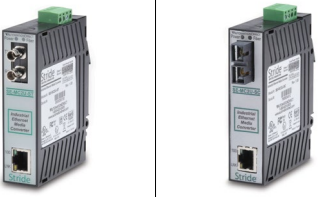


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*When you see the "exclamation mark" icon in the left-hand margin, the paragraph to its immediate right will be a warning or a caution. This information could prevent injury, loss of property, or even death (in extreme cases). The words **WARNING** or **CAUTION**: in **boldface** will mark the beginning of the text.*

Product Overview

Stride Unmanaged Ethernet Switches		
Part Number	Description	
SE-SW5U SE-SW5U-WT		<p>STRIDE™ SlimLine Industrial Unmanaged Ethernet Switch with five 10/100BaseT RJ45 Ethernet ports. Redundant power inputs with surge and spike protection. Auto-crossover. 35 mm DIN rail mounting. Supports store & forward wire speed switching and full-duplex with flow control. UL, CSA (CUL), & CE</p> <p><i>Note: -WT models have a metal case and are rated for a wider temperature range, from -40 ° to +85 °C.</i></p>
SE-SW8U SE-SW8U-WT		<p>STRIDE™ SlimLine Industrial Unmanaged Ethernet Switch with eight 10/100BaseT RJ45 Ethernet ports. Redundant power inputs with surge and spike protection. Auto-crossover. 35 mm DIN rail mounting. Supports store & forward wire speed switching and full-duplex with flow control. UL, CSA (CUL), & CE</p> <p><i>Note: -WT models have a metal case and are rated for a wider temperature range, from -40 ° to +85 °C.</i></p>
SE-SW5U-ST SE-SW5U-SC SE-SW5U-ST-WT SE-SW5U-SC-WT		<p>STRIDE™ SlimLine Industrial Unmanaged Ethernet Switch with four 10/100BaseT RJ45 Ethernet Ports and one 100BaseFX Fiber Optic Port (ST or SC type multimode fiber connector for links up to 4km). Redundant power inputs with surge and spike protection. Auto-crossover. 35 mm DIN rail mounting. Supports store & forward wire speed switching and full-duplex with flow control. UL, CSA (CUL), & CE</p> <p><i>Note: -WT models have a metal case and are rated for a wider temperature range, from -40 ° to +85 °C.</i></p>
SE-SW9U-ST SE-SW9U-SC SE-SW9U-ST-WT SE-SW9U-SC-WT		<p>STRIDE™ SlimLine Industrial Unmanaged Ethernet Switch with eight 10/100BaseT RJ45 Ethernet Ports and one 100BaseFX Fiber Optic Port (ST or SC type multimode fiber connector for links up to 4km). Redundant power inputs with surge and spike protection. Auto-crossover. 35 mm DIN rail mounting. Supports store & forward wire speed switching and full-duplex with flow control. UL, CSA (CUL), & CE</p> <p><i>Note: -WT models have a metal case and are rated for a wider temperature range, from -40 ° to +85 °C.</i></p>
SE-MC2U-ST SE-MC2U-SC		<p>STRIDE™ SlimLine Industrial Unmanaged Ethernet to Fiber Converter with one 10/100BaseT auto-detecting, auto-crossover and auto-polarity RJ45 Ethernet Port and one 100BaseFX Fiber Optic Port (ST or SC type multimode fiber connector for links up to 4km). Redundant power inputs with surge and spike protection. 35 mm DIN rail mounting. Supports store & forward wire speed switching and full-duplex with flow control. UL, CSA (CUL), & CE</p>

Product Overview (cont'd)

<i>Stride Managed Ethernet Switches</i>		
<i>Part Number</i>		<i>Description</i>
SE-SW5M		STRIDE™ SlimLine industrial managed 5-port Ethernet switch, metal housing, -40 to +75 deg. C operating temperature range, five 10/100BaseT RJ45 Ethernet ports. Redundant power inputs with surge and spike protection, auto-crossover, 35 mm DIN rail mounting. Supports Store and Forward wire speed switching and full-duplex with flow control. UL/CUL HazLoc (Class I, Div. 2, Groups A, B, C, D) and CE marked.
SE-SW5M-2ST SE-SW5M-2SC		STRIDE™ SlimLine industrial managed 5-port Ethernet switch, metal housing, -40 to +75 deg., three 10/100BaseT RJ45 Ethernet ports and two multi-mode 100BaseFX fiber ports(ST or SC type multimode fiber connector for links up to 4km). Redundant power inputs with surge and spike protection, auto-crossover, 35 mm DIN rail mounting. Supports Store and Forward wire speed switching and full-duplex with flow control. UL/CUL HazLoc (Class I, Div. 2, Groups A, B, C, D) and CE marked.
SE-SW8M		STRIDE™ SlimLine industrial managed 8-port Ethernet switch, metal housing, -40 to +75 deg. C operating temperature range, eight 10/100BaseT RJ45 Ethernet ports. Redundant power inputs with surge and spike protection, auto-crossover, 35 mm DIN rail mounting. Supports Store and Forward wire speed switching and full-duplex with flow control. UL/CUL HazLoc (Class I, Div. 2, Groups A, B, C, D) and CE marked.
SE-SW8M-2ST SE-SW8M-2SC		STRIDE™ SlimLine industrial managed 8-port Ethernet switch, metal housing, -40 to +75 deg., six 10/100BaseT RJ45 Ethernet ports and two multi-mode 100BaseFX fiber ports(ST or SC type multimode fiber connector for links up to 4km). Redundant power inputs with surge and spike protection, auto-crossover, 35 mm DIN rail mounting. Supports Store and Forward wire speed switching and full-duplex with flow control. UL/CUL HazLoc (Class I, Div. 2, Groups A, B, C, D) and CE marked.
SE-SW16M		STRIDE™ SlimLine industrial managed 16-port Ethernet Switch, metal housing, -40 to +75 deg. C operating temperature range, sixteen 10/100BaseT RJ45 Ethernet ports. Redundant power inputs with surge and spike protection, auto-crossover, 35 mm DIN rail mounting. Supports Store and Forward wire speed switching and full-duplex with flow control. UL/CUL HazLoc (Class I, Div. 2, Groups A, B, C, D) and CE marked.
SE-SW8MG-4P		STRIDE™ SlimLine industrial managed 8-port Ethernet switch all Gigabit, metal housing, -40 to +75 deg., eight 10/100/1000 BaseT RJ45 Ethernet ports and four advanced combination SFP ports that accept noise-immune fiber optic links up to 40 km. Redundant power inputs with surge and spike protection, auto-crossover, 35 mm DIN rail mounting. Supports Store and Forward wire speed switching and full-duplex with flow control. UL/CUL HazLoc (Class I, Div. 2, Groups A, B, C, D) and CE marked. SFP option modules sold separately.
SE-SW10MG-2P		STRIDE™ SlimLine industrial managed 10-port Ethernet switch with Gigabit, metal housing, -40 to +75 deg., seven 10/100 BaseT RJ45 Ethernet ports, three Gigabit 10/100/1000 BaseT RJ45 port and two advanced combination SFP ports that accept noise-immune fiber optic links up to 40 km. Redundant power inputs with surge and spike protection, auto-crossover, 35 mm DIN rail mounting. Supports Store and Forward wire speed switching and full-duplex with flow control. UL/CUL HazLoc (Class I, Div. 2, Groups A, B, C, D) and CE marked. SFP option modules sold separately.

Managed Switch Accessories

<i>SFP Transceiver</i>	
<i>Part Number</i>	<i>Description</i>
SFP-4K-FMF	STRIDE™ 100Mb Small Form Factor Pluggable (SFP) transceiver module (Transmit/Receive). Uses a long wavelength of 1310nm, supports data transmission up to 4km on a multi-mode fiber. LC duplex receptacle, SFP Multi-Source Agreement compliant. 125Mbps IEEE802.3u 100Base-FX compliant, 125Mbps FDDI ISO/IEC 9314-1 compliant.
SFP-30K-FSF	STRIDE™ 100Mb Small Form Factor Pluggable (SFP) transceiver module (Transmit/Receive). Uses a long wavelength of 1310nm, supports data transmission up to 30km on a singlemode fiber. LC duplex receptacle, SFP Multi-Source Agreement compliant.
SFP-500-GMF	STRIDE™ Gigabit (1.25GB) Small Form Factor Pluggable (SFP) transceiver module (Transmit/Receive). Uses a short wavelength of 850nm, supports data transmission up to 550 meters on a multi-mode fiber. LC duplex receptacle, SFP Multi-Source Agreement compliant. 1.0625Gbps Fibre Channel FC-PI 100-M5-SN-I compliant. 1.0625Gbps Fibre Channel FC-PI 100-M6-SN-I compliant. 1.25Gbps IEEE802.3z 1000Base-SX compliant. 1.25Gbps IEEE802.3ah compliant.
SFP-2K-GMF	STRIDE™ Gigabit (1.25GB) Small Form Factor Pluggable (SFP) transceiver module. Uses a long wavelength of 1310nm, supports data transmission up to 2km on a multi-mode fiber. LC duplex receptacle, SFP Multi-Source Agreement compliant. IEEE 802.3 1000Base-SX compliant.
SFP-10K-GSF	STRIDE™ Gigabit (1.25GB) Small Form Factor Pluggable (SFP) transceiver module (Transmit/Receive). Uses a long wavelength of 1310nm, supports data transmission up to 10km on a singlemode fiber. LC duplex receptacle, SFP Multi-Source Agreement compliant. 1.0625Gbps Fiber Channel FC-PI 100-SM-LC-L compliant. 1.25Gbps IEEE 802.3 1000Base-LX compliant.
SFP-30K-GSF	STRIDE™ Gigabit (1.25GB) Small Form Factor Pluggable (SFP) transceiver module (Transmit/Receive). Uses a long wavelength of 1310nm, supports data transmission up to 30km on a singlemode fiber. LC duplex receptacle, SFP Multi-Source Agreement compliant. 1.25Gbps IEEE 802.3 1000Base-LX compliant.



General Information

Overview

This user's manual will help you install and maintain the *STRIDE* industrial Ethernet switches and media converters. Installation of these devices is very easy and they will begin to operate as soon as they are powered up.

Operation













Unlike an Ethernet hub that broadcasts all messages out all ports, these industrial Ethernet switches will intelligently route Ethernet messages only out the appropriate port. The major benefits of this are increased bandwidth and speed, reduction or elimination of message collisions, and deterministic performance when tied with real-time systems.

These industrial Ethernet switches can support 10BaseT (10 Mbps) or 100BaseT (100 Mbps) on their RJ45 ports. Each of these ports will independently auto-sense the speed and duplex, mdi/mdix-crossover and polarity allowing you to use patch or crossover cables. Managed switches include models that support gigabit Ethernet.

Some models include fiber optic ports, or slots that accept SFP fiber optic transceivers.

Safety Standards

These industrial Ethernet switches meet the following standards plus others:

 	<p>Electrical Safety - CE per Low Voltage Directive and EN61010-1 (IEC1010) UL recognition per UL508 (UL File #E200031) CSA per C22.2/14 (cUL File #E200031) See Warnings on following page</p>
	<p>Install the Switches in accordance with local and national electrical codes.</p>
	<p>Lightning Danger: Do not work on equipment during periods of lightning activity. Do not connect a telephone line into one of the Ethernet RJ45 connectors.</p>
 	<p>EMC (emissions and immunity) - <ul style="list-style-type: none"> • CE per the EMC directive, EN61000-6-2, EN61000-6-4 • FCC part 15 and ICES 003; Class B. See FCC statement on following page.</p>
 	<p>Marine, maritime and offshore - These devices, when installed in an appropriately IP rated enclosure. Comply with DNV No. 2.4 and equivalent Lloyds and ABS standards. For marine and maritime compliance, do not install this product within 5 meters of a standard or a steering magnetic compass.</p>
	<p>WEEE compliance - These devices comply with the WEEE directive. Dispose of properly.</p>
	<p>RoHS compliance - These devices comply with the RoHS directive and are considered lead and other hazardous substance free.</p>
 	<p>Hazardous Locations - <ul style="list-style-type: none"> • CE per ATEX directive and EN60079-15 (Zone 2); EEx nA II T4 X (-40 °C ≤ T_a ≤ +85 °C) • UL per UL HazLoc (Class 1, Div. 2), Groups A, B, C, D (UL File #E200031) • CSA per C22.2/213 (Class 1, Div.2), Groups A, B, C, D (cUL File #E200031) See Warnings on following page</p>

Installation and Hazardous Area Warnings



Warning: These products should not be used to replace proper safety interlocking. No software-based device (or any other solid-state device) should ever be designed to be responsible for the maintenance of consequential equipment or personnel safety. In particular, AutomationDirect.com disclaims any responsibility for damages, either direct or consequential, that result from the use of this equipment in any application. All power, input and output (I/O) wiring must be in accordance with Class 1, Division 2 wiring methods and in accordance with the authority having jurisdiction.

WARNING (EXPLOSION HAZARD)	SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR CLASS 1, DIVISION 2 (ZONE 2).
WARNING (EXPLOSION HAZARD)	WHEN IN HAZARDOUS LOCATIONS, DISCONNECT POWER BEFORE REPLACING OR WIRING UNITS.
WARNING (EXPLOSION HAZARD)	DO NOT DISCONNECT EQUIPMENT UNLESS POWER HAS BEEN SWITCHED OFF OR THE AREA IS KNOWN TO BE NONHAZARDOUS.
WARNING (EXPLOSION HAZARD)	IN HAZARDOUS OR POTENTIALLY HAZARDOUS LOCATIONS, DO NOT SEPARATE ANY PART OF THE UNIT WHEN ENERGIZED. USE THE UNIT FOR INTERNAL CONNECTIONS ONLY.

FCC Statement

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.

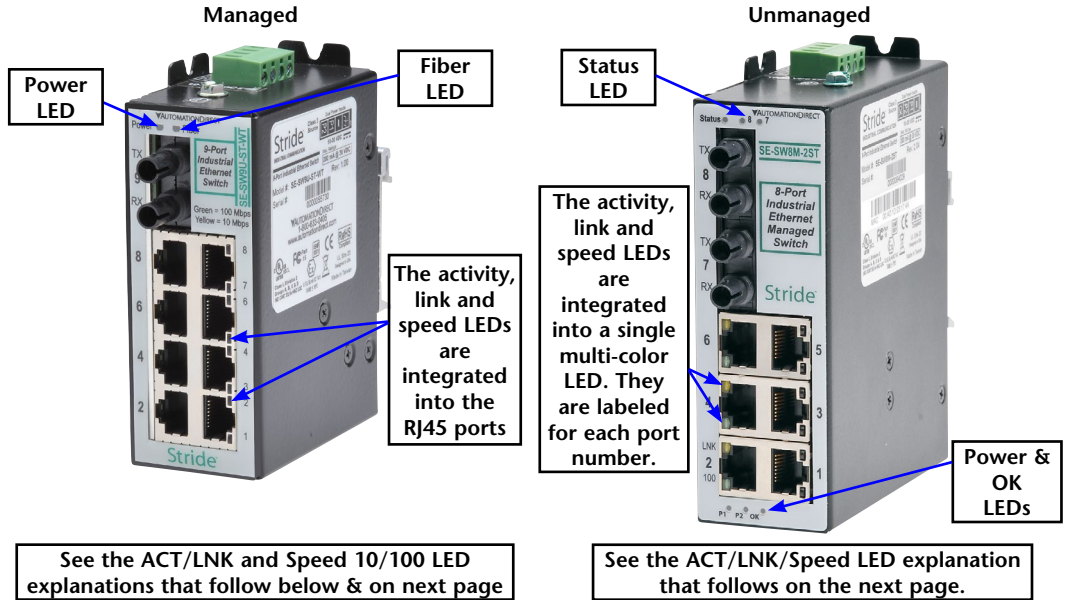


NOTE: All information in this document is subject to change without notice.

LED Indicators

Overview

The *Stride* industrial Ethernet switches have 1 or 2 communication LEDs for each port and a power LED. The managed models also have an “OK” output LED, a status LED and dual power LEDs.



Status LED

Managed Models Only: The Status LED indicates the overall health of the switch. It is normally ON solid indicating that no internal CPU or software problems are detected. It will flash when loading firmware and briefly on power up or reset. Otherwise, if it is OFF or flashing for an extended period of time then a problem is detected. In this case, please contact AutomationDirect for support.

Power LED

On unmanaged models there is one power LED that is ON if either power input (P1 or P2) has power applied to it. On the managed models there are two Power LEDs that indicate if there is power applied to the respective input.

Explanation of LED Indicators continued on next page.

ACT/LNK LED

This is the **Yellow** LED on models with two LEDs per RJ45 port.

ON (yellow) (not flashing)	Indicates that there is a proper Ethernet connection (Link) between the port and another Ethernet device, but no communications activity is detected.
ON (yellow) (flashing)	Indicates that there is a proper Ethernet connection (Link) between the port and another Ethernet device, and that there is communications activity.
OFF	Indicates that there is not a proper Ethernet connection (Link) between the port and another Ethernet device. Make sure the cable has been plugged securely into the ports at both ends.

Speed 10/100 LED

This is the **Green** LED on models with two LED's per RJ45 port.

ON (green)	A 100 Mbps (100BaseT) connection is detected.
OFF	A 10 Mbps (10BaseT) connection is detected.

ACT/LNK/Speed LED

This is a bi-color (**Green / Yellow**) LED on models with one LED per RJ45 port.

ON Solid (not flashing)	Indicates that there is a proper Ethernet connection (Link) between the port and another Ethernet device, but no communications activity is detected.
Flashing	Indicates that there is a proper Ethernet connection (Link) between the port and another Ethernet device, and that there is communications activity.
Green	On 10/100 ports, a 100 Mbps connection is detected. On 10/100/1000 ports, a 1000 Mbps connection is detected.
Yellow	On 10/100 ports, a 10 Mbps connection is detected. On 10/100/1000 ports, a 10 or 100 Mbps connection is detected.
OFF	Indicates that there is not a proper Ethernet connection (Link) between the port and another Ethernet device. Make sure the cable has been plugged securely into the ports at both ends.

OK LED

Managed Models: This LED indicates the status of the power inputs. There is an output screw terminal that can be connected as shown in the wiring diagram. **The output voltage between the screw terminal marked 'OK' and the terminal marked '-' will be the same as the applied switch input voltage.** The output will be ON when both the PI and P2 terminals have power applied to them. It will be OFF if either input does not have power or the switch software is not running.

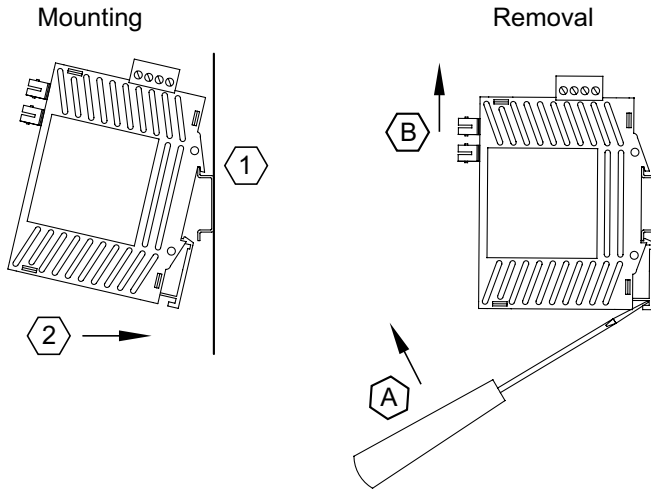
Installation, Plastic Case Switches

Overview

These industrial Ethernet switches and media converters can be snapped onto a standard 35 mm x 7.5 mm height DIN rail (Standard: CENELEC EN50022). The switches and media converters can be mounted either vertically or horizontally. Refer to the mechanical drawings that follow for proper mounting.



NOTE: Make sure to allow enough room to route your Ethernet copper or fiber optic cables.



DIN Rail Mounting

DIN rail mounting steps:

1. Hook top back of unit over the DIN rail.
2. Push bottom back onto the DIN rail until it snaps into place.

DIN rail removal steps:

- A. Insert screwdriver into DIN clip and pry until it releases from the DIN rail.
- B. Unhook top of unit from DIN rail.

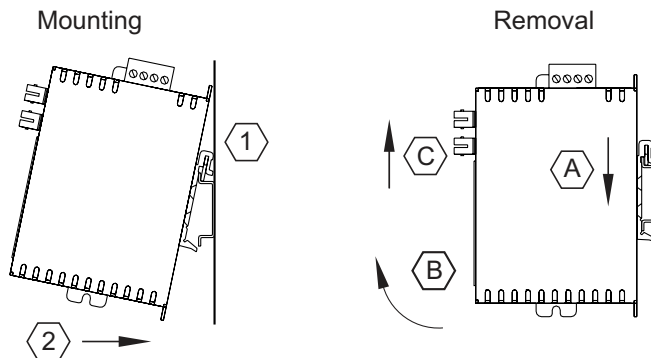
Installation, Metal Case Switches

Overview

These industrial Ethernet switches can be snapped onto a standard 35 mm x 7.5 mm height DIN rail (Standard: CENELEC EN50022). They can be mounted either vertically or horizontally. Refer to the mechanical drawings that follow for proper mounting.



NOTE: Make sure to allow enough room to route your Ethernet copper or fiber optic cables.



DIN Rail Mounting

DIN rail mounting steps:

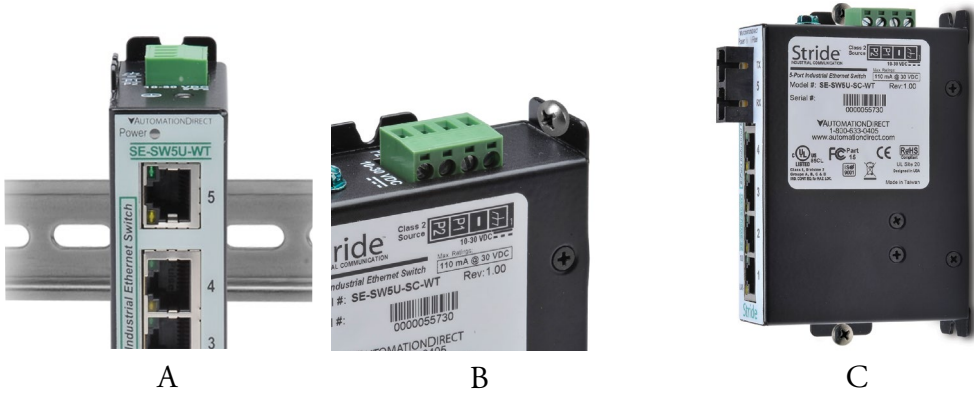
1. Hook top back of unit over the DIN rail.
2. Push bottom back onto the DIN rail until it snaps into place.

DIN rail removal steps:

- A. Push the unit down to free the bottom of the DIN rail.
- B. Rotate the bottom of the unit away from the DIN rail.
- C. Unhook top of unit from DIN rail.

Mounting Options

Stride switches with metal cases offer the following optional mounting methods.



A

B

C

A. Vertical DIN rail mount.

This mounting option allows for quickest installation and optimal utilization of rail space.

B. Vertical screw to panel mount.

This mounting option gives better shock and vibration resistance.

C. Flat screw to panel mount.

This mounting option offers a low profile orientation in shallow boxes plus the best shock and vibration resistance. The power connection terminal block is removable for access to the mounting tab.

Important Notes about Thermal Performance

Stride switches with metal cases use an innovative technique to remove excess heat from the product and its components. This technique effectively utilizes the heavy gauge all-aluminum case as a large heat sink. Therefore, the case may be warm during operation, especially with heavy loads such as all ports linked and active. This is normal operation. For best performance, it is recommended that a DIN rail spacer such as end clamp, part number DN-EB35, be used between the switch and any adjacent device. This will leave an air gap for best heat dissipation off the case.

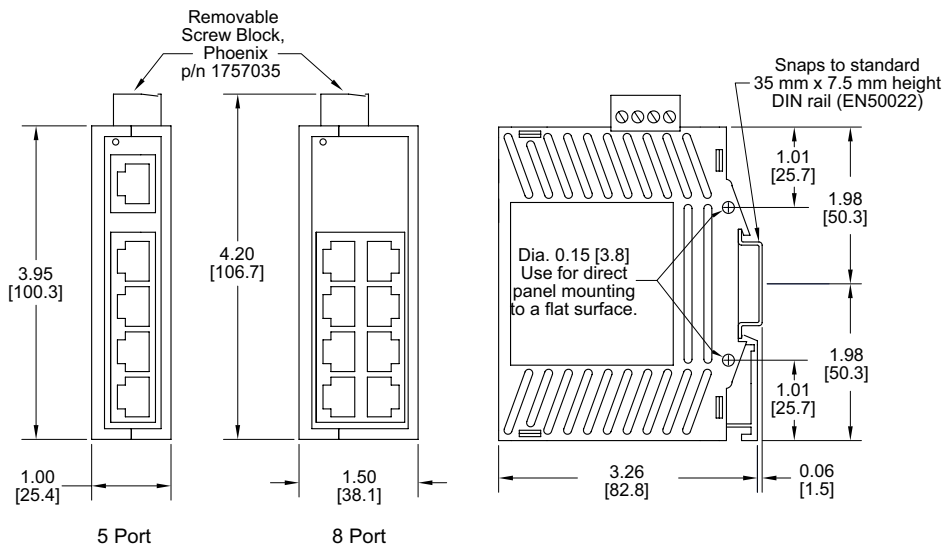
For best thermal performance when direct panel mounting to a metal surface, thermal compound may be used between the switch and mounting surface. This will reduce any air gaps and optimize the transfer of heat from the case to the mounting surface.



Mechanical Dimensions for 5 and 8-Port Unmanaged Models in Plastic Case

Inches [mm]

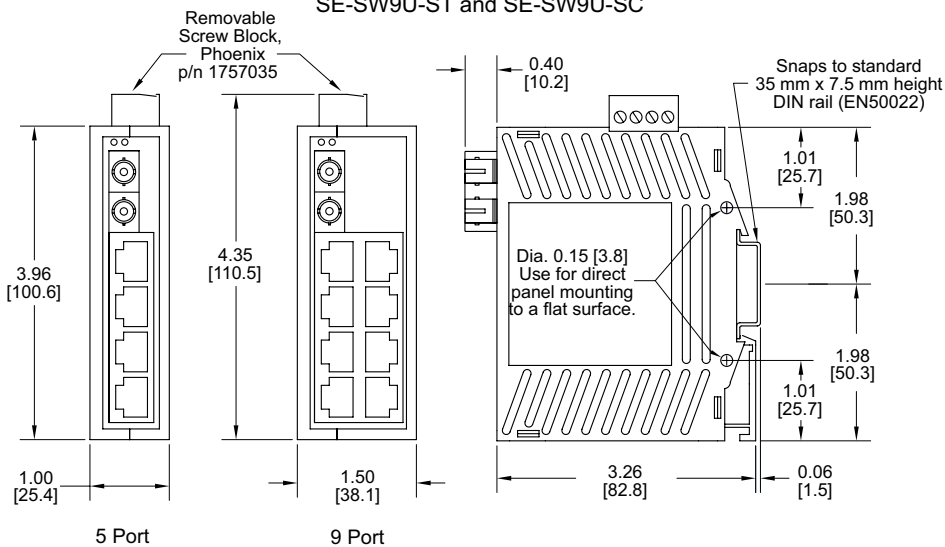
5 or 8 Port – SE-SW5U & SE-SW8U



Mechanical Dimensions for 5 and 9-Port Unmanaged Models with Fiber in Plastic Case

Inches [mm]

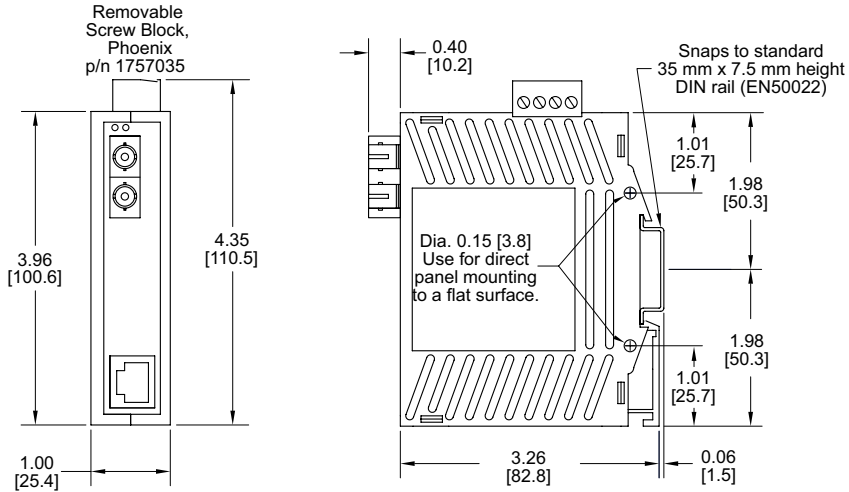
SE-SW5U-ST, SE-SW5U-SC
SE-SW9U-ST and SE-SW9U-SC



Mechanical Dimensions for 2-Port Media Converter in Plastic Case

Inches [mm]

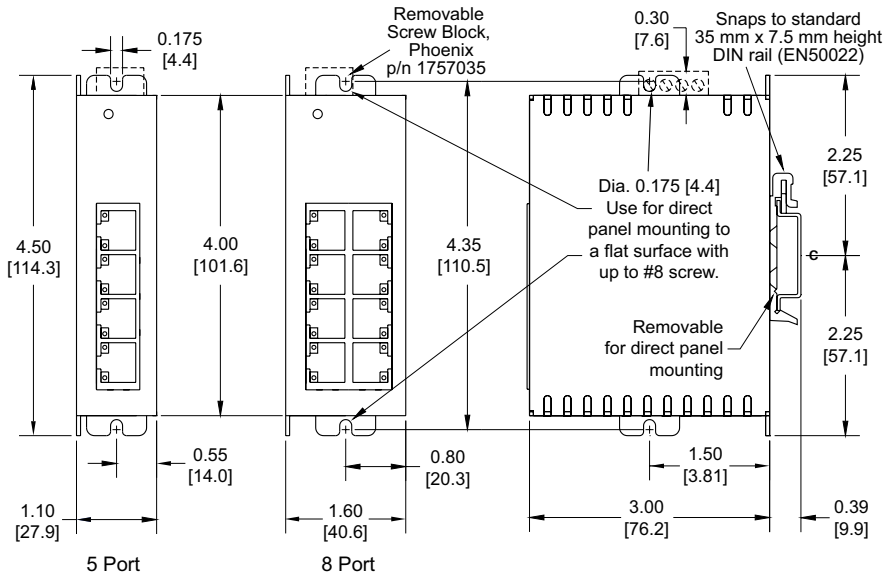
Media Converters – SE-MC2U-ST and SE-MC2U-SC



Mechanical Dimensions for 5 and 8-Port Unmanaged Models in Metal Case

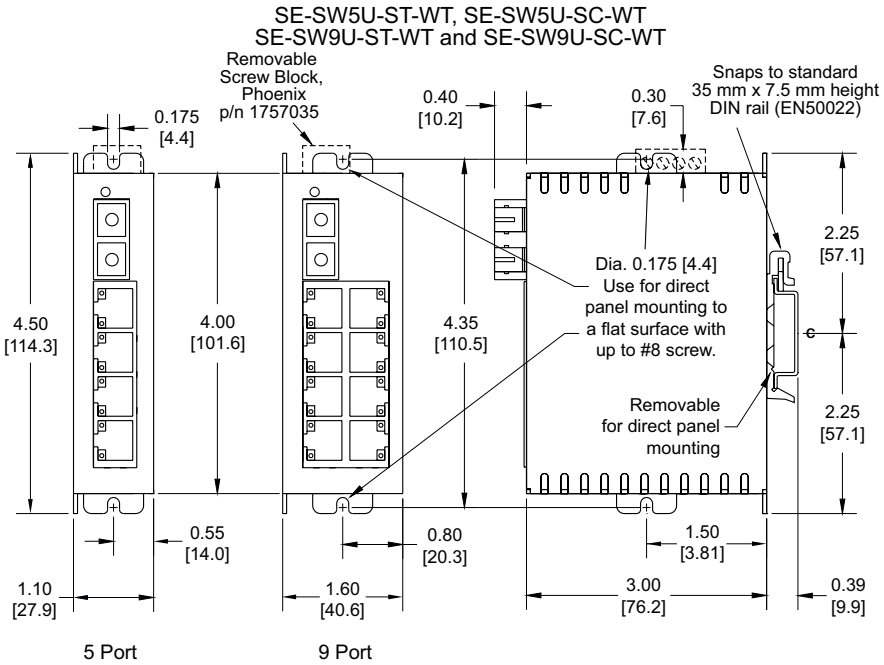
Inches [mm]

5 or 8 Port – SE-SW5U-WT & SE-SW8U-WT



Mechanical Dimensions for 5 and 9-Port Unmanaged Models with Fiber in Metal Case

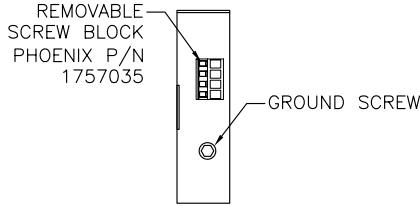
Inches [mm]



Mechanical Dimensions for 5-Port Managed Model

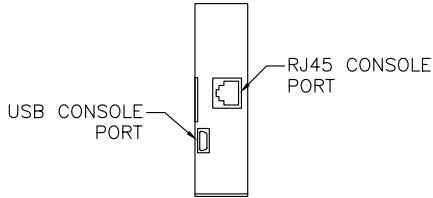
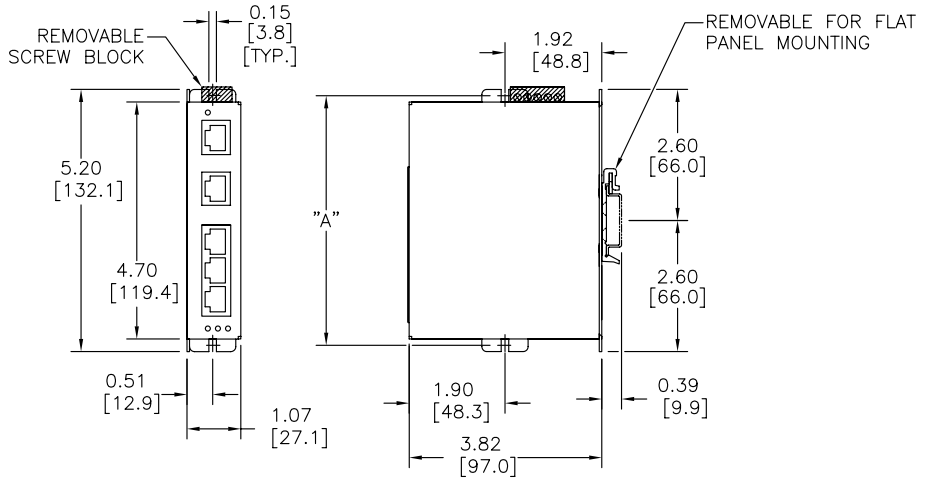
Inches [mm]

SE-SW5M



SCREW MOUNTING LOCATIONS	
SCREW SIZE	DIM "A"
#6	5.05 [128.3]
#8	5.10 [129.5]
#10	5.15 [130.8]
#12	5.20 [132.1]

TOP VIEW

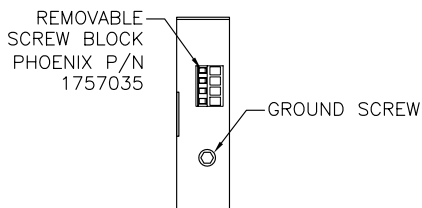


BOTTOM VIEW

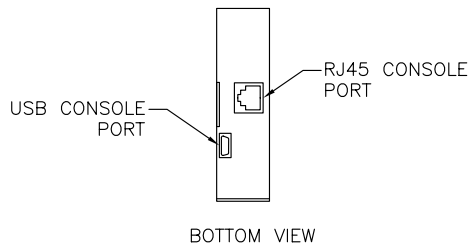
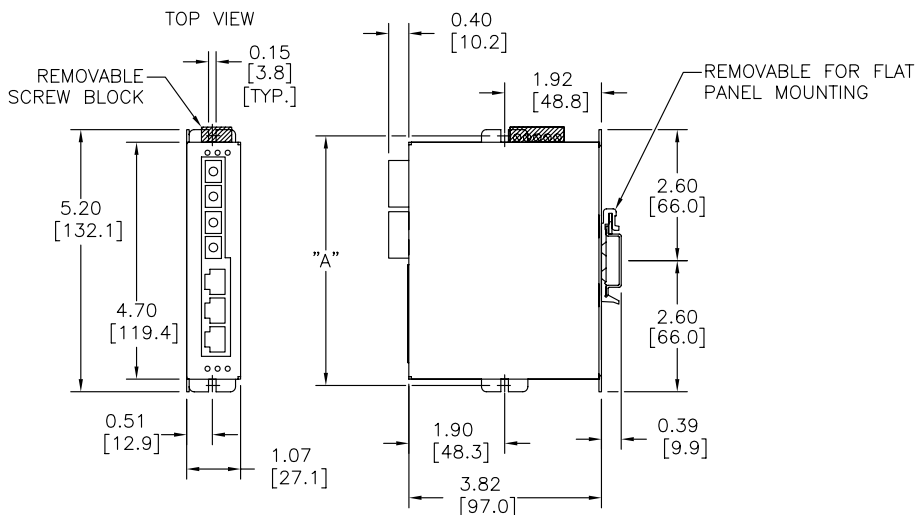
Mechanical Dimensions for 5-Port Managed Models with Fiber

Inches [mm]

SE-SW5M-2ST and SE-SW5M-2SC



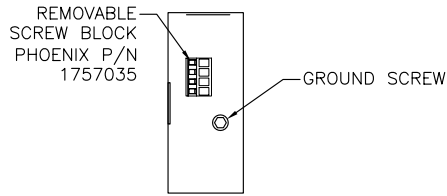
SCREW MOUNTING LOCATIONS		
SCREW SIZE	DIM "A"	
#6	5.05	[128.3]
#8	5.10	[129.5]
#10	5.15	[130.8]
#12	5.20	[132.1]



Mechanical Dimensions for 8-Port Managed Model

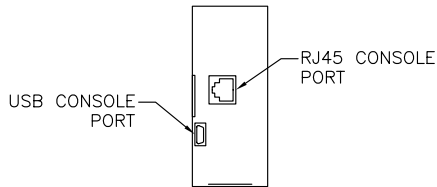
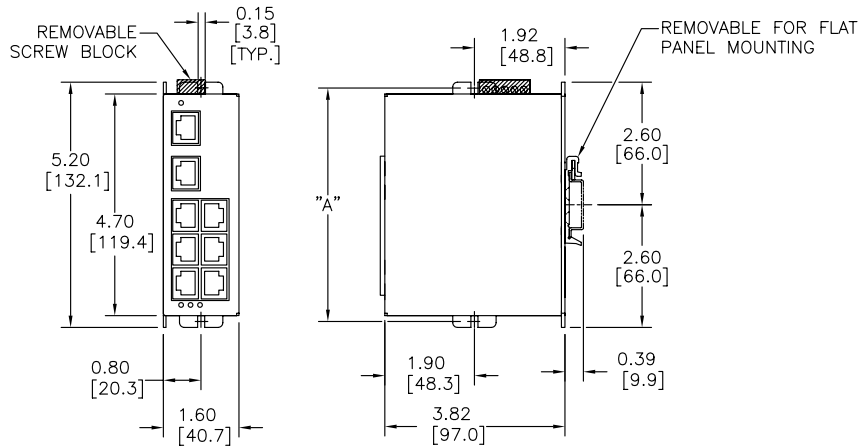
Inches [mm]

SE-SW8M



SCREW MOUNTING LOCATIONS		
SCREW SIZE	DIM "A"	
#6	5.05	[128.3]
#8	5.10	[129.5]
#10	5.15	[130.8]
#12	5.20	[132.1]

TOP VIEW

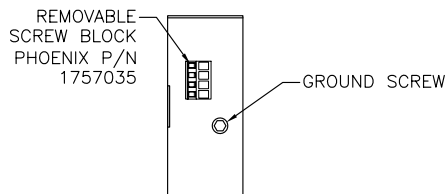


BOTTOM VIEW

Mechanical Dimensions for 8-Port Managed Models with Fiber

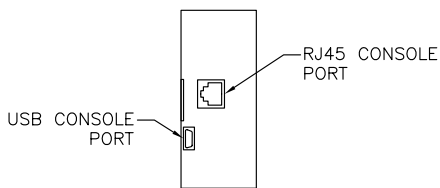
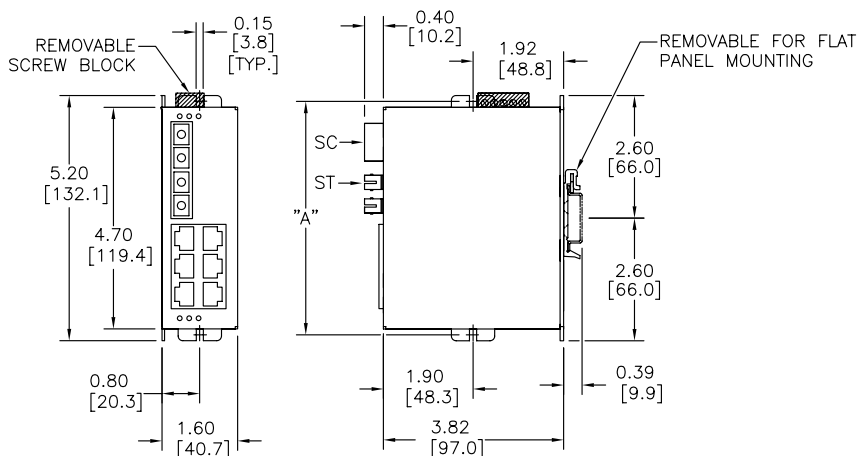
Inches [mm]

SE-SW8M-2ST and SE-SW8M-2SC



TOP VIEW

SCREW MOUNTING LOCATIONS		
SCREW SIZE	DIM "A"	
#6	5.05	[128.3]
#8	5.10	[129.5]
#10	5.15	[130.8]
#12	5.20	[132.1]

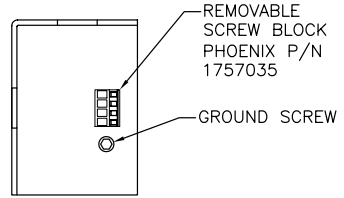


BOTTOM VIEW

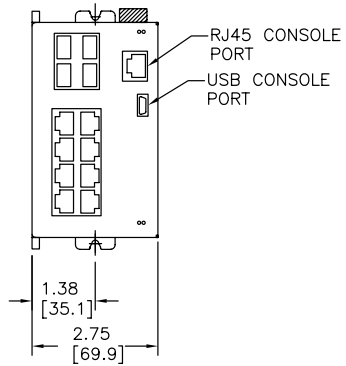
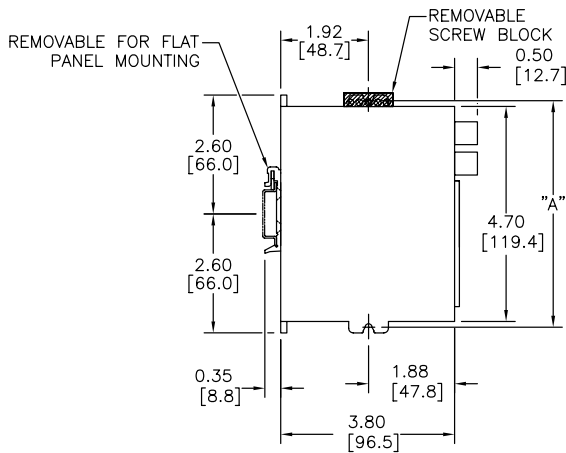
Mechanical Dimensions for 8-Port Managed Gigabit Switch with Four SFP Ports

Inches [mm]

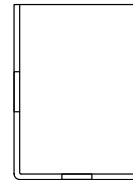
SE-SW8MG-4P



TOP VIEW



SCREW MOUNTING LOCATIONS	
SCREW SIZE	DIM "A"
#6	5.05 [128.3]
#8	5.10 [129.5]
#10	5.15 [130.8]
#12	5.20 [132.1]

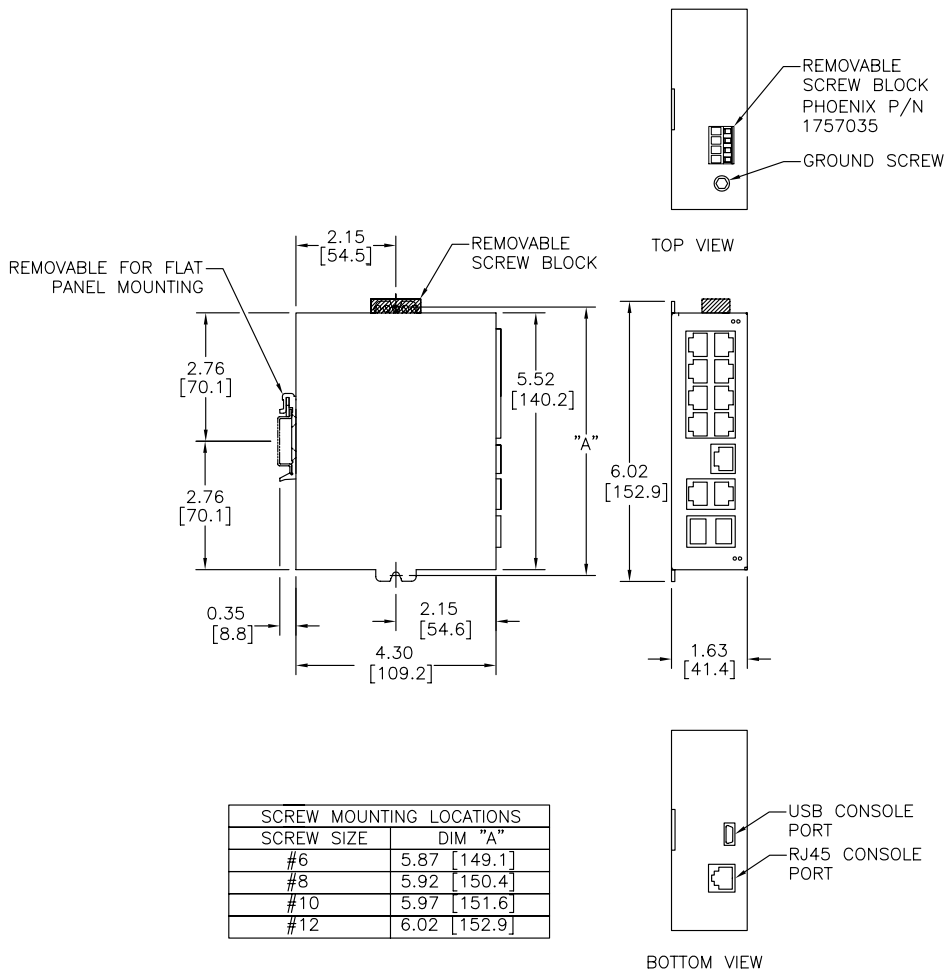


BOTTOM VIEW

Mechanical Dimensions for 10-Port Managed Gigabit Switch with Two SFP Ports

Inches [mm]

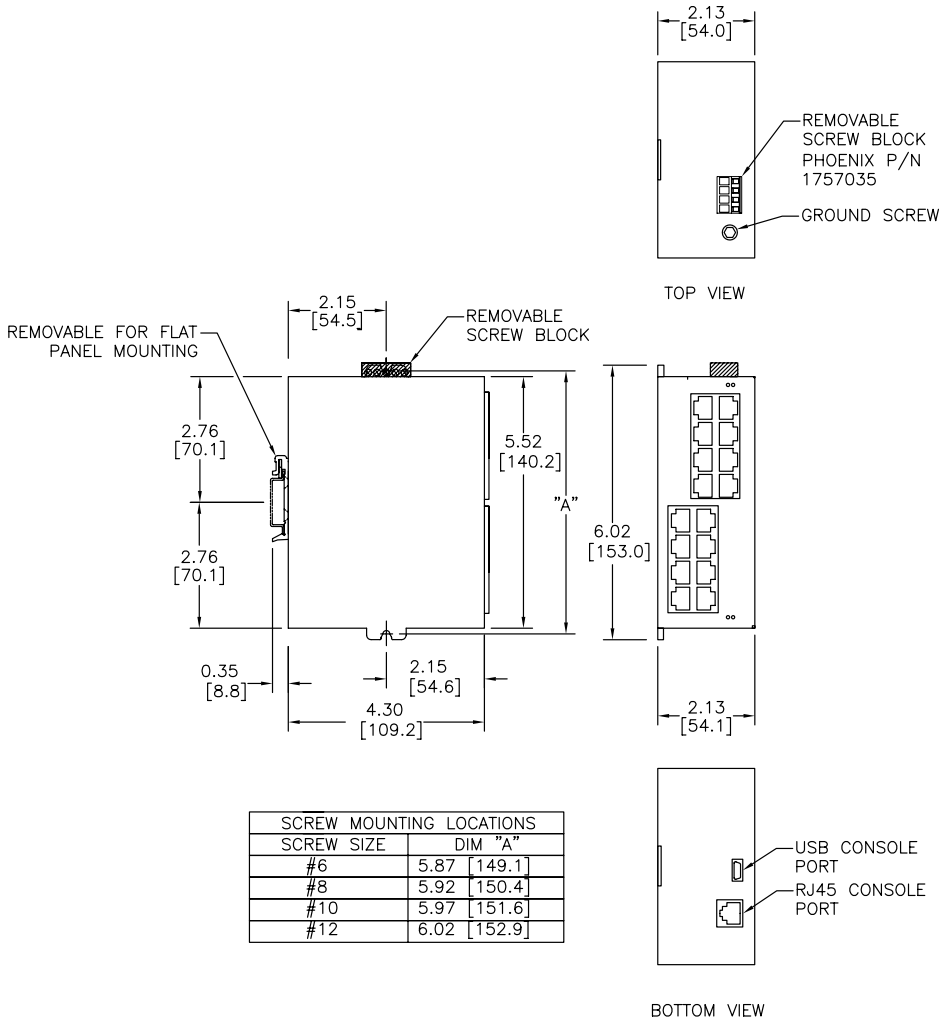
SE-SW10MG-2P



Mechanical Dimensions for 16-Port Managed Model

Inches [mm]

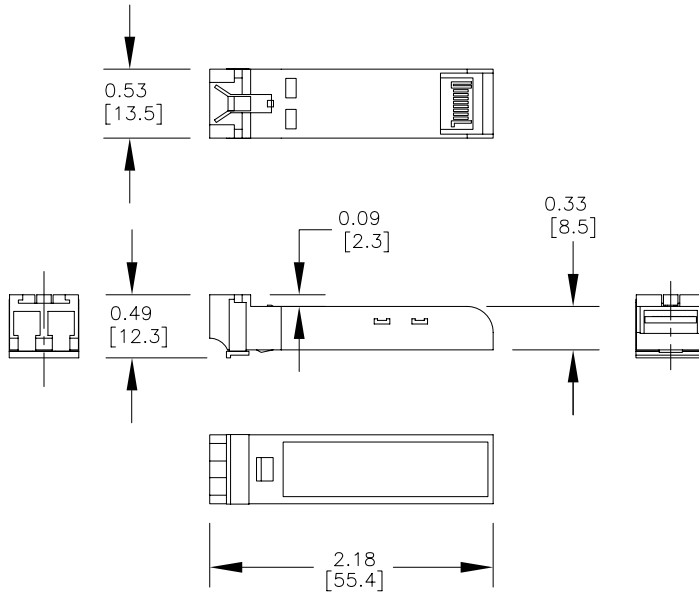
SE-SW16M



Mechanical Dimensions for SFP Transceiver Modules

Inches [mm]

SFP-4K-FMF, SFP-30K-FSF, SFP-500-GMF, SFP-2K-GMF, SFP-10K-GSF and SFP-30K-GSF



Power and Alarm Wiring

Overview

DC voltage in the range of 10 to 30 VDC (3.0W) needs to be applied between the P1 (plus) terminal and the Minus terminal as shown below. To maintain a UL 508 panel listing use a Class 2 power supply. The chassis screw terminal should be tied to panel or chassis ground. To reduce down time resulting from power loss, these industrial Ethernet switches can be powered redundantly with a second power supply as shown below.



NOTE: When powering multiple switches from a common power supply, it is most reliable to power the switches sequentially rather than simultaneously. The characteristics of the power supply and the significant startup current of the switches may result in an error in booting the switches when powered simultaneously.

Screw Torque

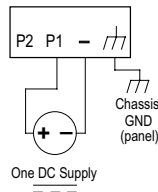
When tightening the screws be careful to tighten to a max. torque of 5 lb-in [0.57 Nm]. Wire size should be between 24 AWG and 12 AWG.

Before performing any wiring to these switches make sure...

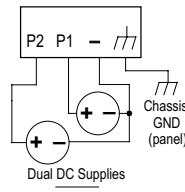
- **The area is currently nonhazardous (especially when working in Class 1, Div 2 or Zone 2 hazardous locations).**
- **Power is off to the switch**
- **The screw terminal block is unplugged. This is especially important on the aluminum housed units as shown below. Connecting or disconnecting wires to the screw block when its in place and power is turned on can allow the screwdriver to short the power to the case**

Unmanaged Models:

Single DC Power



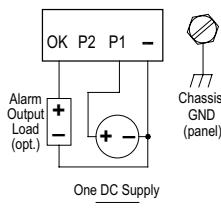
Redundant DC Power



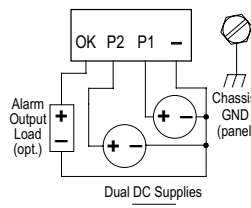
Managed Models:

SE-SW5M, SE-SW5M-2ST, SE-SW5M-2SC, SE-SW8M, SE-SW8M-2ST and SE-SW8M-2SC

Single DC Power



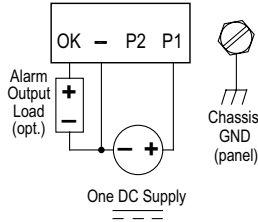
Redundant DC Power



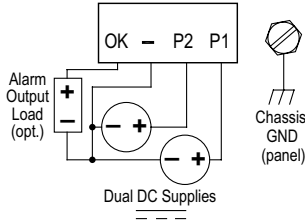
Managed Models:

SE-SW16M and SE-SW10MG-2P

Single DC Power

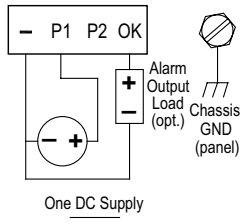


Redundant DC Power

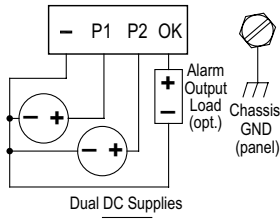


SE-SW8MG-4P

Single DC Power



Redundant DC Power



Communication Ports Wiring

Overview

The industrial Ethernet switches and media converters provide connections to standard Ethernet devices such as PLCs, Ethernet I/O, industrial computers and much more. RJ45 (copper) Ethernet ports and fiber optic Ethernet ports are available depending on model.

RJ45 Ethernet Wiring

Use data-quality (not voice-quality) twisted pair cable rated category 5e (or better) with standard RJ45 connectors. Straight-through or crossover Ethernet cable can be used for all devices the switch is connected to because all the ports are capable of auto-mdi/mdix-crossover detection.

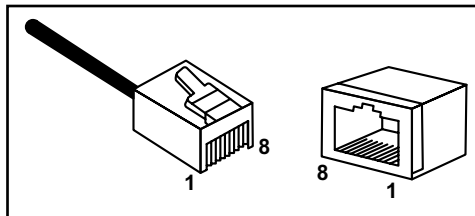
The RJ45 Ethernet port connector bodies on these products are metallic and connected to the Chassis GND terminal. Therefore, shielded cables may be used to provide further protection. To prevent ground loops, the cable shield should be tied to the metal connector body at one end of the cable only. Electrical isolation is also provided on the Ethernet ports for increased reliability.

Straight-thru Cable Wiring	
Pin 1	Pin 1
Pin 2	Pin 2
Pin 3	Pin 3
Pin 4	Pin 4
Pin 5	Pin 5
Pin 6	Pin 6
Pin 7	Pin 7
Pin 8	Pin 8

Cross-over Cable Wiring	
Pin 1	Pin 3
Pin 2	Pin 6
Pin 3	Pin 1
Pin 4	Pin 4
Pin 5	Pin 5
Pin 6	Pin 2
Pin 7	Pin 7
Pin 8	Pin 8



NOTE: For reference only. Either cable wiring will work.



Ethernet Plug & Connector Pin Positions

RJ45 Cable Distance

The maximum cable length for 10/100BaseT is 100 meters (328 ft.).

Ethernet Fiber Wiring Guidelines

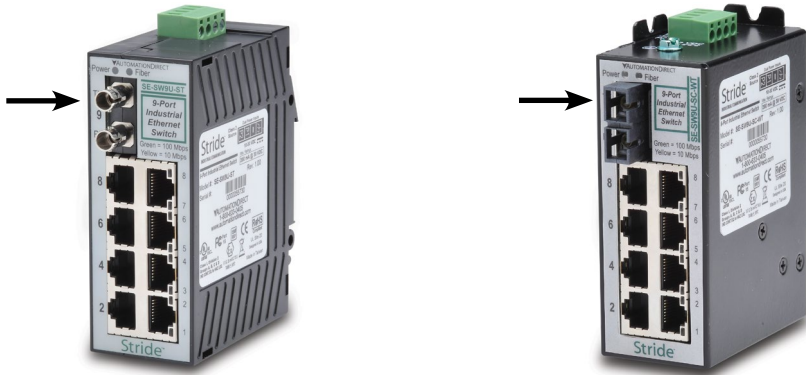
Depending on the model these industrial Ethernet switches may include one, two or four fiber optic ports. All 100 Mbps fiber ports are available with dual SC or ST multimode style connectors. Refer to the technical specifications for details.

All 1000 Mbps fiber ports are provided as SFP (small form pluggable). These accept plug-in fiber transceivers that have an LC style connector. They are available with either multimode or singlemode transceivers. Refer to the technical specifications for details.

For each fiber port there is a transmit (TX) and receive (RX) signal. When making your fiber optic connections, make sure that the transmit (TX) port of the switch connects to the receive (RX) port of the other device, and the receive (RX) port of the switch connects to the transmit (TX) port of the other device.

Use standard fiber optic wiring techniques (not covered by this manual) to make your connections. The corresponding ACT/LNK LED will be ON solid or flashing when you have made a proper connection.

Fiber Ports on Switches



Fiber Ports on Media Converters



Duplex Operation

The RJ45 ports will auto-sense for Full or Half duplex operation; the fiber ports are configured for full duplex operation. On managed switches the duplex setting is software configurable.



NOTE: Fiber devices with half duplex settings will communicate with the switch in most situations.

Network Device Check

The industrial Ethernet switches and media converters support 10/100BaseT or 10/100/100 Base T on the RJ45 (copper) ports and 100BaseFX or gigabit Ethernet on the fiber optic ports depending on model. Make sure you connect the appropriate devices to each port.



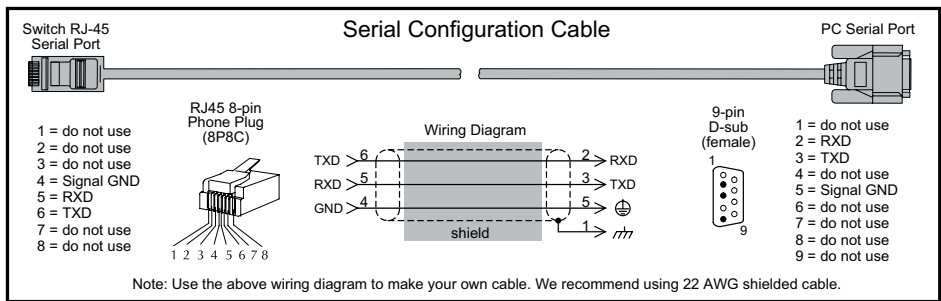
NOTE: The following AutomationDirect PLC Ethernet Modules are not compatible with the Stride Ethernet switches and Media Converters with fiber optic connections because the modules have a speed of 10BaseF (fiber optic) only: Ethernet Communications Module, p/n H2-ECOM-F & H4-ECOM-F; Ethernet Base Controller Module, p/n H2-EBC-F & H4-EBC-F; Ethernet Remote Master Module, p/n H2-ERM-F & H4-ERM-F.

Verifying Connectivity

After all Ethernet and/or fiber connections are made, check the LEDs corresponding to the ports that each of the devices are connected to. Ensure that for each port that is in use, the LED is on or blinking. If a port LED is off, go back and check for connectivity problems between that port and the network device connected to that port. In addition, the color of the LED should indicate the speed at which your device is connected (see prior section on LEDs).

Serial Console Port Wiring

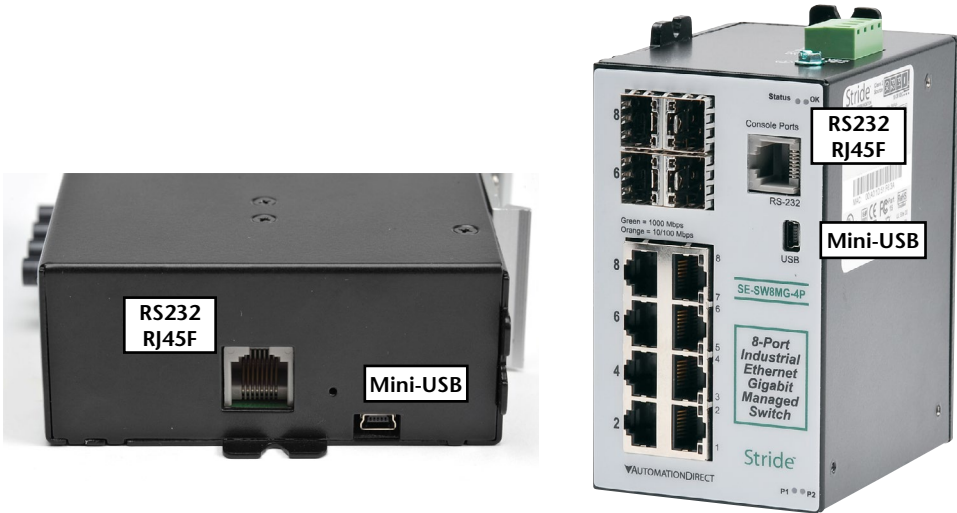
An optional way to configure the managed switch is through the RJ45 console RS232 port. Wire a serial console cable as shown below to make a connection between a COM port on your PC (DB9 male) and the RS232 port of the managed switch (RJ45 female).



USB Console Port Wiring

The managed switches also have an USB port alternative to the RS232 port. Use a standard USB cable with a mini-USB plug on one end and an A-type-USB plug on the other end. The A-type plug goes into a standard USB port on a computer. The mini-USB plug goes into the USB port on the switch.

The USB driver is available for download at automationdirect.com.



NOTE: The RS-232 and/or USB ports may be located on the bottom edge or front face of the switch.

Technical Specifications

Technical Specs

Here are the hardware technical specifications for the industrial Ethernet switches and media converters covered by this manual.

General Specifications	
Ethernet switch type	Unmanaged or Managed
Operating mode	Store & forward, wire speed switching, non-blocking
Devices supported	All IEEE 802.3 compliant devices are supported
Protocols (managed models only)	SNMPv1/v2/v3, RMON, DHCP, SNMP, TFTP, STP, RSTP, QoS/CoS/ToS/DS, IGMPv1/v2, VLAN (tag and port based), HTTP, HTTPS (SSL & TLS), Telnet, SSH and more
Industrial Protocols supported	Modbus/TCP, EtherNet/IP, PROFINet, Foundation Fieldbus HSE and others
Standards (depends on model)	IEEE 802.3, 802.3u, 802.3ab/z, 802.3x, 802.1D/w, 802.1p, 802.1Q and others
Management Interfaces (managed models only)	Web, text (Telnet & SSH), CLI (command line interface) and SNMP (see Chapter 2 - Managed Switch Software for supported MIBs)
MAC addresses	1024 on unmanaged models; 2048 on managed models with 5, 8 or 9 ports 8192 on Gigabit models with more than 9 ports
Memory bandwidth	3.2 Gbps on models with 9 or fewer ports 3.2 Gbps on models with more than 9 ports
Latency for 10 Mbps ports*	16 us + frame time (typical)
Latency for 100 Mbps ports*	< 5 us + frame time (typical)
Ethernet isolation	1500 VRMS 1 minute
Management Serial Port (managed models only)	RS232 (TXD, RXD and GND), 9600, 8, N, 1 fixed and/or mini-USB
* <i>Varies on load and settings</i>	

Technical Specifications continued on the next page.

Technical Specifications (cont'd)

<i>Copper RJ45 Ports: (10/100 Mbps or 10/100/1000 Mbps)</i>	
Copper Ports	Shielded RJ45
Speed	10/100 Mbps or 10/100/1000 Mbps (depending on model)
Protocols supported	All standard IEEE 802.3
Auto-crossover	Yes, allows you to use straight-through or crossover wired cables
Auto-sensing operation	Yes, Full and half duplex
Auto-negotiating	Yes, 10BaseT and 100BaseT
Auto-polarity	Yes, on the TD and RD pair
Flow control	Automatic
Ethernet isolation	1500 VRMS 1 minute
Plug and play	Yes
Cable requirements	Twisted pair (Cat. 5 or better) (shielded recommended)
Max. cable distance	100 meters (328 ft)

Technical Specifications continued on the next page.

Technical Specifications (cont'd)

SC or ST Fiber Ports: 100BaseF multimode	
100BaseFX ports	1 on some unmanaged switch models 2 on some managed switch models
Fiber port mode	Multimode (mm)
Fiber port connector	Duplex SC or ST
Optimal fiber cable	50/125 or 62.5/125 μ m for mm; 9/125 μ m for sm
Center wavelength	1300 nm
Multimode	Links up to 4 km typ.; 1300 nm; use with 50 or 62.5/125 μ m fiber > Transmitter power (dB): -21 min, -17 typ, -14 max > Receiver sensitivity (dB): -34 typ, -31 max
Nominal max. distance (full duplex) (see web for details)	4 km
Half and Full Duplex	Full duplex
Ethernet Compliance	100BaseF
Eye Safety	IEC 60825-1, Class 1; FDA 21 CFR 1040.10 and 1040.11

SFP (Small Form Factor pluggable) Ports	
<i>Note: On the Gigabit (MG) models these ports are pluggable and accept any SFP Multi-Source Agreement compliant transceiver.</i>	
Gigabit SFP ports	2 or 4 depending on model
Port Types Supported	All SFP Multi-Source Agreement compliant transceivers
<i>Note: 100 Mbps fiber transceiver modules are also supported on these ports.</i>	
Ethernet Compliance	1000BaseT and 1000BaseF (SX/LX/LH)
Eye safety	IEC 60825-1, Class 1; FDA 21 CFR 1040.10 and 1040.11



NOTE: Refer to SFP module specifications for details specific to the SFP installed.



NOTE: When powering multiple switches from a common power supply, it is most reliable to power the switches sequentially rather than simultaneously. The characteristics of the power supply and the significant startup current of the switches may result in an error in booting the switches when powered simultaneously.

Technical Specifications (cont'd)

<i>"OK" Alarm Output (Managed models only)</i>	
<i>"OK" Output</i>	ON if P1 and P2 have power and switch software is running
<i>Voltage</i>	Same as switch input voltage
<i>Maximum Current Output</i>	0.5 Amp

<i>Power Input</i>	
<i>Power Input</i>	Redundant Input Terminals
<i>Input power (typical with all ports active at 100 Mbps)</i>	SE-MC2U-SC - 2.0W SE-MC2U-ST - 2.0W SE-SW5U - 2.0W SE-SW5U-WT - 2.0W SE-SW5U-SC - 3.0W SE-SW5U-SC-WT - 3.0W SE-SW5U-ST - 3.0W SE-SW5U-SC-WT - 3.0W SE-SW8U - 4.0W SE-SW8U-WT - 4.0W SE-SW9U-SC - 5.0W SE-SW9U-SC-WT - 5.0W SE-SW9U-ST - 5.0W SE-SW9U-ST-WT - 5.0W
	SE-SW5M - 3.6W SE-SW5M-2SC - 5.6W SE-SW5M-2ST - 5.6W SE-SW8M - 4.3W SE-SW8M-2SC - 6.3W SE-SW8M-2ST - 6.3W SE-SW8MG-4P - 12.0W - No Fiber SE-SW8MG-4P - 15.0W - With 4 Fiber plugged in SE-SW10MG-2P - 5.0W - No Fiber SE-SW10MG-2P - 7.0W - With 4 Fiber plugged in SE-SW16M - 7.0W
<i>Input Voltage (all models)</i>	10-30 VDC (continuous)
<i>Reverse Power Protection</i>	Yes
<i>Transient Protection</i>	15,000 watts peak
<i>Spike Protection</i>	5,000 watts (10x for 10 uS)

Technical Specifications (cont'd)

<i>Environmental</i>	
Storage Temperature Range	-40 to +85 °C (-40 to +185 °F)
Humidity (non-condensing)	5 to 95% RH
Electrical Safety	UL508/GSA C22, EN61010-1, CE
EMC: emissions and immunity	FCC part 15, ICES-003; EN61000-6-2, EN61000-6-4 Typical 8 or 9/125 µm for singlemode (sm)
Hazardous Locations	UL HazLoc, CSA C22.2/213 (Class I, Div.2) ; EN60079-15 (Zone2), CE (ATEX)
Eye Safety (fiber models)	IEC60825-1, Class 1; FDA 21 CFR 1040.10 and 1040.11
RoHS and WEEE	RoHS (Pb free) and WEEE compliant
ISO9001:2000	Certified "Total Quality" company

<i>Mechanical</i>	
Ingress Protection	IP30 for all plastic cased units. IP40 for all metal cased units.
Packaging and Protection	UL94V0 Lexan plastic for all plastic cased units. Aluminum w/ protective finish for all metal cased units.
Dimensions (L x W x H)	See mechanical drawings for details

MANAGED SWITCH QUICK START



In This Chapter...

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Connecting to the Switch for the first time

Connecting to the switch over Ethernet:

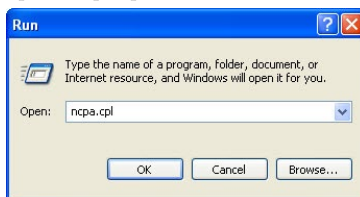


NOTE: See *Setting up PC for USB connection to Switch* later in this chapter for the option of using USB for switch connection.

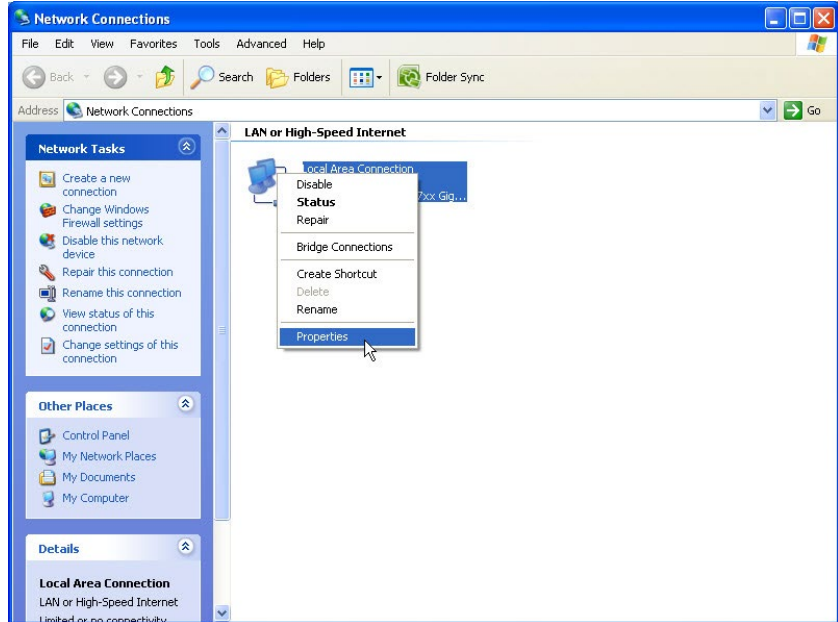
Connecting to the switch for the first time over Ethernet requires no extra tools or driver installation and is, therefore, the recommended way to accomplish this.

The default IP address and subnet mask of the switch is 192.168.0.1 and 255.255.255.0. This means that your PC's network interface card (NIC) that is connected to the switch must be set to a compatible IP address and subnet mask to access the web-based switch configuration tool. It is recommended that you connect your PC directly to the switch for the initial setup of the network settings. An example IP address and subnet mask to set your PC's network interface to is 192.168.0.100 and 255.255.255.0.

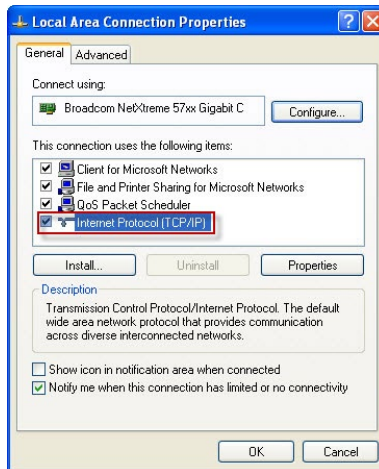
1. Go to the Start Button and click on "Run" (if you do not see a "Run" option, type Run in the search box and hit Enter). Type in `ncpa.cpl` and hit OK.



2. Right click on the Network Interface that is connected to your switch and choose Properties.

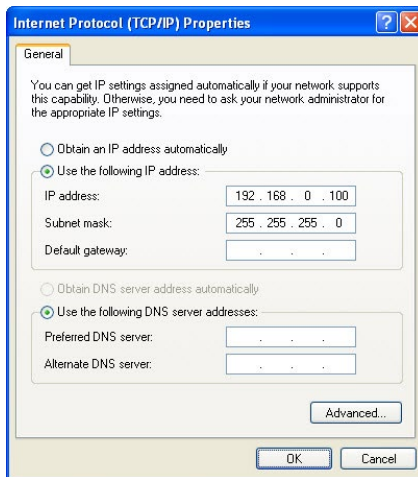


3. Scroll down and highlight the “Internet Protocol Version 4 (TCP/IPv4)” selection and click on the Properties button.



4. Write down the current settings so that you may put them back in after configuring the Network settings of the switch to a compatible setup for your environment.

5. Type in the IP address and subnet mask of 192.168.0.100 and 255.255.255.0 or another compatible IP address and subnet mask. Click on the OK button. Click on the OK button for the Network Interface Properties window and close the Network Connections window.



NOTE: Neither the Network Address nor the Broadcast Address for you subnet are valid host addresses. For our example that has a Subnet Mask of 255.255.255.0 and the first three octets are 192.168.0, neither the pc nor the switch are permitted to be assigned 192.168.0.0 or 192.168.0.255 as an IP address.

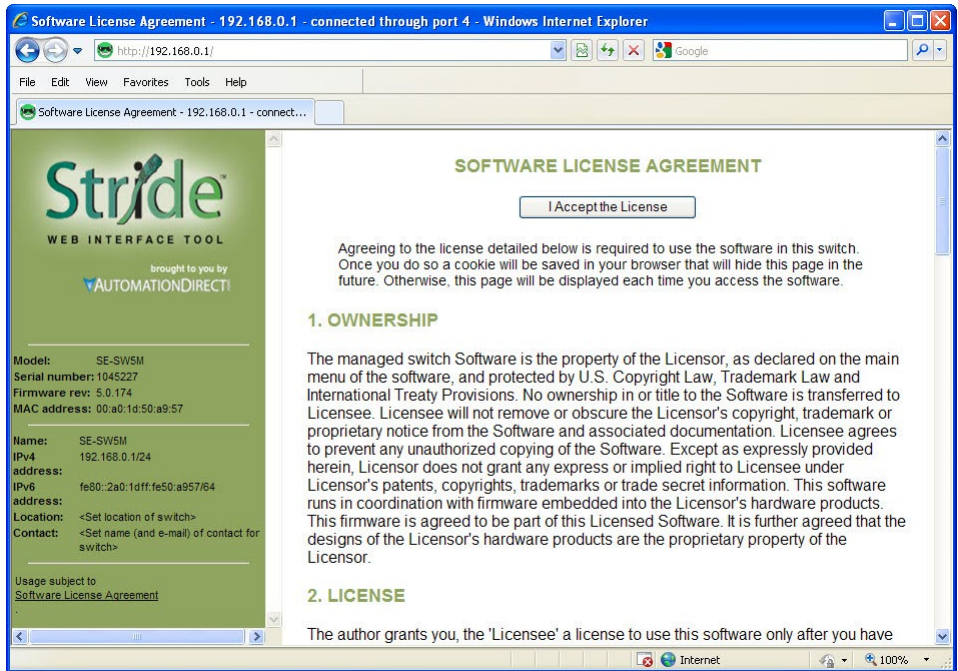
6. Open up your web browser program such as Internet Explorer, Mozilla Firefox or other and type in 192.168.0.1 in the URL line.



7. Enter in admin for the User name and admin for the password and click on OK.



8. Read the Software License Agreement and click the “I Accept the License” button.



- Click on the “Quick Setup” link on the upper left hand side of the window to access the Network Settings.

- Enter in the desired IP address and subnet mask that is compatible with the network that the switch will go on or enable DHCP if that is the method you choose to assign the network settings. Click on the “Commit Changes” button to enable the new settings.



NOTE: Neither the Network Address nor the Broadcast Address for you subnet are valid host addresses. For our example that has a Subnet Mask or 255.255.255.0 and the first three octets are 192.168.0, neither the pc nor the switch are permitted to be assigned 192.168.0.0 or 192.168.0.255 as an IP address.

11. Return to steps 1 – 4 to put in the original network settings for your PC.
12. Connect your PC and the switch to the network and enter in the new IP address into your web browser URL to access the switch. If you chose DHCP as the method for assigning the network settings to your switch, you will need to contact the network administrator to see which IP address has been assigned to the switch or connect via USB or serial (explained further down in this document) to ascertain what the IP address is on the switch.
13. Now that you can access the switch, you may begin to configure the switch with the settings appropriate for your network. If you are unsure of where to start with the configuration, go the section titled, “Why do you need a managed switch?” to understand more about the Stride managed switch, its capabilities and how these features can be used. Note that the default settings enable RSTP and IGMP which will be adequate for many networks with no further configuration.

Setting up PC for USB connection to switch:

This method can be used to initially configure the switch settings. It may also be needed if the switch has been previously configured and the network settings are unknown. If the switch has been set to DHCP, this method can be used to ascertain the current IP address that has been assigned to the switch by the DHCP server.

Three things will be required in order to connect to the switch via the USB port:

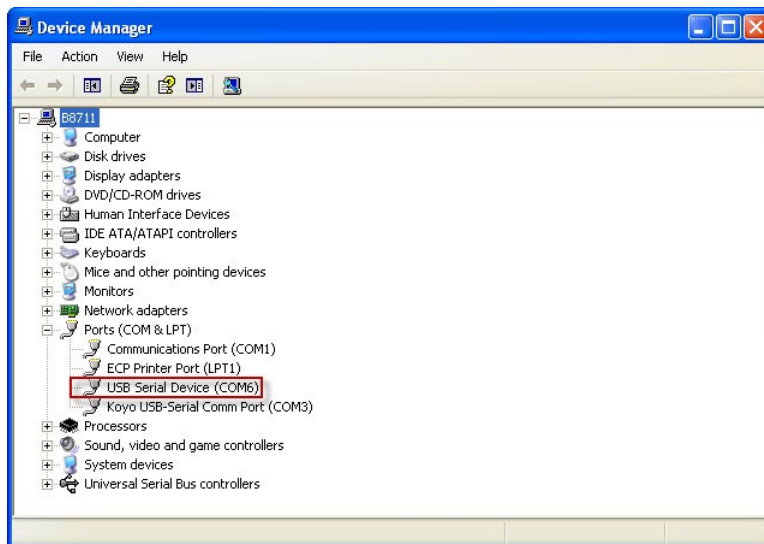
1. **USB driver:** This can be obtained from www.automationdirect.com. Download the executable and run it to install the driver.
2. **Cable:** The cable required is a Male-A connector (plugs into PC) to Male Mini B-type (5 pin) connector (plugs into switch).
3. **Terminal software tool:** Hyperterminal used to come pre-installed in Windows until Windows Vista and 7 were released. TeraTerm is another tool that can be downloaded and installed for free.

After the USB driver EXE file has been downloaded and run, plug the USB cable into the PC and switch.

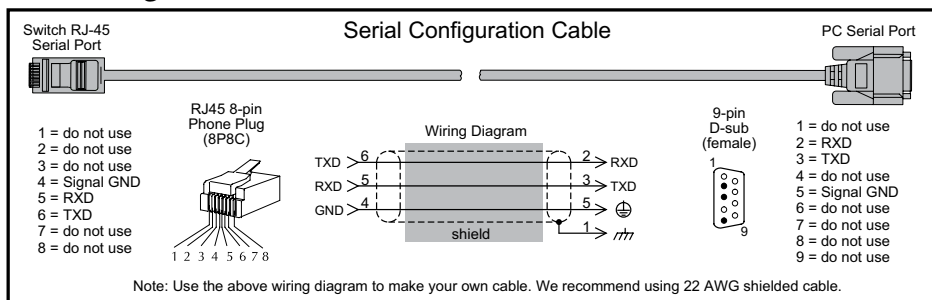
Windows will install the driver. If the New Hardware Wizard appears, select the “No, not this time” selection and click Next. On the following screen, select the “Install Software automatically” option and click Next. Once the driver is loaded, you may get prompted by a window that says the driver has not been verified by Windows. Click on the “Continue Anyway” button to complete the installation.

To locate which COM Port has been assigned to the switch, click on “Start” menu in the PC taskbar and choose “Control Panel”. Double click on the “System” icon. Select the “Hardware” tab.

Click on the “Device Manager” button and then expand the “Ports (COM & LPT)” option on the left hand side and you should see a “USB Serial Device” with a COMxx beside it. This will be the COM port number that you will select with your Terminal software tool.



PC to switch using Serial Port:

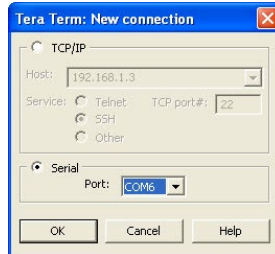


In addition to the USB console port, the switches have an RJ45 console port. The RJ45 console port can connect to a 9-pin serial port on your PC. A driver does not need to be installed.

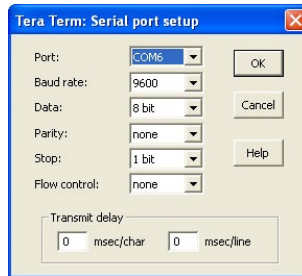
USB and Serial connection to switch with Terminal Software Program:

The software terminal program used for this tutorial will be TeraTerm. Any serial terminal software should work fine. TeraTerm is free and can be downloaded from www.teraterm.org.

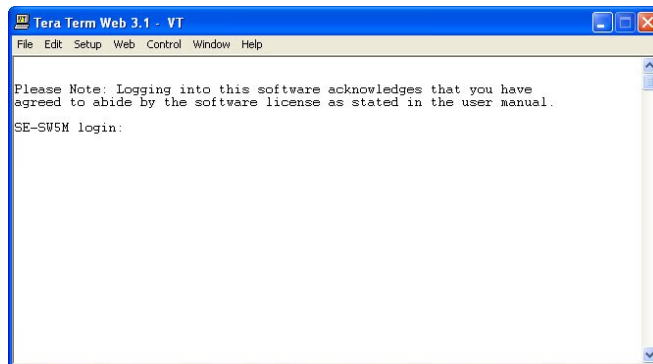
1. Open the TeraTerm software and choose Serial and the COM port connected to the switch.



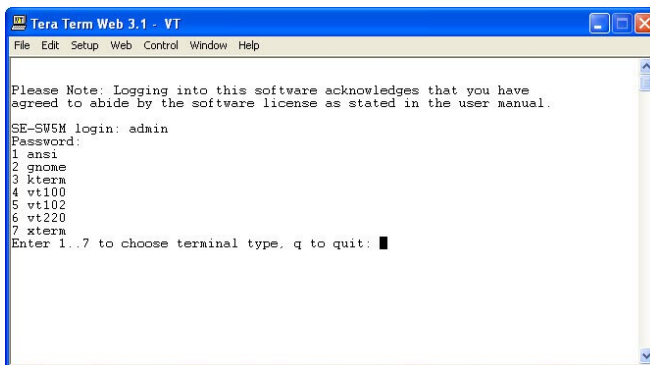
2. Configure the terminal program to connect to the switch with the following parameters:
 - a. Baud rate: 9600
 - b. Data bits: 8
 - c. Parity: None
 - d. Stop bits: 1
 - e. Flow control: None



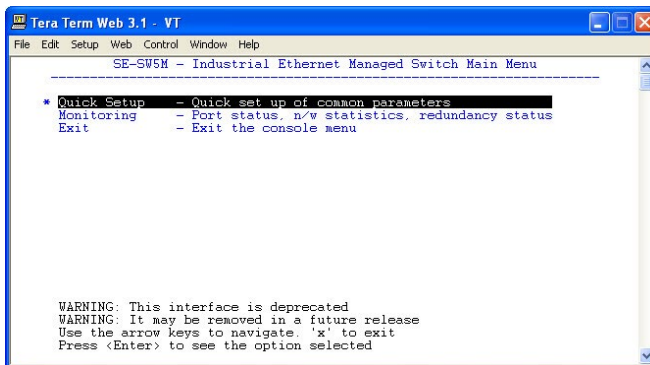
3. Press Enter to get the prompt shown below.



4. Enter the login, then the password. The default user name is **admin** and the default password is **admin**.

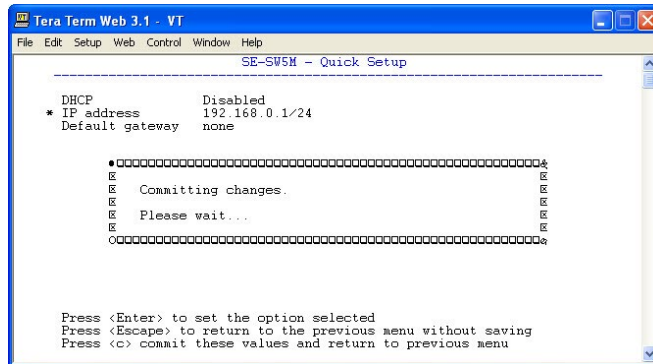


5. Choose selection 4 for vt100.
6. Highlight (by using the up and down arrow keys on the PC keyboard) the “Quick Setup” option and press Enter.

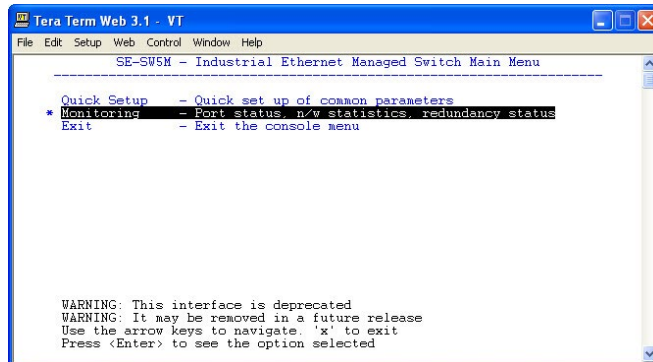


7. To enable DHCP, highlight the DHCP option and press Enter. Arrow down and choose the Enable option and press Enter. Press the c key to commit the change.
8. To set a static IP address, arrow down and highlight the “IP address” option and press Enter.

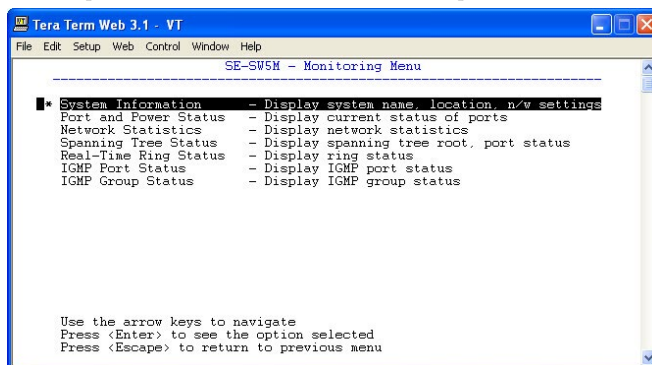
9. Enter in the desired IP address and subnet mask. Note that the subnet mask is configured using, what is called CIDR notation. The “/xx” number denotes how many 1’s are in the subnet mask starting from the most significant bit. A /24 indicates a subnet mask of 255.255.255.0. A /16 indicates a subnet mask of 255.255.0.0 and a /8 indicates a subnet mask of 255.0.0.0. Once the IP address and subnet mask have been configured, press Enter. Press the c key to commit this change and to activate the new IP address for the switch.



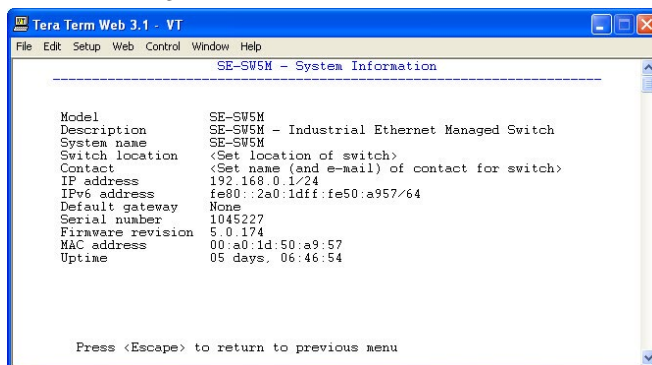
10. If the switch has been configured to obtain an IP address from a DHCP server, you can also view the IP address that is currently assigned to the switch by hitting ESC to go back to the main menu. Arrow down and highlight the “Monitoring” option and press Enter.



11. Highlight the first option called, “System Information” and press Enter.



12. The IP address currently assigned to the switch will be shown here.



You are now able to use your web browser with the new IP address to configure the switch.

Default Setup

The table below shows the Default settings for the switch:

Stride Managed Switch Default Settings			
		Configuration Parameter	Default Setting
Main Settings	System Settings	DHCP	Disabled
		IP Address	192.168.0.1
		Subnet Mask	255.255.255.0
		Default Gateway	none
		Primary DNS Server	none
		Secondary DNS Server	none
		Domain	
		Redundancy Protocol	Rapid Spanning Tree Protocol
		System Name	Switch model (i.e. SE-SW8MG-4P)
		Switch Location	<Set Location of Switch>
		Contact	<Set Name (and email) of contact for Switch>
	Remote Access Security	SNMP Access	Basic and secure SNMP access
		Terminal Access	SSH and telnet access
		Web Access	Basic and secure SNMP access
		SNMP Firmware Loading	Disabled
		Command Line Access	Enabled
		Automatic Logout	Disabled
		SNMP Read-Only	Name: public No Password
		SNMP Read/Write	Name: private No Password
	Port Settings	Terminal and Web	Name: admin Password: admin
		Name	port x (x being port number)
		Admin	Enabled
		Negotiation	Auto
		Speed/Duplex	For non Gigabit Switches: 10h,10f,100h,100f all on For Gigabit Switches: 10h,10f,100h,100f,1000f all on
		Flow Control	Off
	Set IP per Port	SFP	1000f selected
		Provide/Do Not Provide IP	Do not provide IP address to any device
		Enabled	Off for all ports
	Switch Time Settings	Address	blank for all ports
		NTP Server	none
		Timezone	Not set
		Set Switch Date	1970-01-01
	Manage Firmware	Set Switch Time	current time
Default		Top line selected	
Install Firmware	Protocol	HTTP	
	All Other Fields	blank	

Stride Managed Switch Default Settings (cont'd)			
Configuration Parameter			Default Setting
Redundancy Settings	Spanning Tree Settings	Redundancy Protocol	Rapid Spanning Tree Protocol
		Bridge Priority	32768
		Maximum Age	20
		Hello Time	2
		Forward Delay	15
		Transmission Limit	6
		Region Name	
		Configuration Revision	0 (grayed out)
		Max Hops	20 (grayed out)
	MST Instance	None by default	
	Spanning Tree Port Settings	Exclude	Off for all ports
		Priority	128 for all ports
		Path Cost	20000 for all 10 / 100 / 1000 Ports, 200,000 for all 10 / 100 ports
		Type	Auto for all ports
		Point-to-Point	Auto for all ports
	Real-time Ring Settings	Enable	Off for all ports
		Ring Name	Ring x (x being port number) Grayed out by default
		Primary Port	none
Backup Port		none	
		Ring Master	Automatic Master
Settings	QoS/CoS Settings	Priority Frame Setting	Send all high priority frames before any others
		Use 802.1p Tag Priority	On for all ports
		Use IP ToS/DiffServ	On for all ports
		Priority Precedence	Tag for all ports
		Default Out Q	Normal for all ports
		Type	Transparent for all ports
	802.1p Tag Settings	Priority 0 (Best Effort)	Normal
			Background
		Priority 2 (Spare)	Background
		Priority 3 (Excellent Effort)	Normal
		Priority 4 (Controlled Load)	Expedited
		Priority 5 (Video)	Expedited
		Priority 6 (Voice)	Urgent
	Priority 7 (Network Control)	Urgent	
	Message Rate Limiting	Limit Broadcast and Multicast	Disabled for all ports
		Forward Unknown	Enabled for all ports

Stride Managed Switch Default Settings (cont'd)			
		Configuration Parameter	Default Setting
Multicast Filtering (IGMP)	Protocol Settings	IGMP Mode	Active IGMP handling
		Multicast Suppression	All unreserved multicast
		IGMP Version	Version 2
		Robustness	2
		Query Interval	125
		Query Response Interval	10
Virtual LANs (VLANs)	VLAN Settings	Exclude	Disabled for all ports
		Router	Auto detect for all ports
		VLAN Mode	Disabled
		Core Type	0x8100
	VLAN Port Settings	Learning	Shared
		Default VLAN Settings	Management: Tag-Based, ID=1, FID=0, CPU selected as well as all ports
Security Settings	Remote Access Security	PVID	1
		Force	Off for all ports
	Port Security Enables	Type	Transparent for all ports
		Same settings as in Main Settings	
	Port Security MAC Entries	Global Security Enable	Off
		Port Enabled	Off for all ports
	IKE Policy	Entry	None
		Ipssec Settings	Disabled by default
		IKE Phase 1 Policies	None
		IKE Phase 2 Policies	1 by default but Disabled with 8h lifetime (anonymous source and dest)
IKE Phase 2 Algorithms		Cipher aes (AES Rijndael) Enabled	
		Cipher 3DES Enabled	
	Hash hmac_SHA1 Enabled		
	Hash hmac_SHA256 Enabled		
Compression deflate Enabled			
All others disabled			
Monitoring Settings	Alarm (OK) Output	Disabled by default	
		A power input lost enabled	
	Modbus	All others disabled	
		Enabled	Disabled
		Station Number	1
		Transport Layers	TCP & UDP
		TCP Timeout	0
		TCP Connection Limit	4
Port	502		
SNMP Notifications	Everything disabled by default		

Why might you need a Managed Switch?

Enhanced traffic filtering:

An unmanaged switch will filter out many packets from an end device that a hub would not but there are still many types of packets that an unmanaged switch cannot determine what to do with and must forward on to all ports. Whenever a device receives a packet that is not specifically targeted to that device, there is a certain amount of processing time that takes away from other important tasks that the device may really need to be spending time on. These 'unintentional' packets also get in the way of the packets that are intended for that device. This hurts the determinism of a process. A managed switch can help with this in several different ways:

- **Multicast Filtering (IGMP):** It is common in a control system to see a large amount of Multicast packets. These packets cannot be filtered out by an unmanaged switch. The Stride managed switch can intelligently 'learn' whether certain Multicast packets should be sent to the devices on its ports and will filter them or not filter them appropriately.
- **VLANs:** A VLAN is a logical way to separate networks in ways that used to require physical separation. Because of existing network infrastructure or for ease of wiring (and reduced cost), it may be difficult to physically separate networks that need separation due to the type of packets that are on them. Setting up VLANs can simplify the setup for these situations.
- **Traffic Priority (QoS/CoS):** Some traffic may be more important to a specific device than other traffic. Using the Quality of Service feature, the Stride switch can apply tags to a packet coming into the switch to give that packet a higher priority going to another switch. The last switch will then remove the tag before sending the packet to the device. It can also use the tags applied to the packets by the devices themselves if they support this.

Troubleshooting:

As Ethernet messaging becomes more of the standard for communications between devices in a control system, it may become more necessary to gain visibility to these types of communications. With hubs, it was possible to see the messages between devices because hubs broadcast every packet to all ports. Unmanaged switches took away this capability as they filter unicast packets to only the intended physical ports. Managed switches can help with this by utilizing the Port Mirroring feature. The Stride managed switch can also give you visibility in to the type of packets that are being sent across the switch by viewing the Network Statistics page in the configuration.

- **Port Mirroring:** With the Port Mirroring feature you simply specify which ports' data you want to view and where to send that data. Plug your PC into that port and use Ethernet sniffing software (such as Wireshark) and you can now see the data being sent back and forth.
- **Network Statistics:** By looking at what kind of packets that are coming in and out of the switch, you can determine what action needs to be taken to make your network work better. If you see a lot of Multicast traffic, utilize the Multicast Filtering feature. If there are lots of broken packets, troubleshoot the wiring to determine where the problem lies.

Redundancy:

The downside of any Ethernet switch is the simple fact that it is another electronic component in the system that could be subject to failure. There is also the risk that as a network grows and more switches are added to it, a 'ring' may accidentally be created causing

the network to go down. Utilizing the Spanning Tree and/or Real-Time Ring feature of the Stride managed switch can reduce these risks.

- **STP:** The Spanning Tree protocol simply allows you to purposely create a ring that allows for multiple, redundant paths on the network but intelligently decides one path when the network comes up and assigns alternate paths if some part of the original path goes down.
- **RSTP:** The Rapid Spanning Tree Protocol is the preferred method in the industry today as the manner in which it decides the original paths and the time in which it changes over to alternate paths is much, much faster than the original Spanning Tree Protocol. It is really only useful to enable the older STP if your legacy network requires this protocol. The RSTP feature is enabled by default.
- **Real-Time Ring:** In many Control Systems, the time it takes for the RSTP algorithm to change paths upon some network event is too slow. The Real-Time Ring is proprietary to the Stride managed switches but it has the advantage of changing paths very, very quickly.

Security:

Network security has become a great concern for facilities these days. And while the network devices themselves are only one part of a network security strategy, the Stride managed switches have several security features:

- **Port Control:** In the “Port Settings” setup, you can disable ports that are not being used. This can limit unauthorized access.
- **Security Settings:** There are several different methods of enabling security in the switch. There are security methods to prevent access to the switch (Remote Access Security), you can determine which devices can connect to the switch (Port Security MAC Entries) and you can enable encryption for data going between switches (IPsec).
- **Remote Access Security:** You can disable access to the switch or implement secure pass-wording in order to access the switch.
- **IPsec:** There are many different methods that can be employed to encrypt the data going to or from the switch. The particular method (encryption protocol/algorithm) will most likely be determined by your network administrator.

Better Network ‘Awareness’:

The ability of the process to know when something is wrong with the network and what is wrong with the network is a great feature of the Stride managed switches. Your PLC or controlling device can make ‘smarter’ decisions as to what alarms or fallback behavior to trigger based upon the different diagnostic data that is supplied by the switch.

- **Modbus Stats:** If you have a controlling device on the network that has Modbus TCP or UDP client capability, there are several diagnostic tags that can be read from the switch to indicate the health of the network.
- **SNMP:** SNMP stands for Simple Network Management Protocol and is used for just that. There are many software tools out there that can query or receive ‘traps’ sent by the Stride managed switch to ascertain events or health of the switch.
- **Port and Power Status (Alarm Output):** The Stride managed switch has two power inputs that can be used for redundancy. If one of the power inputs fails, there is a relay contact that can be configured to report this failure.
- **Spanning Tree Status:** The switch can be configured to report when something in the Spanning Tree has changed.
- **Real-Time Ring Status:** The Real-Time Ring status can be ascertained from other devices as well.
- **MAC Table:** The switch keeps a table of the MAC IDs of devices that are communicating on it

MANAGED SWITCH SOFTWARE MONITORING



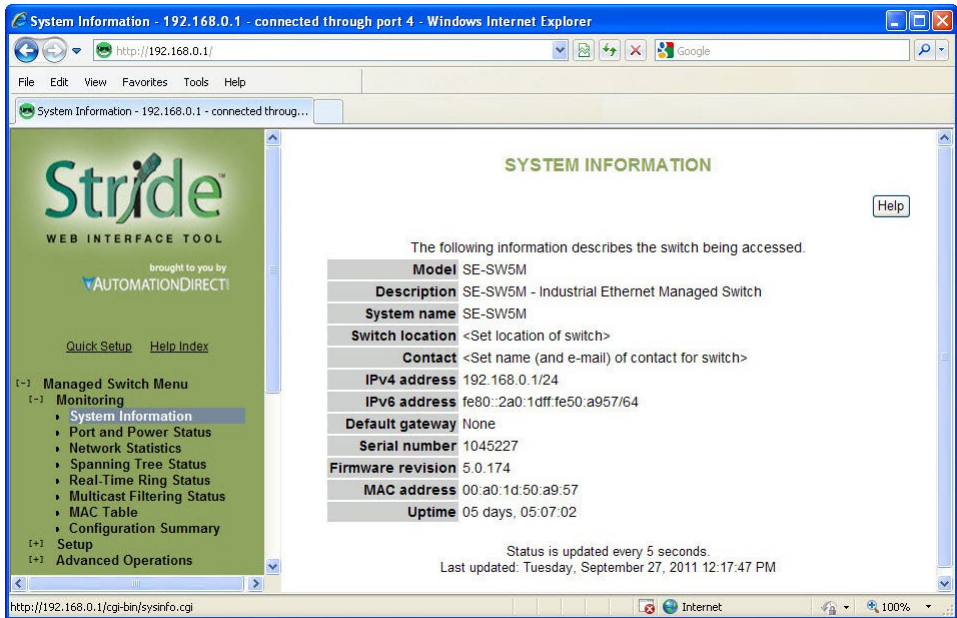
CHAPTER 3

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System Information

The System Information screen simply provides the information shown below. The screen is updated every five seconds.



Model: This field shows the model number of this particular switch. It is set by the factory and cannot be changed.

Description: This field displays more descriptive information about this particular switch model. It is also set by the factory and is not changeable. This data is available via SNMP as SYSTEM.SYSDESCR.0.

System Name: This field is configured by the user with the appropriate text for their application. It is configured in the “System Settings” tab under the Main Settings section. This field is also used as the hostname of the switch and, therefore, must contain only digits, dashes and letters. It is also available via SNMP as SYSTEM.SYSNAME.0.

Switch Location: This field is configured by the user with the appropriate text for their application. It is configured in the “System Settings” tab under the Main Settings section. This data is available via SNMP as SYSTEM.SYSLOCATION.0.

Contact: This field is configured by the user with the appropriate text for their application. It is configured in the “System Settings” tab under the Main Settings section. This data is available via SNMP as SYSTEM.SYSCONTACT.0.

IPv4 address: This field displays the current configured IPv4 address. IPv4 is the traditional 4 octet Internet Protocol address. An IPv4 address comprises 4 8-bit numbers separated by a period. Each number can be between 0 and 255 (some of the fields have more strict

limitations). The IPv4 address can be manually configured in the “System Settings” tab under the Main Settings section or the address can be set to be automatically retrieved using the DHCP protocol. If the address has been configured via DHCP, it will indicate this. This field also indicates the Subnet Mask by using the ‘slash’ notation that indicates the number of bits that are 1 in the mask. For example: A Subnet Mask of 255.255.0.0 would be indicated by a /16. A Subnet Mask of 255.255.255.0 would be indicated by a /24 and so on. The subnet mask is accessible via SNMP as RFC1213-MIB::IPADENT-NETMASK.<IPADDRESS> where <IPADDRESS> is the IP address of the switch (example: 192.168.0.1).

IPv6 address: This field displays the current configured IPv6 address. IPv6 is the newer standard of Internet Protocol addressing that greatly expands the number of addressing possibilities. Instead of the standard 4 x 8-bit address format that is used IPv4, IPv6 uses 8 fields of 16 bit values separated by colons. Each address display in hex format. If one particular fields contains a 0, a :: can be used. An IPv6 address can also be retrieved by DHCP. This field also uses the / designator for the subnet mask.

Default Gateway: This field contains the IP address of the router that this switch should send external packets to. This address can be assigned manually in the “System Settings” tab under the Main Settings section or can be retrieved automatically through DHCP. The default gateway is accessible via SNMP as RFC1213-MIB::IPROUTENEXTHOP.

Serial Number: This is the serial number assigned to this switch at the factory and cannot be changed.

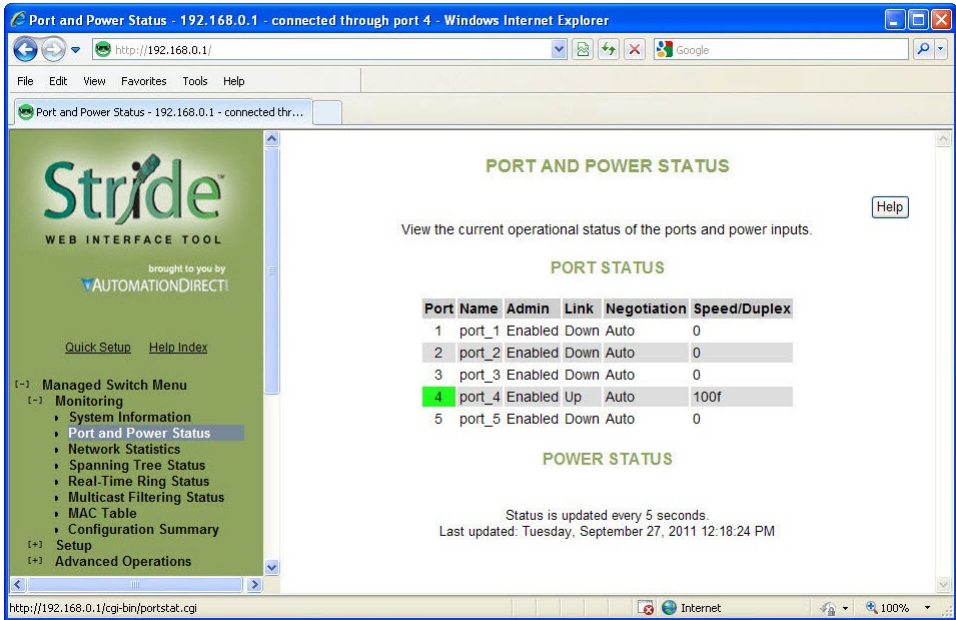
Firmware revision: This is the current running firmware revision of this switch.

MAC address: This is the MAC address of this switch. It is configured at the factory and cannot be changed.

Uptime: This is the amount of time this switch has been running since power was applied. This data is available via SNMP as SYSTEM.SYSUPTIME.0.

Port and Power Status

The current status of each port and the Power and Ok terminal status can be viewed in this section.



Port Status: The status for each port can be viewed in this section. Some of the information shown for the ports is configured through the “Port Settings” tab of the Main Settings section. If the negotiation settings have been set to Auto, this tab will show what settings were negotiated between the switch and the attached device. On this page, the color highlighting the port number indicates the speed:

Yellow = 10 Mbps

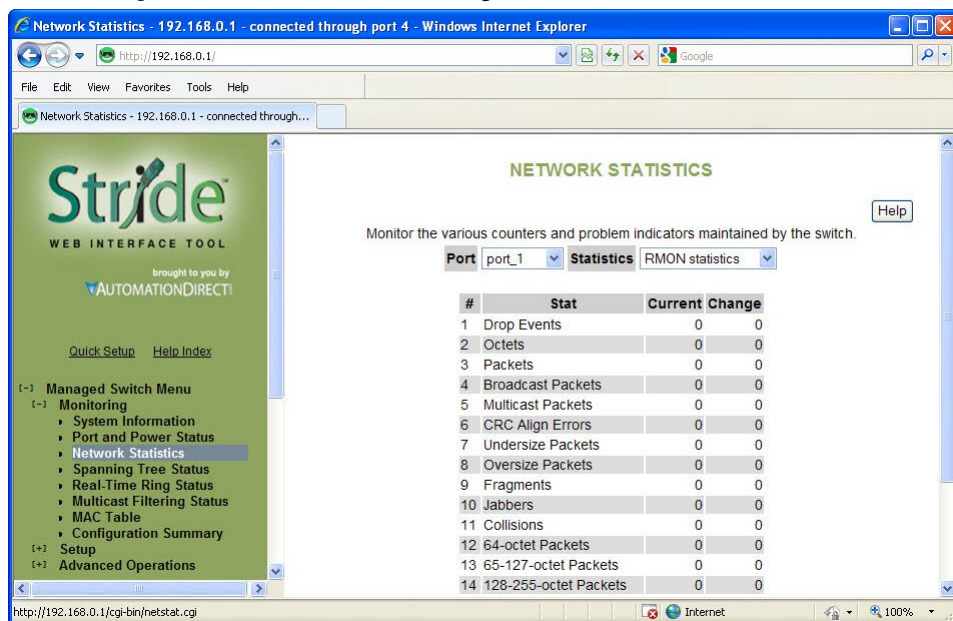
Green = 100 Mbps

Red = 1000 Mbps

Power Status: There are 2 power input terminals for the input 24VDC. This tab will show which terminals have power. This tab will also show if the criteria for enabling the OK output is true or false. The configuration for this output is configured in the “Alarm (OK) Output” tab of the Monitoring Settings section.

Network Statistics

The Network Statistics display can be a very useful diagnostic tool for indication of the type of traffic and packets that the switch is receiving.



RMON Statistics: RMON stands for “Remote Monitoring” statistics and includes the following:

- **Drop Events** = The number of packets that have been dropped by the switch because of a lack of resources and/or large queues.
- **Octets** = The number of data 8-bit units received into this port.
- **Packets** = The number of Ethernet packets received into this port.
- **Broadcast packets** = The number of broadcast packets received into this port.
- **Multicast packets** = The number of multicast packets received into this port.
- **CRC Align errors** = The number of Ethernet packets received into this port with an invalid CRC.
- **Undersize packets** = The number of Ethernet packets received into this port that were less than 64 bytes in size but contained a valid CRC (64 bytes is the minimum required in Ethernet).
- **Oversize packets** = The number of Ethernet packets received into this port that were greater than 1536 bytes in size but contained a valid CRC (1536 is the maximum size allowed in Ethernet).
- **Fragments** = The number of Ethernet packets received into this port that were less than 64 bytes in size and did not contain a valid CRC.
- **Jabbers** = The number of Ethernet packets received into this port that were greater than 1536 bytes in size and did not contain a valid CRC.
- **Collisions** = The number of collisions detected on this port.

- **64-octet Packets** = The number of Ethernet packets received into this port that were 64 bytes in length.
- **65 – 127-octet Packets** = The number of Ethernet packets received into this port that were between 65 and 127 bytes in length.
- **128 – 255-octet Packets** = The number of Ethernet packets received into this port that were between 128 and 255 bytes in length.
- **256 – 511-octet Packets** = The number of Ethernet packets received into this port that were between 256 and 511 bytes in length.
- **512 – 1023-octet Packets** = The number of Ethernet packets received into this port that were between 512 and 1023 bytes in length.
- **1024 – 1518-octet Packets** = The number of Ethernet packets received into this port that were between 1024 and 1518 bytes in length.

NETWORK STATISTICS

[Help](#)

Monitor the various counters and problem indicators maintained by the switch.

Port: Statistics:

#	Stat	Current	Change
1	Alignment Errors	0	0
2	FCS Errors	0	0
3	Single Collision Frames	0	0
4	Multiple Collision Frames	0	0
5	SQE Test Errors	0	0
6	Deferred Transmissions	0	0
7	Late Collisions	0	0
8	Excessive Collisions	0	0
9	Internal Mac Transmit Errors	0	0
10	Carrier Sense Errors	0	0
11	Frame Too Longs	0	0
12	Internal Mac Receive Errors	0	0
13	Symbol Errors	0	0

Status is updated every 5 seconds.
Last updated: Tuesday, September 27, 2011 11:38:04 AM

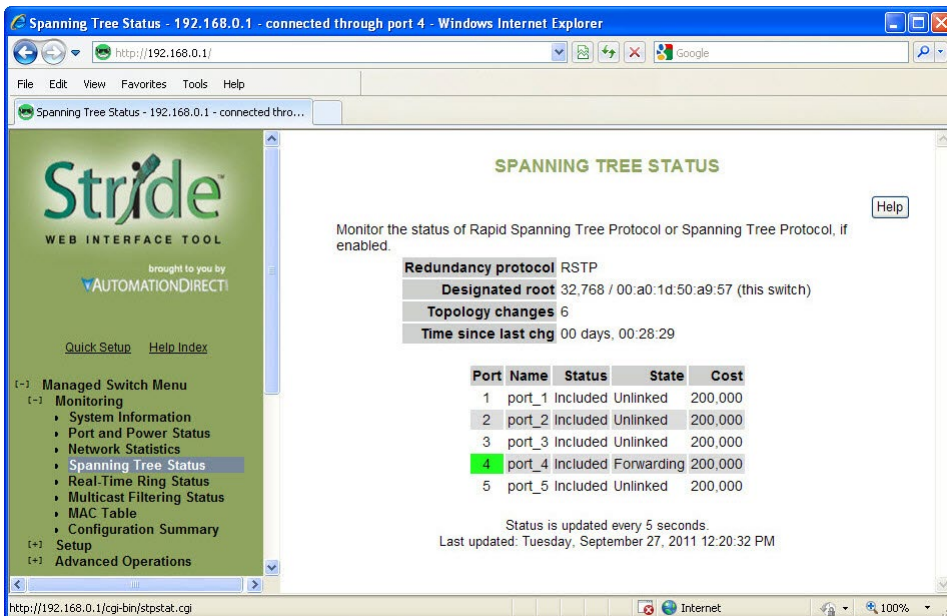
Ether-like statistics: The Ether-like statistics provide information on possible hardware, electrical and/or noise problems on the network.

- **Alignment Errors** = These errors are more indicative of receiving the improper number of bits. These errors are a good indication of noise and/or electrical problems. Check the wiring and routing of cables in the event that many of these errors are seen.
- **FCS Errors** = This is the error that results from an incorrect CRC calculation. These errors along with the Alignment Errors indicate noise and/or electrical problems. Check the wiring and routing of cables in the event that many of these errors are seen.
- **Single Collision Frames** = This error occurs when only 1 collision occurs and the sending device is able to send the packet on the subsequent attempt.
- **Multiple Collision Frames** = This error occurs when collisions occur on more than 1 attempt to send a packet from a device.
- **SQE Test Errors** = The Signal Quality Error test verifies that the collision detection circuit is working correctly. If the device does not detect the SQE test, this causes an error.

- **Deferred Transmissions** = A deferred transmission occurs when the device detects a carrier signal (a device is already transmitting).
- **Late Collisions** = In some situations, a collision is not detected until after the Ethernet device has started transmitting the packet. This is called a Late Collision. A Late Collision is more specifically defined as a collision that is detected 51.2 microseconds after the device has started sending on a 10BASE-T network and 5.12 microseconds on a 100BASE-T network. Late collisions are usually caused by improper network configurations, compliance issues between devices, incorrect cabling and/or fault Network Interface Cards.
- **Excessive Collisions** = As part of the CSMA/CD mechanism, an Ethernet device will attempt to re-transmit a frame 16 times if a collision is detected. If the device is unsuccessful after 16 times, it will give up and that frame will not be transmitted.
- **Internal MAC Transmit Errors** = This error occurs when frames fail to be transmitted correctly due to an internal MAC sub-layer transmit error.
- **Carrier Sense Errors** = This error occurs when the carrier sense is lost during a transmission from the Ethernet device. The error only increments once during the transmission even if the carrier sense is lost and regained multiple times during that transmission.
- **Frame Too Long** = This error occurs when a frame is encountered that exceeds the maximum frame size.
- **Internal MAC Receive Errors** = This error occurs when frames fail to be received correctly due to an internal MAC sub-layer receive error.
- **Symbol Errors** = These errors occur when the device could not correctly decode a symbol that has been received. This is usually indicative of bad cabling and/or electrical noise problems. A symbol is a waveform change on the wire that may contain 1 or many bits of information.

Spanning Tree Status

This section shows the current status of the Spanning Tree redundancy feature of the switch. For more information on the particular details of the Spanning Tree features of the switch, refer to the “Spanning Tree Settings” section under the “Redundancy Settings” section of this document.



On this page, the color highlighting the port number indicates the speed:

Yellow = 10 Mbps

Green = 100 Mbps

Red = 1000 Mbps

Redundancy protocol: This is the protocol that the switch has been configured for. The selections available are Spanning Tree Protocol, Rapid Spanning Tree Protocol or None.

Designated root: This field specifies which device is the Root switch and what the Bridge ID of that switch is along with the MAC ID.

Topology changes: This counter tracks the number of times that the topology has changed on the network layout. There are a number of things that can cause the topology to change. If the link is lost on a port that is forwarding and the switch has to change its path, this will cause a topology change. If a Topology Change Notice is received by the switch from some other switch, the counter will also increment.

Time since last chg: Informs how long it has been since the last topology change occurred.

Port: The number of the port. This corresponds to the labels on the switch.

Name: The user configured name of the port.

Status: The configured state of the port in the STP protocol (included or excluded). An included port is part of the managed network. An excluded port will not be used as part of the managed network. For example, a single uplink from a managed network of factory devices to a business network would be configured to be excluded from STP use. A pair of ports configured for Real-Time Ring should be excluded from Spanning Tree.

State: The STP/RSTP state of the port:

STP:

- **Blocking** = A port in this state does not participate in frame relay (pass frames received to other locations). Once a port is in this state, it prevents frame duplication caused by multiple paths in an active topology.
- **Listening** = A port in this state is about to participate in frame relay, but is not involved in any relay of frames (no frames will be forwarded). The reason for not entering frame relay immediately is to ensure that there are no temporary loops introduced when the network topology is changing. During this state, the switch will disable all learning states on its ports to prevent the race conditions when ports are changing roles and the forwarding process will discard all frames and not submit any frames for transmission. Meanwhile BPDUs (Configuration Messages - Bridge Protocol Data Units) can still be received and forwarded to keep the algorithm running.
- **Learning** = A port in this state is about to participate in frame relay, but it is not involved in any relay of frames. Frame relays are not performed to prevent the creation of temporary loops during the active topology of a changing bridged LAN. In addition, the forwarding process will discard all frames and not submit any frames for transmission. The reason for enabling learning is to acquire information prior to any frame relay activities. Information gathered will be used and placed in the filtering database (MAC table) to reduce the number of frames being unnecessarily relayed.
- **Forwarding** = A port in the forwarding state is currently participating in frame relay. BPDUs will include the forwarding port in the computation of the active topology. BPDUs received are processed according to the Spanning Tree algorithm and transmitted based on the hello time or BPDU information received.

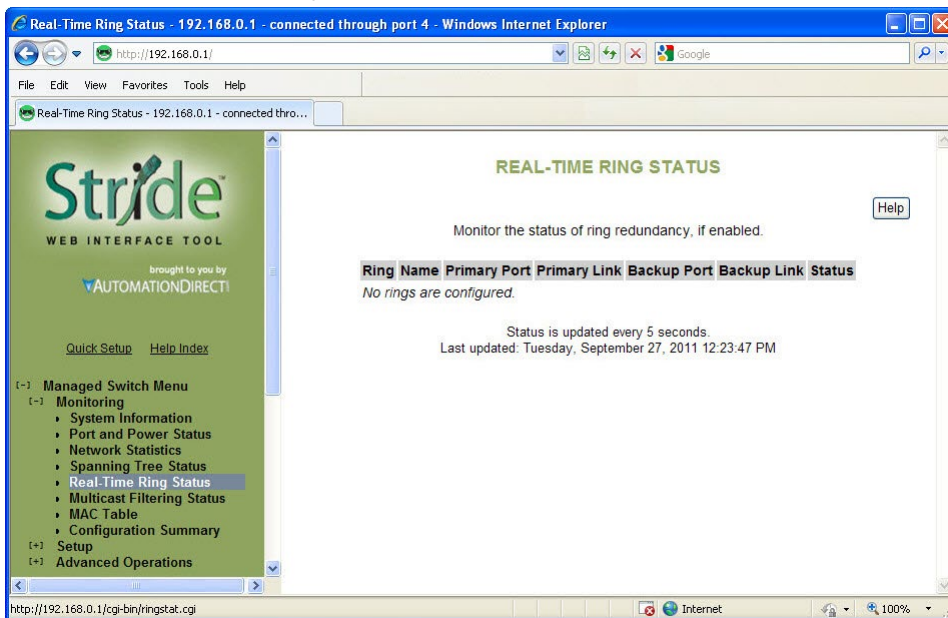
RSTP:

- **Discarding** = In this state, station location information is not added to the Filtering Database (MAC table) because any changes in port role will make the Filtering Database information inaccurate.
- **Learning** = In this state, information is being added to the Filtering Database under the assumption that the port role is not changing. Gathering information before frame relay (forwarding state) will reduce the number of frames sent out when entering the forwarding state.
- **Forwarding** = Frames will be forwarded to and from the particular port that is in the forwarding state. In addition, during the forwarding state, the learning process is still incorporating station information into the Filtering database.

Cost: The cost of using this port to reach other parts of the managed network. The cost is used in calculating the best path from the switch to the root bridge. The lower the cost, the more likely that the path will be used. See the configuration section for Spanning Tree settings for more detail.

Real-Time Ring Status

Each ring that is configured is assigned a number and can be given a name. For more information on the Real-Time Ring feature, refer to the “Real-Time Ring Settings” section under the “Redundancy Settings” section of this document.

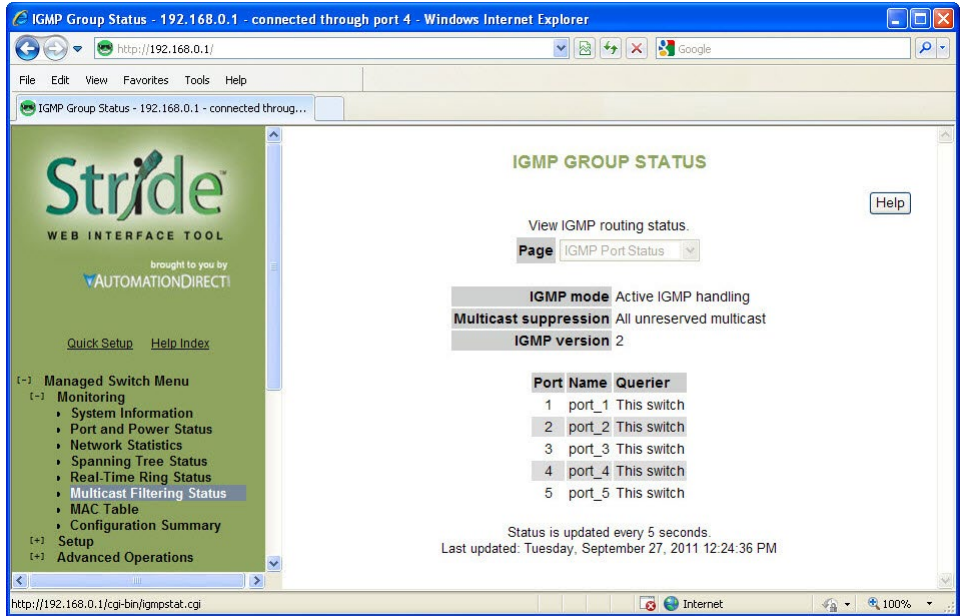


On this page, green highlight on the ring number indicates the ring is complete, red indicates the ring is broken. On the Port, green indicates both ends of the link are connected and communicating. Red indicates on side of the link is not connected or communicating. For each ring configured a Primary port is assigned and a Backup port (if the Primary port is disrupted). The Ring Status page shows the status of the Primary port, its Link status, the status of the Backup port and its Link status.

The Status field indicates whether the Ring is complete or if there is a break in the Ring. If the Ring is broken at the switch being monitored, it will indicate “Local”. If the Ring is broken at another switch, it will indicate “Remote”.

Multicast Filtering Status

This section shows the current IGMP Multicast Filtering Status. For more information on the particular details of the Multicast Filtering features of the switch, refer to the “Multicast Filtering (IGMP)” section of this document.



IGMP Port Status:

- **IGMP mode:** Displays the configured mode of IGMP handling. The three choices are: IGMP disabled, Passive IGMP handling and Active IGMP handling. The specific details of each mode are discussed in more detail in the “Multicast Filtering (IGMP)” configuration section.
- **Multicast suppression:** Displays the configured mode of Multicast suppression. The three choices are: None, IP multicast groups and All unreserved multicast. The specific details of each mode are discussed in more detail in the “Multicast Filtering (IGMP)” configuration section.
- **IGMP version:** Displays the configured version of IGMP for this switch. The choices are Version 1 or Version 2. The specific details of these versions are discussed in more detail in the “Multicast Filtering (IGMP)” configuration section.
- **Querier:** Indicates what device is sending out IGMP query messages. When the switch is set to “Active IGMP handling”, the Querier will most often be this same switch.

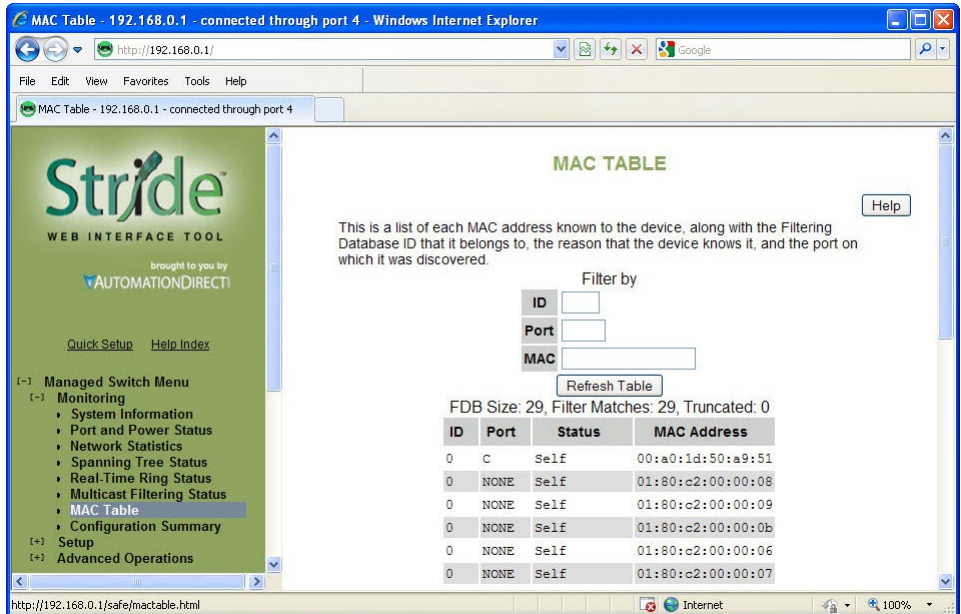
IGMP Group Status:

- **Group:** Displays the Multicast IP address of a particular multicast group.
- **Port:** Displays the port that the particular multicast group is active on.
- **Reporter:** Displays the IP address of the last host to report membership in this group on this port. Hosts send IGMP reports to a switch or router for the purpose of having the switch or router include them into a particular multicast group.
- **Age:** The number of seconds since this group was last reported on this port.
- **Expiration:** The number of seconds until this group will be dropped unless a new report is received.

MAC Table

The MAC address table page displays the current MAC address table of the switch. This data can be filtered by the Filter Database ID (FID: Values that are applied as the devices are encountered, no other significance to the value), the port(s) of discovery or by all or part of the MAC address. Please note that Port 33 or 65 is the internal CPU port, depending upon the model.

Entries in the MAC table will time out after 300 seconds of inactivity. Alternatively, the MAC table can be flushed by power cycling the switch.



The screenshot shows the Stride Web Interface Tool in a Windows Internet Explorer browser window. The page title is "MAC Table - 192.168.0.1 - connected through port 4". The main content area is titled "MAC TABLE" and includes a "Help" button. Below the title, there is a description: "This is a list of each MAC address known to the device, along with the Filtering Database ID that it belongs to, the reason that the device knows it, and the port on which it was discovered." There are three input fields for filtering: "Filter by ID", "Port", and "MAC", each with a corresponding text box. A "Refresh Table" button is located below the input fields. The table below shows the current MAC table entries:

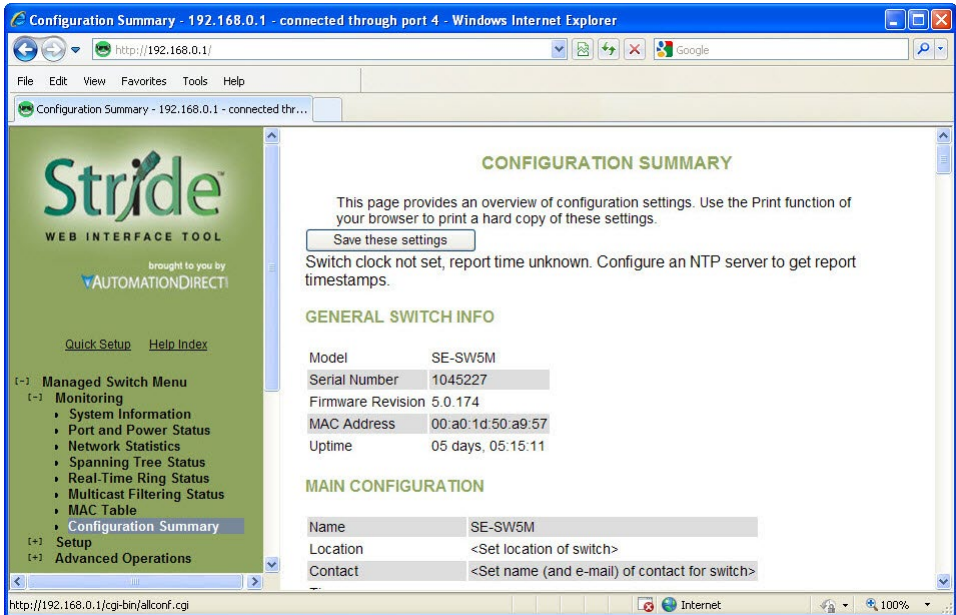
FDB Size: 29, Filter Matches: 29, Truncated: 0

ID	Port	Status	MAC Address
0	C	Self	00:a0:1d:50:a9:51
0	NONE	Self	01:80:c2:00:00:08
0	NONE	Self	01:80:c2:00:00:09
0	NONE	Self	01:80:c2:00:00:0b
0	NONE	Self	01:80:c2:00:00:06
0	NONE	Self	01:80:c2:00:00:07

The left sidebar contains a "Managed Switch Menu" with options like "Monitoring", "System Information", "Port and Power Status", "Network Statistics", "Spanning Tree Status", "Real-Time Ring Status", "Multicast Filtering Status", "MAC Table", "Configuration Summary", "Setup", and "Advanced Operations".

Configuration Summary

The Configuration Summary Page provides a complete overview of the configuration settings of the switch. The summary is generated in a print-friendly format. If an NTP (Network Time Protocol) server is configured, the report will also report a timestamp. To save these settings to a configuration file, click the “Save these settings” button to be redirected to the Configuration Management screen.



NOTE: This page is for viewing settings only. To change settings, please go to the individual configuration screens.

MANAGED SWITCH SOFTWARE SETUP



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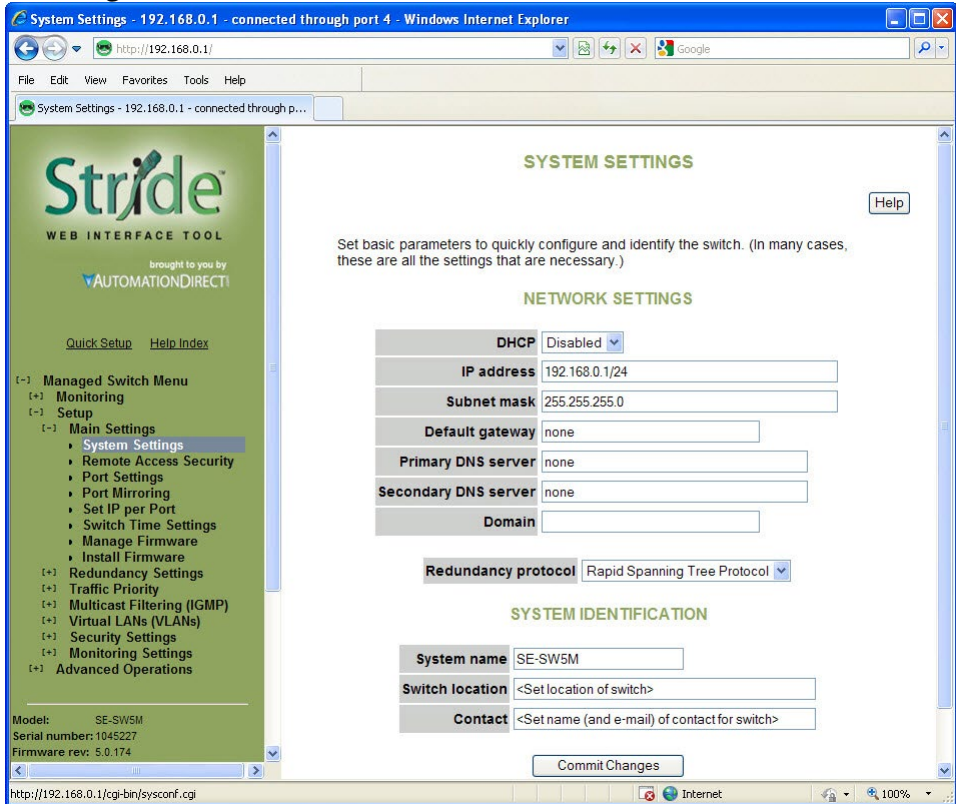
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Main Settings

The Main Settings section is where the general network settings of the switch are configured, such as the IP address and security access User name and password.

System Settings



To control and monitor the switch via the network, it must be configured with basic network settings, including an IP address and subnet mask. Refer to the quick start guide in Chapter 2 to learn how to initially access your switch.

To configure the switch for network access, select Quick Setup from the Main menu to reach the System Settings menu. The settings in this menu control the switch's general network configuration.

DHCP Enabled/Disabled: The switch can automatically obtain an IP address from a server using the Dynamic Host Configuration Protocol (DHCP). This can speed up initial set up, as the network administrator does not have to find an open IP address.



NOTE: *If DHCP has been enabled, it will be necessary to connect to the console port serially or via USB in order to ascertain which IP address has been assigned so that you may be able to access the Switch using the web browser.*

IP address and Subnet Mask: The IP address of the switch can be changed to a user-defined address along with a customized subnet mask.



NOTE: *For additional security, advanced users can set the IP address to 0.0.0.0 to disable the web browser access. However, any features requiring an IP address (i.e., web interface, etc.) will no longer be available.*

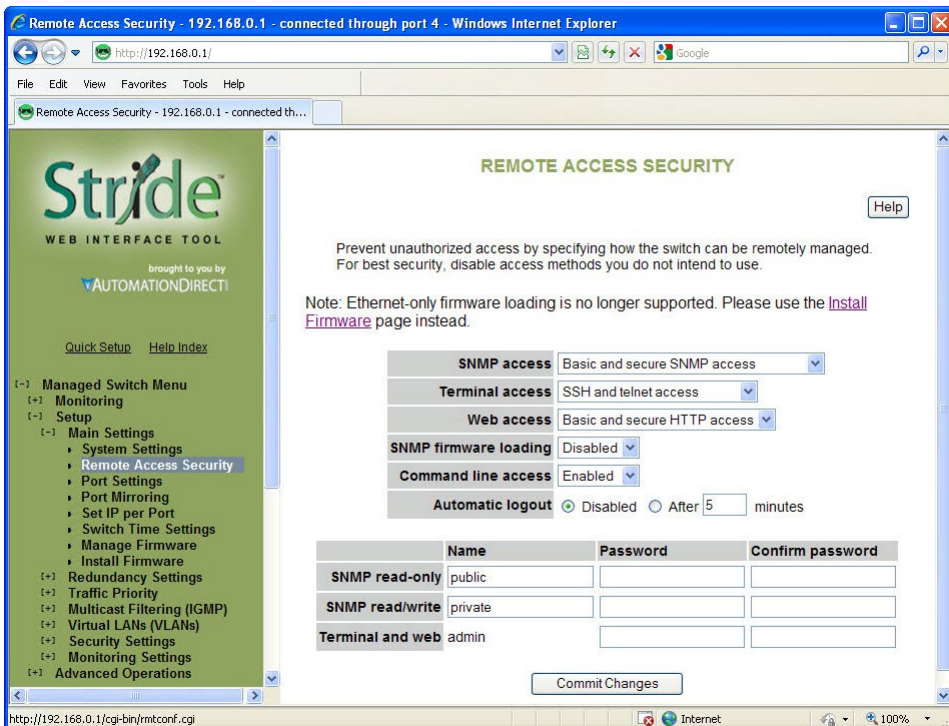
Default gateway: A Gateway address is the address of a router that connects two different networks. This can be an IP address or a Fully Qualified Domain Name (FQDN) such as “domainname.org”.

Primary DNS server: A DNS server address will be required if domain names are used in the switch settings. A Domain Name System Server converts a name, such as “domainname.org”, into an IP address that is usable in the Ethernet messaging. Consult your network administrator for the proper DNS address for your network.

Secondary DNS server: A secondary DNS server can be configured in the case that the Primary DNS server is unreachable.

Remote Access Security

This screen allows you to set your remote access security settings.



SNMP Access: Choose the level of SNMP access to allow.

- **None:** No SNMP access allowed.
- **SNMPv1 & SNMPv2 access (no passwords):** SNMP v1 and SNMPv2 access with community string (None) sent in clear text and no password required.
- **SNMPv3 access:** SNMPv3 access with encrypted password.
- **Basic and secure SNMP access:** SNMPv1, SNMPv2 and SNMPv3 access allowed.

Terminal access: Choose the type of terminal access to allow

- **None:** No terminal access to the switch will be allowed.
- **Non-secure access via telnet:** Non-secure access via telnet protocol. Remote access is possible through this protocol, although all information being transacted between server and client will be sent as clear text. Should security be of concern, use the Secure Shell protocol instead.
- **Secure access via SSH:** Secure access can be achieved through the use of the Secure Shell protocol (SSH), which implements strong authentication and secure communications using encryption. Using this protocol will ensure that your login information never gets sent as clear text, keeping the switch protected against possible attacks coming from the network.

- **SSH and telnet access:** The switch can be accessed through secure (SSH) and non-secure (telnet) terminal access.

The switch supports these encryption algorithms for SSH:

- 3DES
- Blowfish
- AES
- Arcfour

To take advantage of the SSH capability in the switch, you will need to use an SSH client program. There are many SSH client programs available for you to log onto the host (the switch).

Two open source SSH client programs are available on the Internet:

- Program name: OpenSSH for Windows: <http://sshhwindows.sourceforge.net/>
- Program name: PuTTY: <http://www.chiark.greenend.org.uk/~sgtatham/putty/>

The SSH protocol requires some way for clients to be sure they are communicating with the intended host. The host computes a “fingerprint” based on its key and provides that to the client for verification. The first time a client program sees a fingerprint, it typically displays it and asks something like “The host is offering me these credentials, should I trust it?”

If you agree, the fingerprint is stored for later reuse.

For the system to be secure, the fingerprint used for comparison must be transmitted “out of band” (by a means other than the channel that is being secured by the fingerprint). In this case, via documentation.

The RSA fingerprint for the managed switch’s encryption key is:

1e:0f:31:39:26:3f:23:8c:ba:7e:e9:d1:56:ff:98:f6

Web access: Choose the level of web access to allow.

- **No web access:** No web access allowed.
- **HTTP access:** Basic HTTP access allowed.
- **Secure HTTP (HTTPS) access:** Secure HTTP (HTTPS) required. Attempts to access the switch via http will be redirected to the secure protocol.
- **Basic and secure HTTP access:** Basic and secure HTTP access allowed.

SNMP firmware loading: Allows or disallows loading firmware via the SNMP protocol.

Command line access: Allows or disallows Command Line (CLI) access.

Automatic Logout: Specify the number of minutes of inactivity before terminal sessions automatically logout to prevent unauthorized access. The default is 5 minutes.

SNMP read-only name: This parameter sets the SNMPv2 community string and SNMPv3 user name that may be used by SNMP clients for read-only access of settings. Enter your own value if you wish to secure read-only access. (Default is “public”).

SNMP read-only password: These parameters set the password for secure SNMPv3 access by the read-only user. SNMP passwords must be at least eight characters long. The default read-only password is ‘publicpwd’ (w/out quotes).

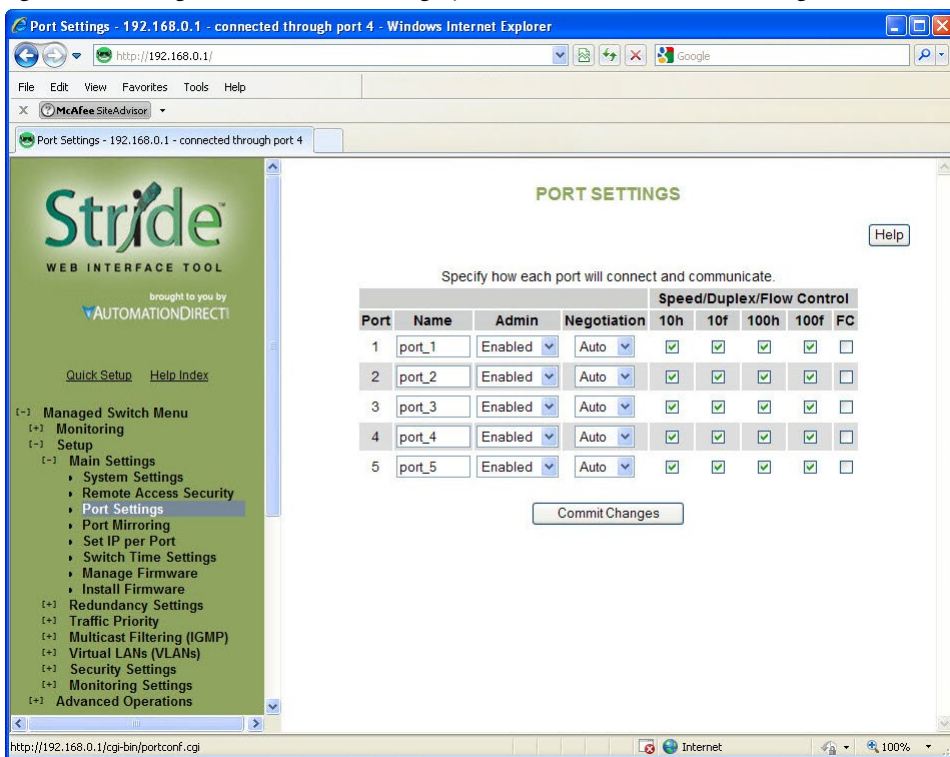
SNMP read/write name: This parameter sets the SNMPv2 community string and SNMPv3 user name that may be used by SNMP clients for read/write access to settings. Enter your own value if you wish to secure read/write access. (Default is “private”).

SNMP read/write password: These parameters set the password for secure SNMPv3 access by the read/write user. SNMP passwords must be at least 8 characters long. The default read/write password is ‘privatepwd’ (w/out quotes).

Terminal and web: Password set here is used for Telnet and web access. To change the administrative password, select this option. (Default password is ‘admin’).

Port Settings

The switch comes with default port settings that allow you to connect to the Ethernet Ports without any configuration. Should there be a need to change the name of the ports, negotiation settings or flow control settings, you can do this in the Port Settings menu.



Port Name: Each port in the managed switch can be identified with a custom name. Specify a name for each port here.

Admin: Ports can be enabled or disabled in the managed switch. For ports that are disabled, they are virtually non-existent (not visible in terms of switch operation or spanning tree algorithm). Choose to enable or disable a port by selecting Enabled or Disabled, respectively.

Negotiation: All copper ports and gigabit fiber ports in the managed switch are capable of auto-negotiation such that the fastest bandwidth is selected. Choose to enable auto-negotiation or use fixed settings. 100Mbps fiber ports are fixed speed only.

Speed/Duplex/Flow Control: Each port can be set to allow speed and duplex to be negotiated to any or all Speed/Duplex/Flow control options. Network performance can be optimized by using Fixed Negotiation and restricting Speed/Duplex/Flow Control to a single value if network traffic is known.

These options are available:

- 10h – 10 Mbps, Half Duplex
- 10f – 10 Mbps, Full Duplex
- 100h – 100 Mbps, Half Duplex
- 100f – 100 Mbps, Full Duplex
- 1000f – 1000 Mbps, Full Duplex

On managed switches with gigabit combination ports, those ports will have two rows, a standard row of check boxes and a row labeled “SFP” with radio buttons. The SFP setting independently sets the speed at which a transceiver will operate if one is plugged in. Otherwise, the switch will use the fixed Ethernet port and the corresponding settings for it.



NOTE: *The SFP settings are NOT automatically sensed or negotiated. If a 100 Mbps SFP is installed in the switch, that port must be manually set on the port settings page to 100 Mbps.*

Flow Control: Flow control can also be enabled or disabled, and is indicated by ‘FC’ when enabled. Devices use flow control to ensure that the receiving devices takes in all the data without error. If the transmitting device sends at a faster rate than the receiving device, then the receiving device will eventually have its buffer full. No further information can be taken when the buffer is full, so a flow control signal is sent to the transmitting device to temporarily stop the flow of incoming data.

Port Mirroring

In an unmanaged switch, each port is filtered to only send and receive Ethernet packets to devices physically connected to that port. This makes it impossible to view the messages occurring between two other devices from a third device (such as a PC running a tool like “Wireshark”).

The mirroring option is ideal for performing diagnostics by allowing traffic that is being sent to and received from one or more source ports to be replicated out the monitor port.

Choose a monitor port.

Choose the source ports to be mirrored (monitored). For each source port choose the data to monitor: choose to monitor messages being sent (select Egress), messages being received (select Ingress) or messages being sent and received (select Both).



NOTE: The Ingress Only option is not supported on SE-SW5M-xxx and SE-SW8M-xxx models.

The screenshot shows the 'PORT MIRRORING' configuration page. The 'Monitor port' is set to '1'. The table below lists five source ports, each currently set to 'None' for data to monitor.

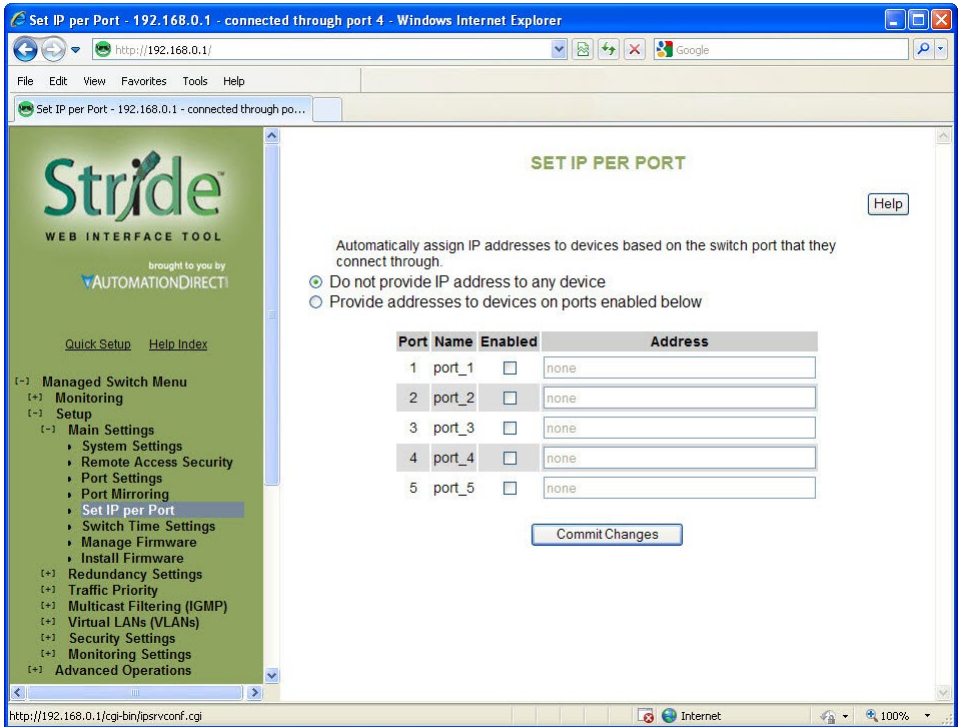
Port	Name	Data to Monitor
1	port_1	None
2	port_2	None
3	port_3	None
4	port_4	None
5	port_5	None

Below the table is a 'Commit Changes' button. The left navigation menu includes: Managed Switch Menu, Monitoring, Setup, Main Settings (System Settings, Remote Access Security, Port Settings, Port Mirroring, Set IP per Port, Switch Time Settings, Manage Firmware, Install Firmware), Redundancy Settings, Traffic Priority, Multicast Filtering (IGMP), Virtual LANs (VLANs), Security Settings, Monitoring Settings, and Advanced Operations.

To view the traffic, connect a PC running network monitoring software (such as Wireshark) to the Monitor port.

Set IP per Port

The switch may provide an IP address to one device on each network port. This feature may be turned on and off for the whole switch and individually controlled for each port.



This feature is not a DHCP service. With Set IP per Port enabled on a port, the switch will respond to a DHCP request on that port with an IP address only.

For the feature to function properly, the host and network must meet the following criteria:

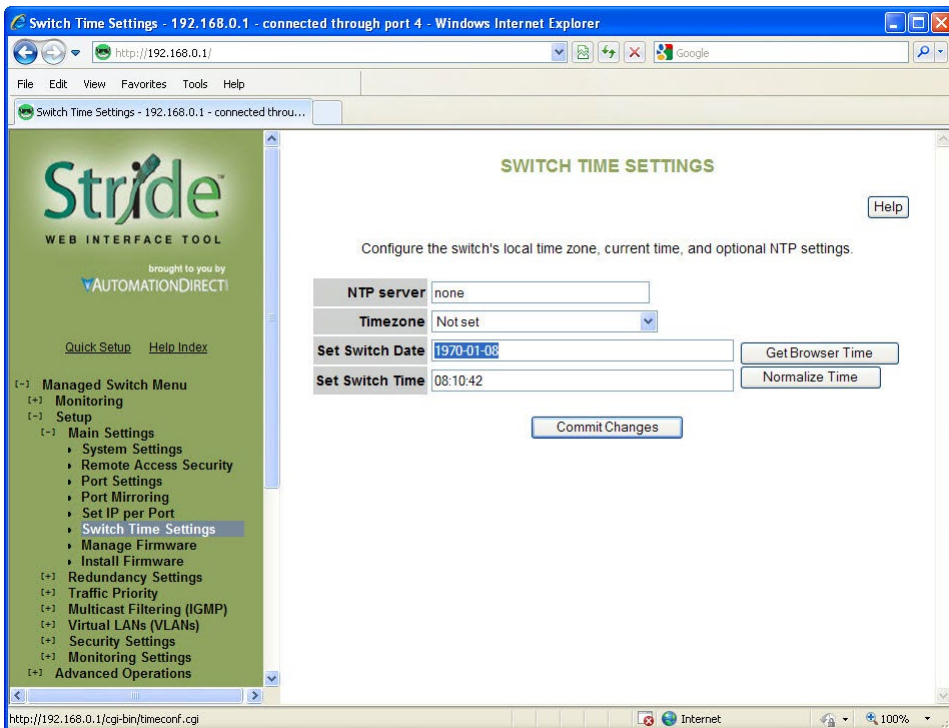
1. A single host must be directly connected to the switch port.
2. The host must not require a Subnet Mask to be offered.
3. The host and network must not require a Default Gateway to be offered.
4. There must be no other DHCP server on the network.
5. VLAN's must not be configured on the network.



NOTE: Productivity3000, ECOM/ERM modules and C-more panels require a Subnet Mask in the DHCP.

Switch Time Settings

This screen allows you to configure the switch's time settings, including time zone, current date and time as well as an NTP (Network Time Protocol) time server.



NTP server: You may specify an NTP server to automatically set the switch's clock. If a DNS server is configured, you may use a fully qualified domain name; otherwise, you must specify an IP address.

Timezone: This is the local timezone where the switch is installed. The switch will offset accordingly from the current time configured in the switch.

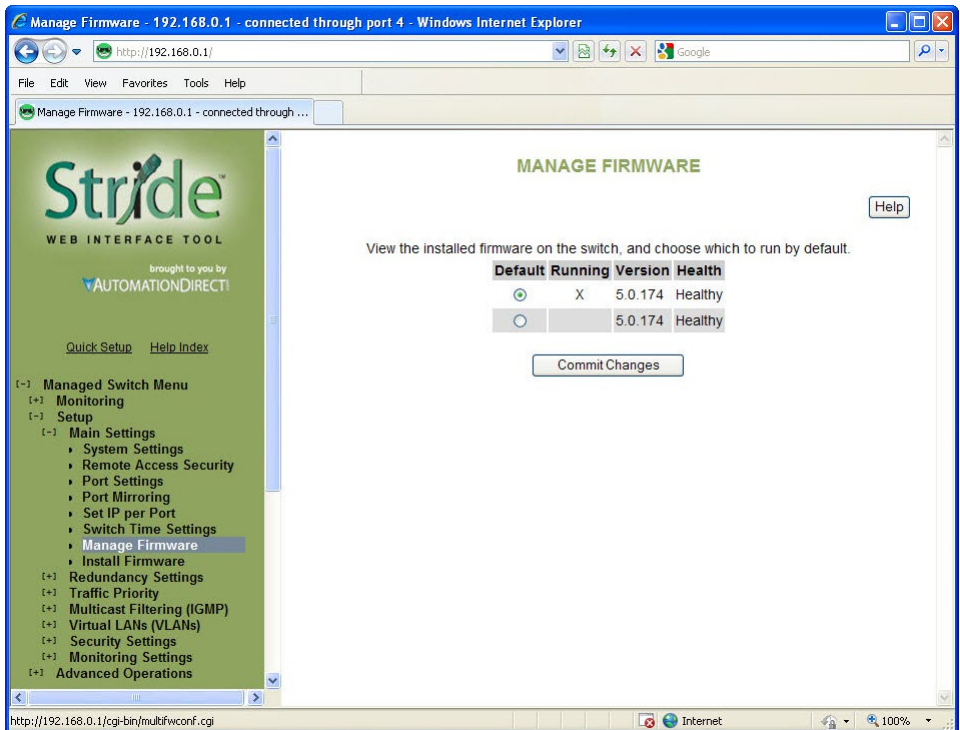
Set Switch Date: This is where the date is set for the switch. The format of the date is Year-Month-Day (YYYY-MM-DD).

Set Switch Time: This is where the time is set for the switch. The format of the time is hour:minute:second (HH:MM:SS).

There is also a "Get Browser Time" button to synchronize the switch's clock to your local browser's time and a "Normalize Time" button to format the time in a manner that the switch will view it. In other words, if the seconds are left out in time field, the normalize button will show the seconds field that will be set when the Commit button is pressed.

Manage Firmware

The Manage firmware page displays the current status of each of the two firmware images on a switch, and allows for changing which one will run the next time the switch is reset.



Default: Shows the current default firmware image to run when the switch is reset. May be changed to run a different firmware on the next reset.

Running: Shows the current running firmware image. This may be different from the current default firmware image if the switch failed to boot recently.

Version: Displays the firmware version number for each installed firmware. If the version cannot be determined, this will report “Unknown”.

Health: Shows the health of each firmware image. The health can be one of the following:

- **Healthy:** The firmware is running or is expected to be in good enough shape to run.
- **Broken:** The firmware is known to be in a state that would prevent it from booting. The Default column will not allow this image to be selected for booting.
- **Unknown:** The firmware may be bootable, but the switch cannot be certain. This will happen if the switch is running the non-default firmware. This can happen if the default firmware somehow became corrupt, or if the switch lost power part way through booting.

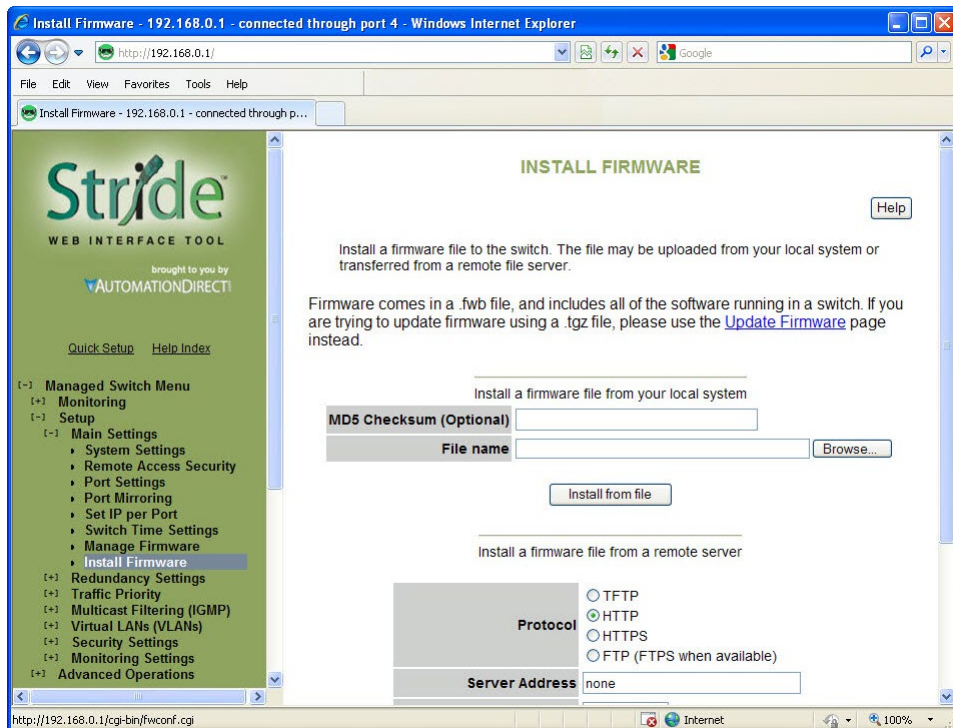
If the firmware that is currently running is not the default, and the switch is reset without explicitly saving the default (“Commit Changes”), the current firmware will be run again. To

boot the firmware marked as the default, first, **commit this page** and then **reset the switch**.

Install Firmware

The Install Firmware page allows the inactive firmware (the selection not marked Running on the Manage Firmware page) to be replaced with a new version. To make the new version be the running version on the switch, after uploading the new version, you must:

- Go to the Manage Firmware page
- Select the new version as default
- Reset the switch



Firmware may be directly uploaded to the switch from the local system.

MD5 Checksum (Optional): If an MD5 checksum of the file is available, it may be entered into this field. Providing a checksum will ensure the firmware arrives at the switch intact and without any glitches. An MD5 checksum is not required.

File name: Use the “Browse” button to locate the .fwb firmware file.

Firmware may also be uploaded to the switch from a remote machine serving the .fwb firmware file. The server must be providing the file via TFTP, HTTP, HTTPS, FTP or FTPS.

Protocol: Choose one of the following protocols to retrieve the .fwb firmware file: TFTP,

HTTP, HTTPS, or FTP (FTPS when available).

Server Address: Enter the address of the server in this field. This may be an IP address, or a domain name if a DNS server has been configured on the System Settings page. Literal IPv6 addresses must be surrounded with square brackets. Example: the address fdda:2301::2 must be entered as [fdda:2301::2].

User Name: Enter the user name in this field if required by the server. Note that this is not available for TFTP.

Password: Enter the password in this field if required by the server. Note that this is not available for TFTP.

Anonymous Download: Check this box if no User Name and Password are required by the remote server.

Remote Filename: Enter the remote .fwb firmware file name into this field. The full path is required.

MD5 Checksum (Optional): If an MD5 checksum of the file is available, it may be entered into this field. Providing a checksum will ensure the firmware arrives at the switch intact and without any glitches. An MD5 checksum is not required.

Redundancy Settings

Another benefit of using managed switches over unmanaged switches is their redundancy capabilities. This allows you to have an Ethernet network with extra connections, so if one path between two points on the network fails, another path can be used to deliver messages. If one link or switch fails, another link or switch can take over transparently to prevent unnecessary down time. So why not just physically connect each of the switches in your network in various loop configurations such that there are always at least two paths going to and from each switch? That would create a broadcast loop that will bring a network to its knees very quickly.

In an unmanaged Ethernet network there can be only one path between any two ports on the network. If there is more than one path from one switch to another a broadcast message (and in some cases other messages) sent by the network will be forwarded until it completes a loop by returning on the second path. Since the switches forward all broadcasts and do not keep track of the messages they have sent, the returning message will be sent around the loop again and again. A single message circulating forever around a loop at high speed is clearly not a good thing, so no loops are allowed.

The limitations of having only one path are even simpler to see. If the one and only path fails for any reason, such as a broken cable or power failure at one of the switches, there are no paths left and no network traffic can get through. We need a way to add alternate paths without creating loops. A redundancy protocol such as RSTP, a loop prevention protocol, is used such that switches can communicate with each other to discover and prevent loops.

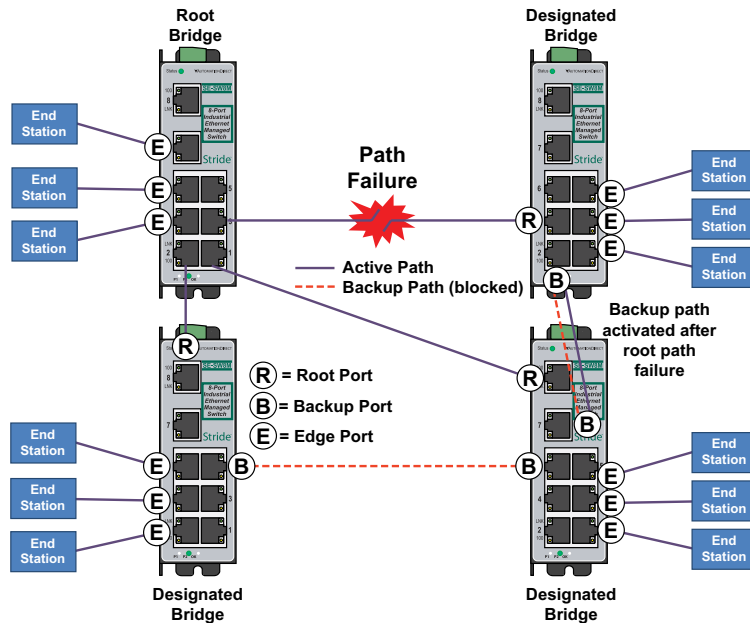
There are four methods of accomplishing redundancy in the Stride managed switches:

- Spanning Tree Protocol (STP)
- Rapid Spanning Tree Protocol (RSTP)
- Multiple Spanning Tree Protocol (MSTP)
- Real-Time Ring

The Spanning Tree Protocols (STP, RSTP and MSTP) are an industry standard and are thus compatible with other manufacturer's managed switches for situations where both need to coexist and communicate. The recovery time, however, is slower with the Spanning Tree Protocols than with the proprietary Real-Time Ring protocol. The merits of both will be discussed in more detail below.

Spanning Tree Protocols:

In the diagram below all the links are the same speed, 100 Mbps. The root ports are those connected directly to the root bridge because they have the lowest path cost (only one hop). The paths that must go through another bridge (switch) have a higher path cost (two hops) and are designated as backup ports (decisions made internal to the switch by the Spanning Tree Protocol). The ports connected directly to end stations are assigned as edge ports (manually assigned on the Spanning Tree Port Settings page) so that RSTP doesn't waste time considering them.



The Rapid Spanning Tree Protocol provides a standardized means for intelligent switches (also called bridges) to enable or disable network paths so there are no loops, but there is an alternative path if it is needed. Why is it called Rapid Spanning Tree Protocol?

- **'Rapid'** – it is faster than the previous (and completely compatible) version called Spanning Tree Protocol (STP).
- **'Spanning'** – it spans (connects) all of the stations and switches of the network.
- **'Tree'** – its branches provide only one connection between two points.

In a Spanning Tree network, only one bridge (managed switch) is responsible for forwarding packets between two adjacent LAN segments to ensure that no loops exist in a LAN. To ensure that only one bridge is responsible, all other bridges on the network must cooperate with each other to form a logical spanning tree that defines the pathways that packets should take from bridge to bridge.

The logical spanning tree has exactly one bridge that is assigned the role of root. All of the other bridges need to have exactly one active path to the root. The job of the root bridge

is to notify all bridges connected in the tree that there has been a topology change and restructuring of the tree is in progress (due to a communications link failure somewhere in the network or a new switch added in the network). The root bridge is determined by the bridge priority assigned to it and the MAC address.

By default, it is the bridge with the lowest MAC address that gets assigned the role as “root”, but a specific bridge can be forced to be the root bridge by changing its bridge priority setting (a lower number with respect to other bridges means higher priority, set on the Spanning Tree Settings page).

Every communication path between each bridge (managed switch) on the network has an associated cost. This “path cost” may be determined by the speed of each segment, because it costs more time to move data at a slower speed, or the path cost can be manually configured to encourage or discourage the use of a particular network. For example, you may not want to use a particular high-speed link except when absolutely necessary because you pay a fee to a service provider for data using that path, while another path is free (no monetary cost).

The path cost is the cumulative cost of all the hops from the root bridge to a particular port on the network. A Spanning Tree network always uses the lower cost path available between a port and the root bridge. When the available network connections change, it reconfigures itself as necessary.

See the RSTP examples topic in this section for an example of how the path cost can be utilized to establish the primary and backup connections.

During the start-up of a Spanning Tree Network, all bridges (managed switches) are transmitting configuration messages (BPDUs) claiming to be the root. If a switch receives a BPDU that is “better” than the one it is sending, it will immediately stop claiming itself as the root and send the “better” root information instead. Assuming the working network segments actually connect all of the switches, after a certain period of time there will be only one switch that is sending its own root information and this switch is the root. All other switches transmit the root bridge’s information at the rate of the root bridge’s “hello time” or when the root bridge’s BPDU is received on one of their ports.

The factor for determining which switch is the root (has the “best” root information) is the bridge priority and its tie-breaker, the switch MAC address. If a switch has more than one path to get messages from the root, other information in the configuration message determines which path is the best.

Once the root bridge is determined, all other switches see the root bridge’s information and information about path (or paths) to the root. If more than one port provides a path to the root the non-root switches must decide which port to use. They check all of their ports to select the port that is receiving messages indicating the best path to the root.

The selected port for each bridge is called the root port. It provides the best path to communicate with the root. The best path is determined first by the lowest total path cost to the root (root path cost). Each port is assigned a cost (usually based on the speed) for messages received on that port. The root path cost for a given path is just sum of the individual port costs for that path. The lowest path cost indicates the shortest, fastest path to the root. If more than one path has the same cost the port priority assigned to each port, and its tie-breaker the port number pick the best path.

Recovery Time, Hops and Convergence:

The typical RSTP recovery time (time to start forwarding messages on the backup port) on a link-loss failure is <50ms per “hop”. A hop is defined as a link between two switches. A link to an end station is not considered a hop.

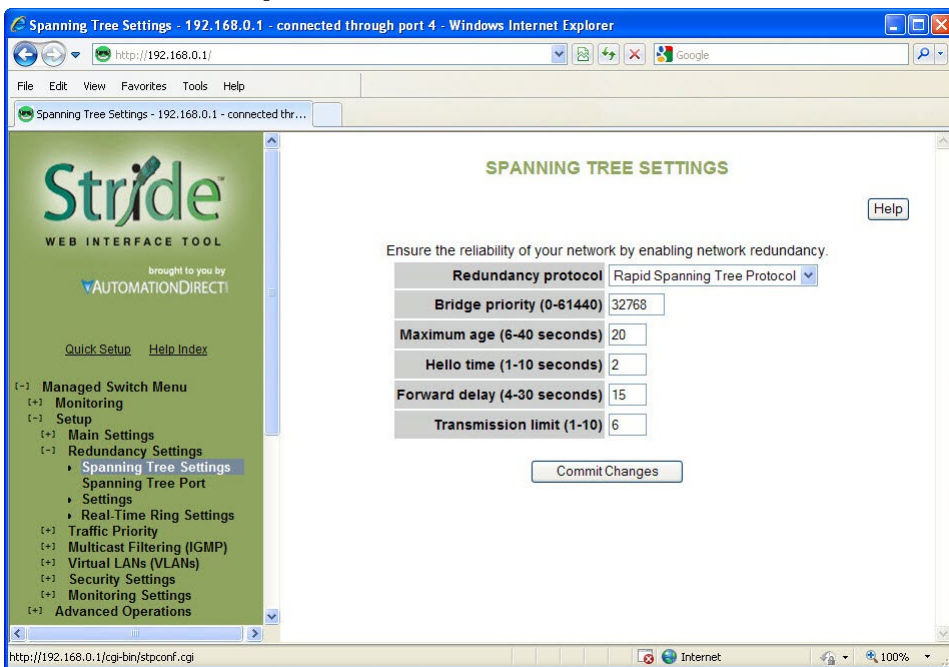
The Max Age setting controls how long RSTP messages may circulate in the network. Since the largest value allowed for Max Age is 40, the largest RSTP network hop-diameter is also 40.

See the RSTP Examples topic in this section for a more detailed explanation about hops and recovery time.

The time it takes for all of the switches to have a stable configuration and send network traffic is called the convergence time. STP was developed when it was acceptable to have a convergence time of maybe a minute or more, but that is not the case anymore. Due to the increased demand for better convergence times, Rapid Spanning Tree Protocol was developed, bringing the normal convergence time for a properly configured network down to a few seconds. The RSTP takes advantage of the fact that most modern Ethernet links between switches are point-to-point connections. With a point-to-point link, the switches can quickly decide if the link should be active or not.

Spanning Tree Settings

The Spanning Tree Settings enable you to choose the redundancy protocol and set parameters related to that protocol.



Redundancy Protocol: Choose the protocol by selecting STP (Spanning Tree Protocol), RSTP (Rapid Spanning Tree Protocol) or MSTP (Multiple Spanning Tree Protocol). A selection of None will disable this advanced feature. Choosing STP, RSTP or MSTP will allow the wiring of redundant networks (such as rings) for automatic failover. RSTP is compatible with STP so in most cases you should choose RSTP. Only choose STP if you want to force the switch to only use this protocol. STP/RSTP/MSTP use BPDUs (Bridge Protocol Data Units) to keep bridges informed of the network status.

MSTP is compatible with RSTP and STP but adds the ability to route VLANs over distinct spanning trees within an MSTP region. In order to configure spanning trees, you must create spanning tree instances using the STP configuration page and assign VLANs to them using the VLAN configuration page.

MSTP falls back to RSTP behavior outside of an MSTP region. A region is identified by the unique combination of Region Name, Configuration Revision and VLAN to MSTI mapping for each switch in that region. If those values match for linked switches running MSTP, those switches consider themselves to be in the same region.



CAUTION: If VLANs and redundancy (STP/RSTP/MSTP) are both enabled, situations can arise where the physical LAN is intact but one or more VLANs are being blocked by the redundancy algorithm and communication over those VLANs fails. The best practice is to make all switch-to-switch connections members of all VLANs to ensure connectivity at all times. Should you intend to use RSTP and VLANs at the same time, please see the “VLAN with RSTP” section for important information concerning the setup of your network. Otherwise, communication failures may occur.

Select none if you do not require the switch to manage redundant network connections. All ports will forward network traffic just as an unmanaged switch would. Otherwise RSTP (Rapid Spanning Tree Protocol) should usually be selected. A selection of STP or RSTP will allow redundant links between switches so those links can keep the network connected even when a primary link fails. RSTP is compatible with switches that only implement STP, an older version of the protocol. If STP is selected only the original STP format messages will be generated. Selecting STP reduces the chances of network packets being duplicated or delivered out of order, but at the expense of much longer reconfiguration time.

Bridge Priority (0 to 61440; Default = 32768): The bridge priority is used to determine the root bridge in the spanning tree. For MSTP, the bridge priority is used to determine the CIST root. The priority ranges from 0 to 61440 (default 32768) and must be a multiple of 4096. Lower numbers indicate a better priority.

By default, the bridge with the lowest bridge priority is selected as the root. In the event of a tie, the bridge with the lowest priority and lower MAC address is selected.

There are two ways to select a root bridge (switch). The first is to leave all the bridge priority settings at the default setting of 32768. When all the switches are set at the default priority, the managed switch with the lowest MAC address is selected as the root. This may be adequate for networks with light or evenly distributed traffic.

The second way to select a root bridge is to customize priority settings of each bridge. Customizing the bridge priority settings allows the network to select a root bridge that gives the best network performance. The goal is generally to have the network traffic pass through the network as directly as possible, so the root should be central in the network. If most messages are between one central server and several clients, the root should probably be a switch near the server so messages do not take a long path to the root and another long path back to the server.

Once you decide which switch should be the root, it should be given the best (numerically lowest) bridge priority number in the network.

Maximum Age (6 to 40; Default = 20): For STP, the max age indicates the maximum time (in seconds) that the switch will wait for configuration messages (BPDUs) from other managed switches. If that time expires, the switch assumes that it is no longer connected to the root of the network. If a link goes down in a way that the switch can detect the loss of link, it does not wait before reconfiguring the network.

RSTP waits 3 times the Hello Time instead of Max Age before assuming that it is no longer connected to the root of the network. However, Max Age is used to limit the number of hops Spanning Tree information may travel from the root bridge before being discarded as invalid. Furthermore, MSTP only counts hops that take place to or from switches outside the

MSTP region for this check. The value of Max Hops (below) is used to limit hops within an MSTP region.



NOTE: Assign all Switches in an RSTP/STP network the same Max Age.

The maximum age must satisfy the following constraints:

$2 \times (\text{Hello Time} + 1.0 \text{ seconds}) < \text{max message age} < 2 \times (\text{forward delay} - 1.0 \text{ seconds})$

Hello Time (1 to 10; Default = 2): Configuration messages (BPDUs) are sent periodically to other bridges based on a time period labeled hello time. Decreasing the hello time gives faster recovery times; increasing the hello time interval decreases the overhead involved.

The hello time must satisfy the following constraints:

$2 \times (\text{hello time} + 1.0 \text{ seconds}) < \text{max message age} < 2 \times (\text{forward delay} - 1.0 \text{ seconds})$

Forward Delay (4 to 30; Default = 15): The forward delay is a time (in seconds) used by all switches in the network. This value is controlled by the root bridge and is used as a timeout value to allow ports to begin forwarding traffic after network topology changes. If a port is not configured as an edge port and RSTP cannot negotiate the link status, a port must wait twice the forward delay before forwarding network traffic. In a properly configured network using RSTP (not STP) this setting has very little effect. For STP networks, setting the time too short may allow temporary loops when the network structure changes (switches turn on or off or links are added or broken). A longer time will prevent temporary loops, but network traffic will be disrupted for a longer time.

The default value for the forward delay is 15 seconds. If you change this setting, the switch will not allow a value unless it satisfies the following formula:

$2 \times (\text{hello time} + 1.0 \text{ seconds}) < \text{max message age} < 2 \times (\text{forward delay} - 1.0 \text{ seconds})$

Transmission Limit (1 to 10; Default = 6): The transmission limit controls the maximum number of BPDUs that can be sent in one second.

The transmission limit can range from 1 to 10 messages/second (6 messages/second default). Increasing Transmission limit can speed convergence of the network but at the cost of configuration messages using a larger share of the available network bandwidth.

Region Name (MSTP): The region name is used together with the configuration revision and VLAN to MSTI (MST Instance) mapping to define an MSTP region.

Configuration Revision (MSTP; 0 – 65535): The configuration revision is used together with the region name and VLAN to MSTI (MST Instance) mapping to define an MSTP region.

Max Hops (MSTP; 6 to 40; Default = 20): Max Hops determines the maximum number of switches a BPDU will be propagated through within an MSTP region. This value is used to prevent old data from endlessly circulating within a region.

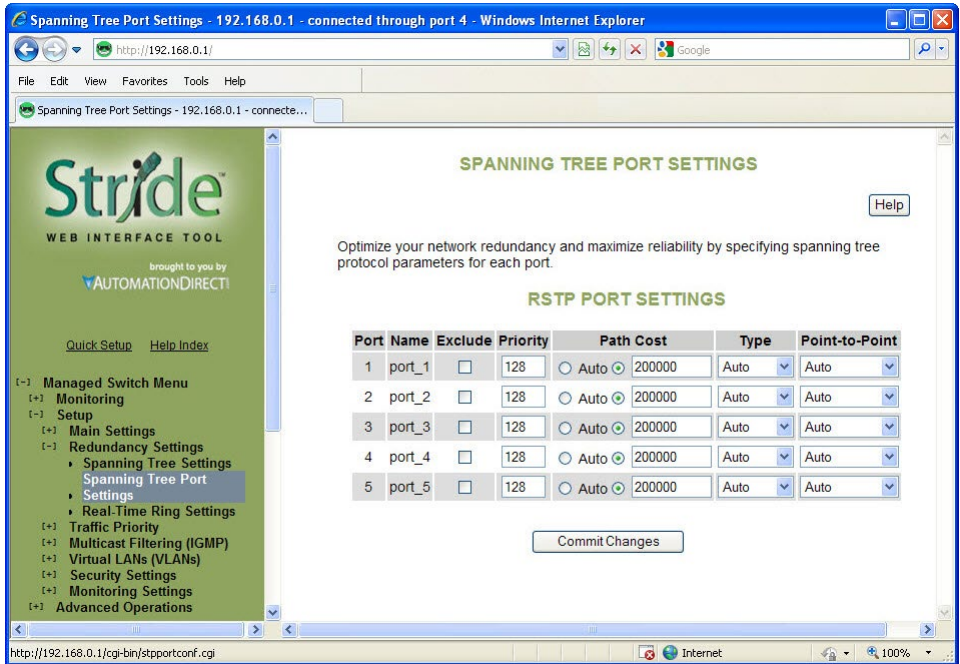
MST Instances: For MSTP, you can configure multiple spanning tree instances. Add an instance by clicking Add MSTI. For each MSTI, you can configure a name, the MST ID, and this bridge's priority in that spanning tree.

Spanning Tree Port Settings

Each port can be configured to tune the STP/RSTP/MSTP spanning tree. With MSTP, each spanning tree instance can be tuned independently.

Using MSTP, you can configure separate port settings for the CIST (Common Internal Spanning Tree) and for every spanning tree created by MSTP. Settings for individual MSTIs (Multiple Spanning Tree Instances) only affect ports connected to switches within the same MSTP Region.

By default, MSTIs inherit their settings from the CIST. To configure an MSTI individually, you must select it from the drop-down box and click the Customize button for the instance. Click Inherit if you want a spanning tree's values to be inherited from the CIST again.



Exclude (Default = Included): Normally all ports should be included in determining the Spanning Tree network topology, either as a normal port or an edge port. It is possible to completely exclude a port, so that it will always forward network traffic and never generate or respond to network messages for RSTP or STP. Excluding a port is an advanced option that should be used only if absolutely necessary. The pair of ports assigned to a Real-Time Ring should be excluded from Spanning Tree.

This option excludes the port from all spanning tree instances and appears with the other CIST settings.

Port Priority (0 to 240; Default = 128): Selection of the port to be assigned “root” if two ports are connected in a loop is based on the port with the lowest port priority. If the root bridge fails, the bridge with the next lowest priority then becomes the root.

This option may be set per port per MSTI.

If the switch has more than one port that provides a path to the root bridge and they have the same root path cost, the selection of which port to use is based on the port priority. The port with the best (numerically lowest) priority will be used. If the port priority is the same, the switch will use the lowest numbered port. The port priority can range from 0 to 240 seconds (128 second default).

Path Cost (1 to 200,000,000; Default = 20,000 for 10 / 100 / 1000 ports and 200,000 for 10 / 100 ports): As with any network, there is an associated cost to go from a source location to a destination location. For RSTP, the root path cost is calculated based on the bandwidth available for that particular connection to the root bridge. The port with the lowest cost for delivering messages to the root is used to pass traffic toward the root.

The path cost can be assigned automatically based on the port speed, using the IEEE standard values of 200,000 for 100Mbps links and 2,000,000 for 10Mbps links, or the value can be specified in the range 1 to 200,000,000.

The default value depends on the capabilities of the port: 200,000 for 100 Mbps and 20,000 for 1000 Mbps ports.

This option can be set per port per MSTI.

See RSTP Examples for an illustration of how the path cost can be utilized to establish the primary and backup connections.

Type (Default = Auto): A port that connects to other switches in the network may be part of a loop. To ensure such loops do not occur, the switch will not put a port in the Forwarding state until enough time has passed for the spanning tree to stabilize (twice the forwarding delay, 30 seconds by default). However, if a port connects directly to a single device at the edge of the network, it may safely be put in Forwarding state almost immediately. The port Type controls the switch's assumptions about what is connected to the port.

- **Auto:** The port will initially be assumed to be an Edge port and go to Forwarding quickly. It will automatically adjust to being a Network port if BPDUs are received and revert to being an Edge port any time no BPDUs are received for 3 seconds.
- **Network:** The port will always wait a safe time before going to the Forwarding state.
- **Edge:** The port will initially be assumed to be a direct connection to a single device but will change to being a Network port if any BPDUs are received. Thereafter, it will always wait a safe time before going to Forwarding whenever a link is reestablished on the port.

This option can be set per port per MSTI.

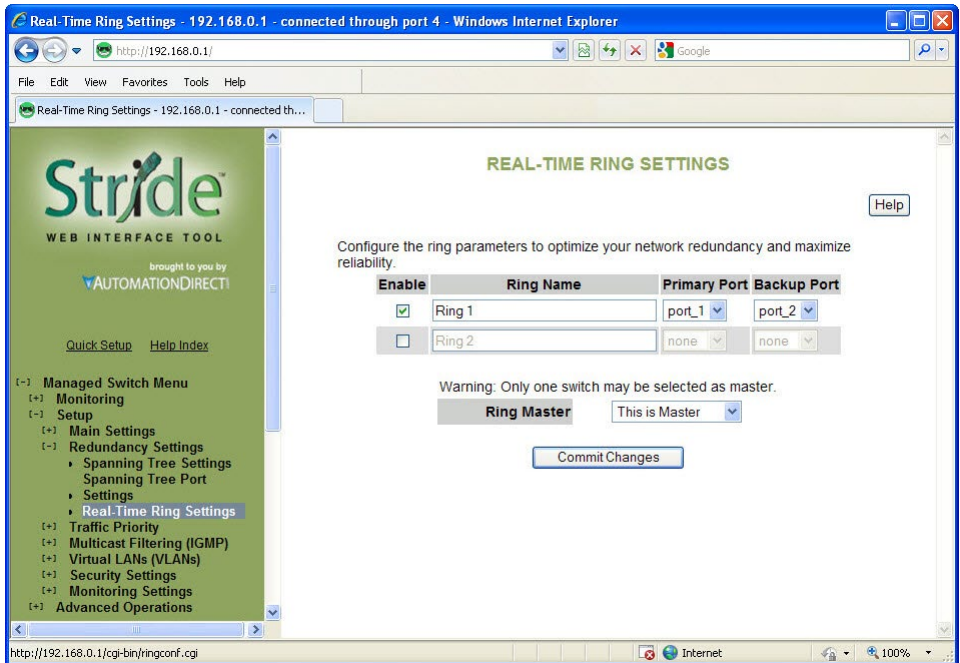
Point-to-Point (Default = Auto): A port is part of a point-to-point network segment when there can be no more than one other network port connected to it. RSTP can decide whether it is safe to forward network traffic very quickly on point-to-point links to other managed switches, otherwise the port must wait many seconds (30 seconds by default, twice the forward delay) before forwarding network traffic. When set to Auto, full-duplex links are assumed to be point-to-point; half-duplex ports are not. This setting can be forced true or false if the automatic determination would be wrong.

Real-Time Ring Settings

The Real-Time Ring Settings page, accessed through the Redundancy Settings, allows configuration of Real-Time Ring protocol in supported switches.

A real-time ring increases network reliability by providing an alternative path for message flow in the event of a network segment failure. When a ring port detects a communications break, it quickly notifies the other switches in the ring. Messages are automatically rerouted through the alternative ring path within milliseconds.

STP (Spanning Tree Protocol) is more flexible than a ring configuration, but recovery times for spanning trees may be in the hundreds of milliseconds. The real-time ring protocol exchanges topological flexibility for recovery times in the tens of milliseconds.



Activate a ring by selecting the appropriate Enable check box. You can configure one ring for every two ports on the switch.

When a ring is enabled, be sure to choose the two ports being used to connect the switch into that particular ring. To do so, pick ports from the Primary Port and Backup Port dropdown lists. Each port should be assigned to only one ring.

The pair(s) or ports assigned to ring(s) should be excluded from Spanning Tree on the Spanning Tree Ports Setup page.

The port defined as Backup will be blocked under normal operating conditions. By default, the switch with the lowest numbered MAC address in a ring will be the master switch, meaning that the communication in the ring will be blocked from one of the two ring ports of that switch. Only the master switch in a ring does this. You may designate a different

switch as the master switch by choosing “This is Master” from the Ring Master dropdown list for the desired switch. All other switches in the ring should be set to the default “Automatic” setting.



NOTE: When a port is configured as a Ring port, that port cannot be used for communication to or through the Switch. It can *ONLY* be connected to another Ring port on a managed Switch or Real-Time Ring Switch.

RSTP Examples

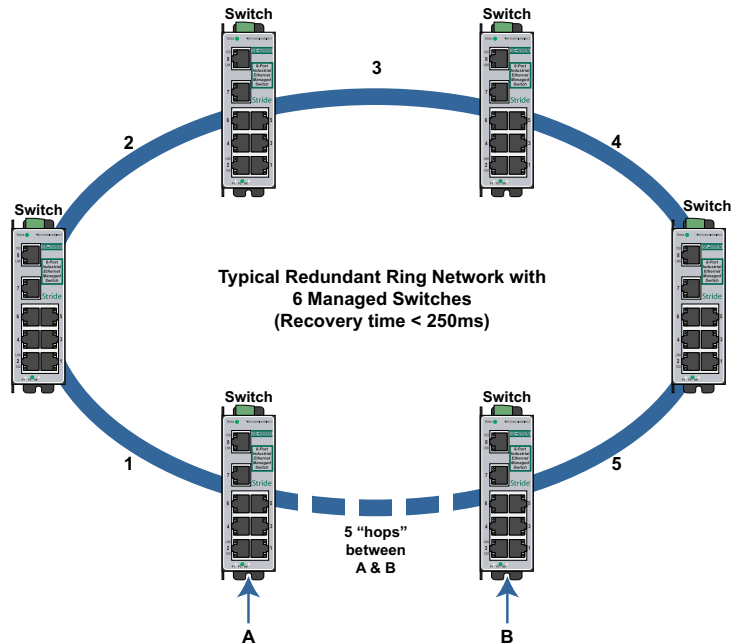
Example 1: Maximum “Hops” and Switches in a Redundant Ring:

The Max Age setting controls how long RSTP messages may circulate in the network. When a switch receives a message, it compares the age of the message with the Max Age (also carried in the message) and if the age has reached the Max Age, the message is discarded. Otherwise, the message age is incremented before the message is forwarded. Therefore, the maximum diameter of a RSTP network is controlled by Max Age. Since the largest value allowed for Max Age is 40, the largest RSTP network hop diameter is also 40.

Number of Hops vs. Recovery Time:

The diagram below shows a typical redundant ring network with 6 managed switches and 5 hops between stations.

The overall recovery time when there is a network segment failure is dependent on the number of hops. The recovery time is typically less than 50 ms per hop. Therefore, in the diagram below of a typical ring with 6 managed switches the overall recovery time would be less than 250 ms (5 hops x <50 ms).

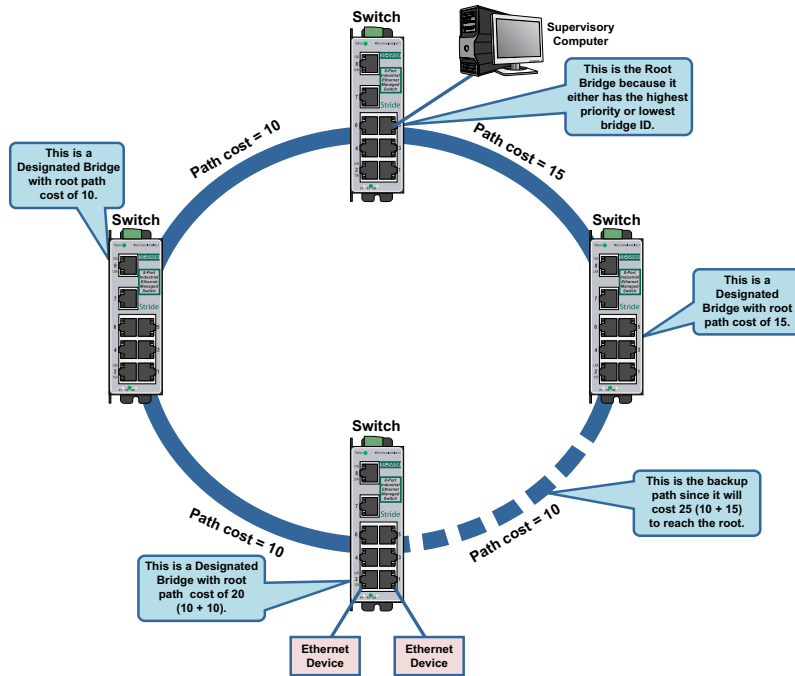


Example 2: Using Path Costs to Establish Primary & Backup Connections:

The path cost can be used to distinguish the best connections to use. You can assign a higher cost to pathways that are more expensive, slower or less desirable in any way. The managed switches will then add up the path costs to determine the best route back to the root switch. See the example below.



NOTE: In most networks you may leave the path costs set to the default settings and allow the Switches to automatically determine the best paths.

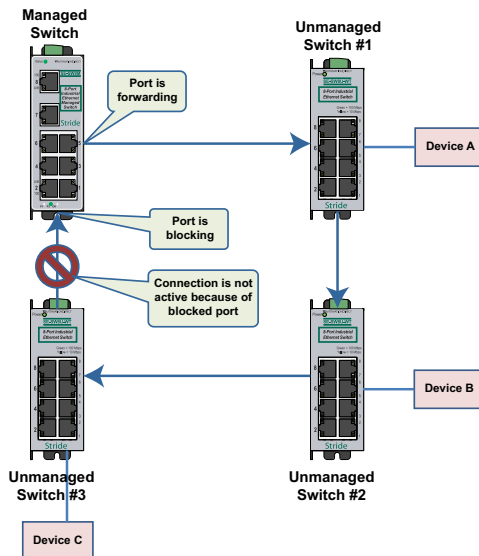


Example 3: Ring Topology with only 1 Managed Switch (Bad idea!):

Implementing a ring topology with a single managed switch and several unmanaged switches is occasionally considered to try to save money. The topology is legal only if that single managed switch is a member of each ring. Although it is legal, it is not recommended, as the hypothetical scenario indicated below will explain.

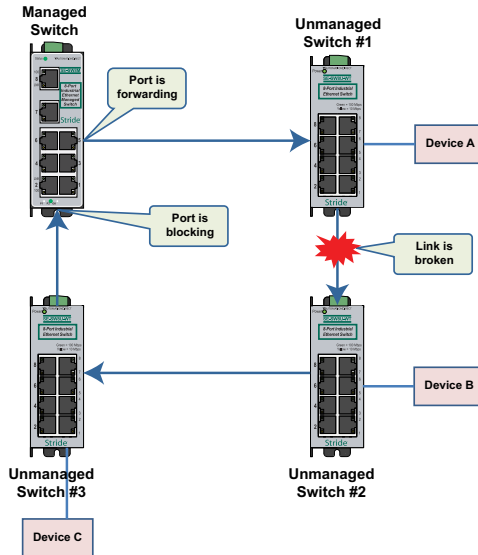
Hypothetical Scenario:

An integrator wishes to implement a single Ethernet ring topology for the proposed network. Only one managed switch is used to connect to three or more unmanaged switches in the loop (Figure below).



Initially, everything is working fine in the network. The managed switch detects the loop by seeing its own configuration messages and based on STP parameters, chooses one port to be in the forwarding state, and the other port to be in the blocking state. No loop is formed and device A can talk to device B.

Somewhere in the plant, a construction vehicle accidentally cuts the connection between unmanaged switch #1 and unmanaged switch #2. The managed switch in the network notices (typically around 6 seconds when connected to an unmanaged switch) that the port in blocking mode is not receiving configuration messages and transitions through the listening, learning, and forwarding states (Figure below).



This would seem to have solved the problem as both ports in the managed switch are in forwarding mode, but it is not the case. Due to the fact that the other three switches are unmanaged, they do not have the intelligence to know that there has been a change in the network topology. switch #1 still points to switch #2 when device A is trying to talk to device B (across the broken Ethernet link). The bottleneck has been discovered, as we have to wait until the MAC table in switch #1 ages out its entries of device A and device B. The same applies for devices connected to switch #2 (B talking to A) and switch #3 (C talking to A).

As a result of this “money saving” configuration, the network redundancy performance is traded off and left at the mercy of the time it takes to age out MAC table entries in switches 1, 2, and 3. Depending on the model of unmanaged Ethernet switch, entries in the MAC table are usually aged out in a time period of 5 minutes or more.

This introduces at least 5 minutes of downtime for the plant, which could have a very detrimental cost with respect to the operation of the plant. By replacing switches 1, 2, and 3 with managed switches, the network convergence time is reduced to a less than a second. An additional benefit is that the network is not limited to only one redundant loop and can have a “mesh” of connections for a truly redundant network scheme at all points in the network.

Traffic Priority (Priority Queuing QoS, CoS, ToS/DS)

Without enabling special handling, a network provides a “best effort” service to all applications. This means that there are no assurances regarding the Quality of Service (QoS) for any particular application because all packets are treated equally at each switch or router. However, certain applications require deterministic response from the network to assure proper operation.

Consider a drilling machine in a plant that is controlled by a computer on a local network. The depth of the machine’s drill is critical; such that if the hole is drilled is too deep, the material will have to be thrown out. Under normal conditions, the drill process is running smoothly (controller and computer are communicating efficiently over the network) but when another user on the network accesses records from an online database, the large volume of traffic can interfere with timely communication with the drill. A delay in communications between the drill and controller causes the drill to go too far and the material has to be thrown away. To prevent this from happening, we need to provide a certain QoS for all drill-controller communications so delay is avoided.

Numerous mechanisms exist to help assure reliable and timely network communication. The managed switch supports two common means of prioritizing messages: IP header and 802.1p user priorities.

The IP header is present in all frames and contains a priority field, which defaults to 0 and may be set as high as 255. This field is sometimes referred to as the Type of Service (ToS) field, or the Differentiated Services (DS or DiffServ) field.

Applications may add IEEE 802.1p tags, which contain a priority field that may be set from 0 to 7. Each value has a traffic type associated with it. For example, a tag of 5 is prescribed for video data.

The switch provides four priority queues for expediting outbound data. The 256 IP priorities and the 7 IEEE priorities are mapped into these ports in a way that optimizes throughput of high priority data.

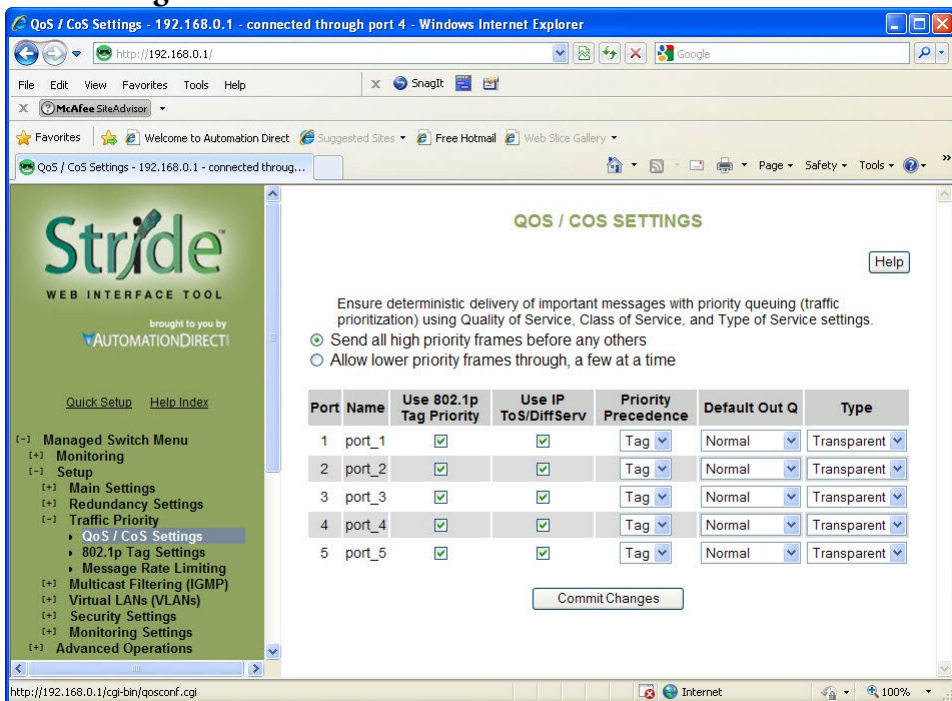
Scheduling:

When choosing how to handle lower priority data, the switch can use strict or fair scheduling. This choice affects all queues on all ports.

Send All Priority Frames before any others: With strict scheduling, all data in the highest priority queue will be sent before any lower priority data, then all data from the second highest priority, and so on. This assures that high-priority data always gets through as quickly as possible.

Allow Lower Priority Frames through, a few at a time: With fair scheduling, a round-robin algorithm is used, weighted so that more high-priority than low priority data gets through. Specifically, the switch will send eight frames from the urgent queue, then four from the expedited queue, two from the normal queue, and one from the background queue, then start over with the urgent queue. This assures that the lower priority queues will not be starved.

QoS / CoS Settings



Use 802.1p Tag Priority: This setting controls whether the switch will honor IEEE tags if present in frames. When enabled, tagged data will be routed to an outbound priority queue based on the configured tag mapping (See below). Disable this setting to ignore IEEE tags on all in-coming frames.

Use IP ToS/DiffServ: This setting controls whether the switch will honor priority fields in the IP header. When enabled, and not overridden by an IEEE tag, data will be routed to an outbound priority queue based on IPv4 Type of Service or IPv6 Traffic Class. The priority queue will be the IP priority field value divided by 64. Disable this setting to ignore IP priority fields.

Priority Precedence: This setting controls which priority mark – IEEE tag or IP header – takes precedence if both are present and enabled. It has no effect if either Use Tags or Use IP is disabled.

Default Out Q: This setting controls the default priority to be assigned to frames when it cannot otherwise be determined. For example, if a frame without an IEEE tag arrived at a port where Use IP was disabled. Select an out-bound priority queue from the list.

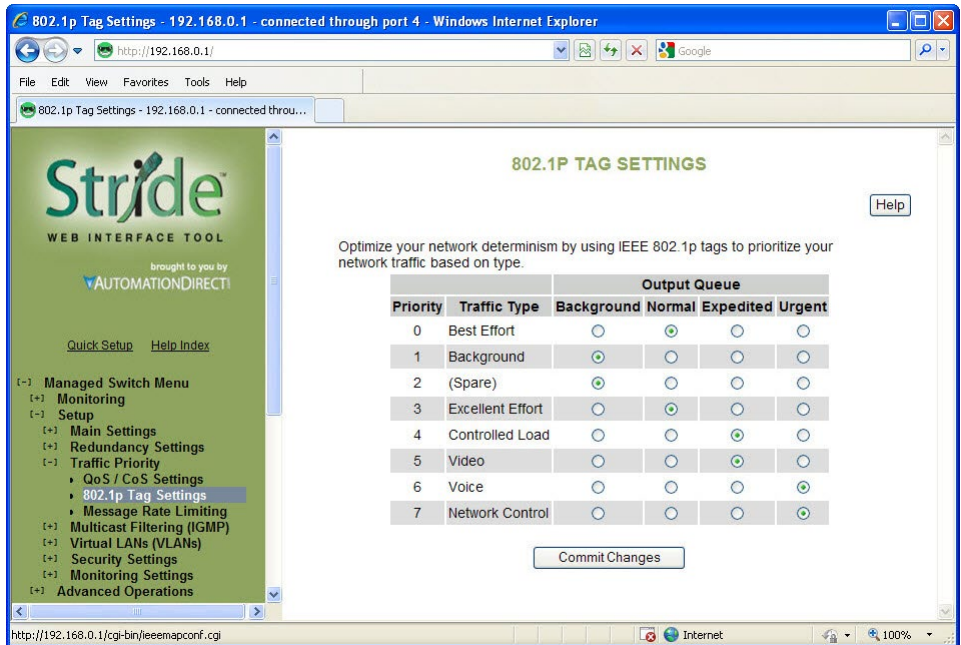
Port Type: This setting controls how IEEE tags are handled in out-going data:

- **Transparent:** Maintains any tag that may have been present in a frame when it entered the switch.
- **Edge:** Removes tags from all out-going frames.

- **Network:** Adds a tag if none is present. The value of the tag is the queue number times two (six for queue 3, etc...)
- **Core:** All frames exiting this port will be tagged, in some cases double-tagged.

802.1p Tag Settings

The managedswitch has four Output Queues: Background, Normal, Expedited and Urgent with Background being the lowest priority and Urgent being the highest priority. In the IEEE 802.1p specification, there are eight different priorities that are carried in the tag. Configure each of the 802.1p priorities for the output queue that is appropriate. More than one 802.1p priority may be configured for a given output queue.



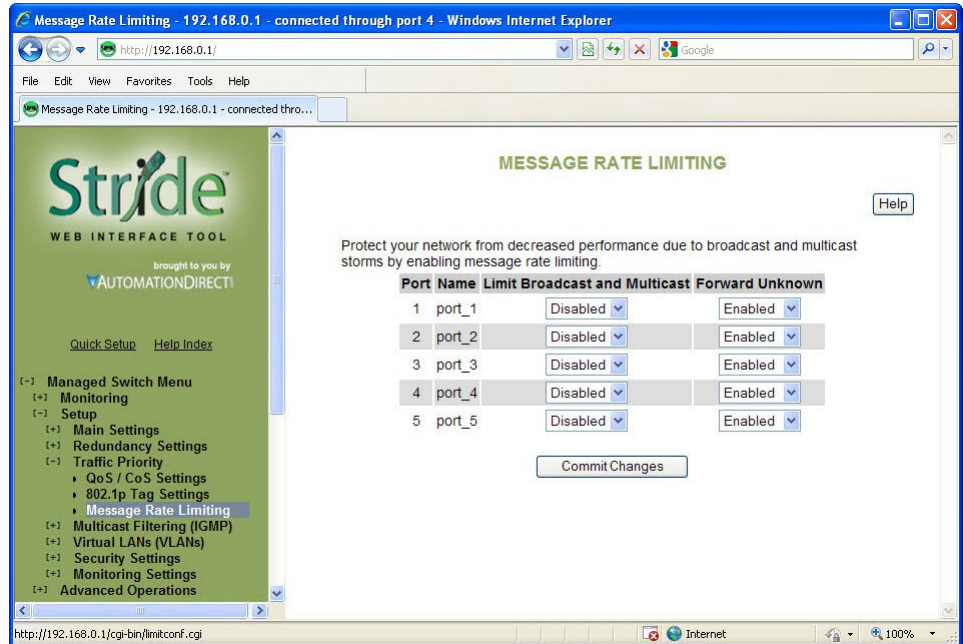
The table below indicates the defaults:

Managed Switch Output Queue					
Priority	Traffic Type (802.1p priority)	Background	Normal	Expedited	Urgent
0	Best Effort		X		
1	Background	X			
2	(Spare)	X			
3	Excellent Effort		X		
4	Controlled Load			X	
5	Video			X	
6	Voice				X
7	Network Control				X

Message Rate Limiting

Message Rate Limiting can prevent your switch and network from being overwhelmed by high volumes of broadcast and multicast messages. When enabled on a port, message rate limiting controls the percentage of messages which are allowed to be broadcast or multicast. Messages over the limit are dropped.

Poorly configured applications and devices or malicious users can flood your network with broadcast packets that are forwarded to all ports and can quickly consume most of a network’s bandwidth. The managed switch provides some protection from such “broadcast storms” by allowing you to limit the rate at which these messages are accepted by the switch. For each port, you may choose to limit the rate of broadcast and multicast messages accepted. Messages over the preset limit will be discarded.



Limiting is done based on message type and priority. Broadcast and multicast messages are prioritized (by IP ToS) then limited to approximately the following rates:

Priority	Limit
Background	10% of link capacity
Normal	20% of link capacity
Expedited	40% of link capacity
Urgent	80% of link capacity

The exact limit depends on link speed.

Messages directly addressed to a single station (unicast messages) are not affected by message rate limiting.

Forward Unknown: By default, messages addressed to unicast addresses that have not yet been learned by the switch are flooded to all other ports. This is important for some protocols that transfer data primarily in one direction, but it can overwhelm smaller systems that do not expect a large amount of traffic. Forwarding of unknown unicast messages can be disabled on a port-by-port basis by disabling “Forward Unknown”.

QoS Example

Let us investigate a detailed example of how to manage a network such that critical real time data will not be interrupted by data that is not as urgent

Hypothetical Scenario:

There is a power plant that is controlled by a central control system. In addition, because of security concerns, cameras have been mounted and installed at each location of mechanical control. The mechanical control devices and video cameras at each site communicate via Ethernet to their own switch. (For reasons of simplicity and clarity, we will assume that only video and control data reside on the network).

- **Problem:** Should any of the mechanical control devices receive delayed control data from the central control system, the power plant can't generate the maximum energy that it is capable of. Customers will experience brown outs, and the plant will be looked upon with negative scrutiny. It is therefore very important that the video traffic created by the cameras not delay critical data.
- **Goal:** To optimize the forwarding of critical real-time control data and minimize or eliminate the impact of video data traversing the network.
- **Solution:** Configure the switch such that video data has lower priority than control data by adjusting the priority queuing settings in the switch.

Configuration of the Switch:

As mentioned earlier in this manual, some applications require a certain Quality of Service (QoS) from the network to achieve a desired level of service. In this example, it is important that we achieve timeliness for control data. Without taking advantage of the switch's priority queuing abilities, we are using the best-effort network model. This means that the network will try to deliver all packets of information, but will not make any sort of promise or guarantees with respect to the timeliness of data for specific applications. Considering our control/video example, there is no guarantee that we can get the response time needed for control data if the video cameras are sending data at the same time.

A way to achieve the QoS desired is to prioritize network traffic. Prioritization of network traffic can be achieved even if the devices (video cameras and control systems) do not support selection or configuration of Quality of Service parameters.

Configure all the ports used to interconnect the switches as follows:

- Use 802.1p Tag Priority = Checked
- Use IP ToS/DiffServ = Checked
- Default Priority Precedence = Tag
- Output Tag = Add Tag

Where the data originates (the camera or control system), configure the QoS/CoS settings for the video camera ports as follows:

- Use 802.1p Tag Priority = Unchecked
- Use IP ToS/DiffServ = Unchecked
- Default Priority Precedence = Expedited
- Output Tag = Remove Tag

Also, configure the control system ports as follows:

- Use 802.1p Tag Priority = Unchecked
- Use IP ToS/DiffServ = Unchecked
- Default Priority Precedence = Urgent
- Output Tag = Remove Tag

In this way, the switches will handle the packets appropriately and tag them for handling elsewhere in the network.

At the destination, configure the control system port as follows:

- Use 802.1p Tag Priority = Checked
- Output Tag = Remove Tag

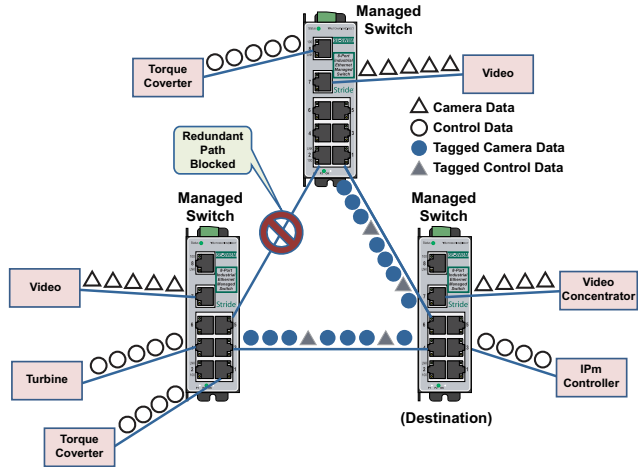
Also, configure the video concentrator port as follows:

- Output Tag = Remove Tag

Result:

Configuring the video data to have a lower priority than control data results in the QoS required for the control data.

In the following diagram, we have an IPm controlling a turbine and some torque converters. In addition, we have a video concentrator device that is collecting video data. Since the switch was configured such that video data (Triangles) has lower priority than control data (circles), we see that the control data gets sent out more often than the video data. For clarity, the diagram notes that untagged data in the network consists of open triangles and circles, while tagged data in the network consists of filled triangles and circles. This achieves the QoS needed for the control application.



Multicast Filtering (IGMP)

IGMP (Internet Group Management Protocol) allows hosts and routers to work together to optimize forwarding of multicast traffic on a network. Without IGMP, all multicast packets must be forwarded to all network segments. With IGMP, multicast traffic is only forwarded to those network segments which connect interested hosts.

IGMPv1 provides a basic mechanism for hosts and routers to communicate about multicast groups. Routers send Query messages and hosts respond with group membership Report messages.

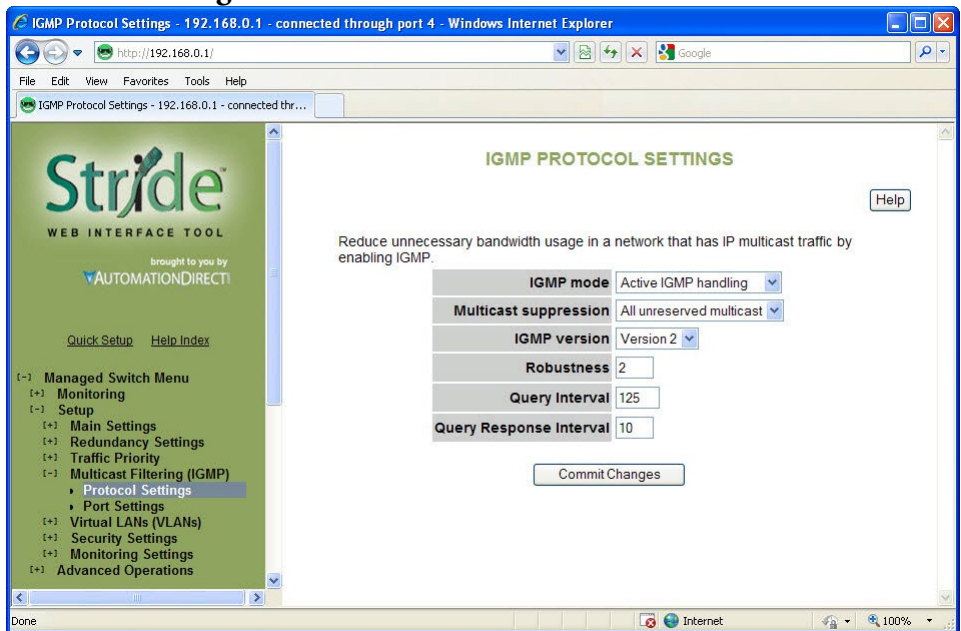
IGMPv2 adds a maximum response time to the Query and adds a Leave message to the protocol. IGMPv1 and IGMPv2 should not coexist on the same network. Also, IGMPv2 routers are expected to perform IGMPv1 on segments where IGMPv1 hosts are found.

An IGMP snooping switch performs many of the functions of an IGMP router. In passive mode, such a switch processes IGMP protocol messages sent by hosts and routers to configure efficient forwarding of multicast traffic. In active mode, a switch will also send its own queries to speed network convergence.

Periodically, routers and IGMP snooping switches in active mode send an IGMP Query on each attached network. (The query interval is generally around 1-2 minutes.) A host that wishes to be a member of a group sets a timer for a short, random delay when it sees the Query. If it sees a Report from another host before its timer expires, it cancels the timer and takes no further action until another Query is seen. If no other Report is seen, a Report is sent when the timer expires. The router or switch uses the Report to configure multicast forwarding.

The router or switch keeps track of how long it has been since the last Report on each port for each group. When the group expires, the router or switch stops forwarding multicast data to that port. Since the query interval is less than the expiration time, data for active groups continues to be forwarded without interruption.

IGMP Protocol Settings



The default settings will allow the switch to recognize members of a multicast group and forward the multicast message to only members of that group.

IGMP Mode: This setting controls how the switch handles IGMP messages to determine how to forward multicast traffic.

- **IGMP Disabled:** Causes the switch to ignore IGMP messages. All multicast traffic will be sent to all ports.
- **Passive IGMP handling:** Causes the switch to listen to IGMP messages and configure forwarding of multicast traffic accordingly.
- **Active IGMP handling:** Causes the switch to act as an IGMP router, sending queries when needed and configuring multicast forwarding according to IGMP membership reports.

Multicast suppression: This enhanced feature can intelligently suppress multicast packets that no host has requested with IGMP.

- **None:** Multicast packets will be sent to all ports unless IGMP is enabled and one or more clients have sent IGMP Report requests.
- **IP multicast groups:** Multicast packets corresponding to IP multicast groups (with MAC addresses starting 01:00:5e) will be suppressed unless one or more clients have sent IGMP Report messages. Multicast packets with other addresses will be sent to all ports.
- **All unreserved multicast:** Multicast packets with reserved multicast addresses (01:80:c2:00:00:0x where x is 0..f) will be sent to all ports. All other multicast packets will be suppressed unless one or more clients have sent IGMP Report messages.

IGMP Version: This setting controls the highest IGMP version that the switch will use. All IGMP routers and snooping switches on a network should be configured for the same IGMP version. Select 1 or 2 as appropriate for your installation.

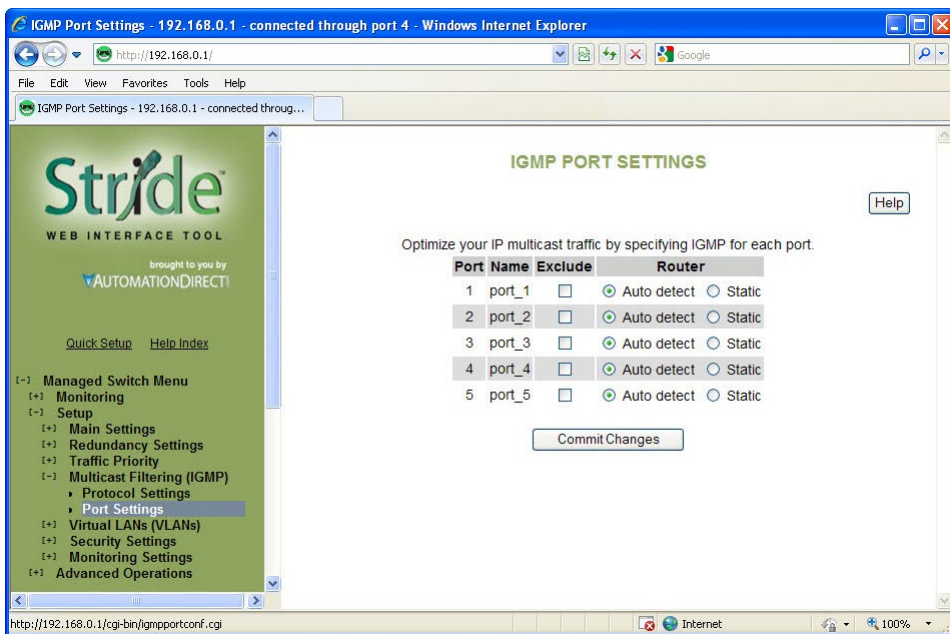
Robustness: This setting specifies how many queries may be lost without impacting forwarding as the switch tries to find IGMP hosts.

Query Interval: This setting specifies how often the switch will send IGMP queries in seconds.

Query Response Interval: This setting specifies the maximum time for hosts to respond to IGMP queries. (For IGMPv1, this is fixed at 10 seconds).

Port Settings

Like the default IGMP Protocol Settings, the default IGMP port settings will allow a switch to function in a network with multicast groups. Generally, the switch will dynamically learn which ports have IGMP routers attached to them by listening for IGMP Query messages. Under some circumstances, it is necessary to statically configure ports as leading to IGMP routers. Force the switch to forward IGMP messages to a specific port by choosing Static as the router type.



Exclude: A port may be excluded from IGMP processing. IGMP queries and reports received on an excluded port are ignored so devices reached via the excluded port cannot join multicast groups filtered by the switch. IGMP queries and reports will not be forwarded to the excluded port so IGMP routers reached via the excluded port will not know of memberships for devices reached by other ports.

Static Router: Specifies whether the switch should assume there is an IGMP router on this port even if no IGMP query messages are received.

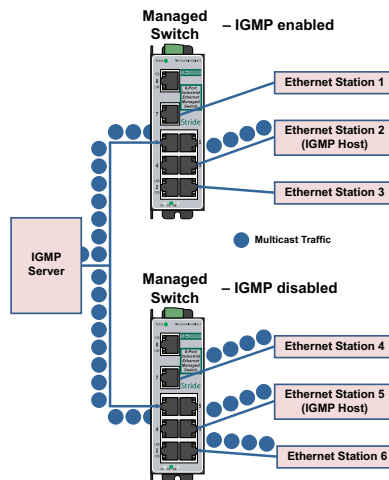
IGMP Example

The Benefits of Enabling IGMP:

Take an already established control network that has an Ethernet device sending multicast data to several other Ethernet devices. Between the source of the multicast data, and the destination Ethernet devices that are interested in the multicast data, multicast packets might pass through a number of switches or routers.

To make this control network more efficient, the switches or routers should know how to handle the flow of multicast data by means of IGMP (Internet Group Management Protocol). Switches or routers that are not capable of supporting IGMP will not know what to do with the multicast data and forward multicast data out all ports. This will slow down the network.

Take a look at the following diagram, where the IGMP server is the source of the multicast data, and the IGMP hosts are the devices interested in receiving multicast data. On the network are two switches, where one has IGMP enabled and the other has IGMP disabled. We see that the switch with IGMP enabled only forwards multicast data to the interested host (Ethernet Station 2). The switch with IGMP disabled will not know where to send the multicast data; thus Ethernet Stations 4 and 6 unnecessarily receive multicast data even though only Station 5 is the interested host.



Virtual LANs (VLANs)

VLANs can segregate traffic flowing through a switch to improve bandwidth utilization or security. Segregation is done based on membership in a group of ports (port-based VLANs) or on IEEE 802.1Q tags which include a VLAN ID (tag-based VLANs).

A port-based VLAN limits forwarding traffic coming in a port to the group of ports to which that port belongs. For example, on a 10-port switch if ports 1, 3, 5, 7, and 9 were placed in a port-based VLAN, broadcast frames coming in port 3 would be sent to ports 1, 5, 7, and 9 (which are members of port 3's VLAN) but not to ports 2, 4, 6, and 8 (which are not members).

A port may be a member of two port-based VLANs, although results of this configuration are not always desirable or easily predictable. When initializing port-based VLANs the switch configures each port to be able to send data to all ports in all the port-based VLANs in which it is a member. For example, if one VLAN had ports 1-5 and another had ports 5-9, traffic from port 1-4 could go to ports 1-5, traffic from ports 6-9 could go to ports 5-9, and traffic from port 5 could go to all ports.

A tag-based VLAN is more common. A tag-based VLAN limits traffic based on the VLAN ID in a 'tag' associated with the frame. VLAN tags may be explicitly placed in frames by applications or switching equipment, or implicitly assigned to frames based on the switch port where they arrive.

VLAN IDs are 12-bits long providing 4096 possible IDs but several values are reserved:

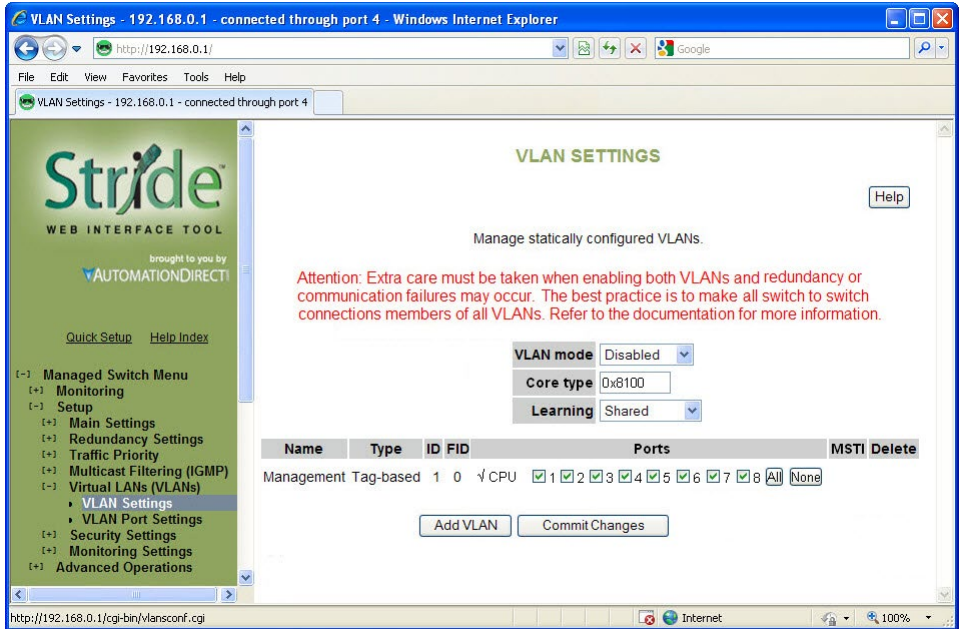
- **0** = Indicates that the tag is not being used for VLAN routing but only to carry priority information. (See QoS/CoS topic).
- **1** = Used for switch configuration and management.
- **4095** = Not allowed by the 802.1Q standard.

VLAN Settings

There are several VLAN modes, which provide varying levels of flexibility and security.

Configuring VLANs requires creating VLANs on the VLAN Settings page and configuring ports for participation in the VLAN on the VLAN Port Settings page.

The VLAN settings page identifies which traffic a port can “listen” to. The VLAN Port Settings page identifies traffic a port can “talk” to. For ports to participate effectively in a VLAN, each port should be assigned to one VLAN on the VLAN settings page, then configured with that VLAN ID on the VLAN Port Settings page.



VLAN Mode:

- **Disabled:** No VLAN processing is done. VLAN IDs and port-based VLANs are ignored.
- **Port-Based:** Only port-based VLANs are used to route frames. VLAN IDs are ignored.
- **Standard:** (Most commonly configured) Port-based VLANs are ignored; all routing is done by VLAN ID. The source port of a frame need not be part of a VLAN for the frame to be forwarded.
- **Secure:** All routing is done by VLAN ID; however, if the source port of a frame is not a member of the target VLAN, then the frame is dropped. For example, if a tag-based VLAN for ID 1024 was configured to include ports 1-5 and a frame with VLAN ID 1204 in its tag arrived at port 6, the frame would not be forwarded.

Core Type: (gigabit switch only) Specify the Ethertype for double-tagged (“Q-in-Q”) frames exiting ports of type Core. The value may be specified in hexadecimal with a 0x prefix.

Learning: This setting describes how different addresses on different VLANs are ‘learned’ by the switch.

- **Shared:** All VLANs (if MSTP is enabled, all VLANs assigned to the same MSTI) use the same forwarding database.
- **Independent:** The forwarding database used by each tag-based VLAN can be configured independently.

The switch supports up to 64 configurable VLANs including the management VLAN. To configure additional VLANs, click the “Add VLAN” button to create an empty row in the table. Then choose the name, ID information and ports for your VLAN. For tag based VLANs, the CPU should not be included in any VLAN other than the default management VLAN (1). The CPU should be included in port based VLANs.

To remove a VLAN, simply click the “X” in the delete column for that VLAN. When your settings have been changed as needed, click “Commit Changes” to save them.

Name: A mnemonic name for a VLAN such as “Cell 7”, “Line 4”, “Building 58”. This is used for display only.

Type: The VLAN’s type, port-based or tag-based.

ID: For tag-based VLANs, this is the ID to look for in the tag. This ID identifies the individual VLANs you create on your network. The VLAN ID must be specified in the range from 2 to 4094.



NOTE: Take care when setting the management VLAN ID. If the device you are configuring from cannot work with VLANs and the port it is connected to does not have the proper PVID and port type setting the management VLAN may make the Switch inaccessible and require a local serial connection to reconnect.

FID: For tag-based VLANs, the forwarding database to use when independent learning is enabled. If MSTP is running, all VLANs in the same MSTI must be configured to use the same forwarding database in independent learning mode. Shared learning automatically assigns a different forwarding database to each MSTI.

This filtering ID allows multiple VLANs to be grouped for easy filtering in the MAC address monitoring page.

Ports: The ports included in this VLAN. For tag based VLANs, the CPU should not be included in any VLAN other than the default management VLAN (1). The CPU should be included in port based VLANs.

To select the ports to include in this VLAN, check the box for each port you wish to include. Remember that if the “CPU” box is not checked, you will be unable to communicate with the switch from within this VLAN.

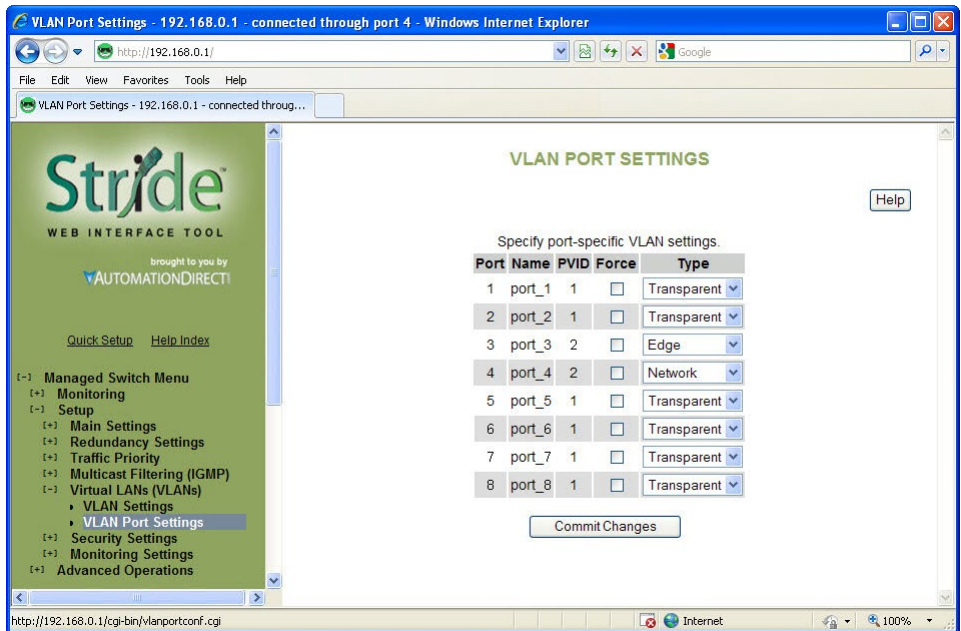


NOTE: When working with tag-based VLANs, ports included in a VLAN may lead to other network devices (which require tags to properly route data) or to end devices, which cannot process VLAN tags. Use the VLAN Port Settings page to configure the appropriate type for each port.

Delete: Select to delete the corresponding VLAN when changes are committed. When selected, this VLAN will be deleted when changes are committed.

VLAN Port Settings

Each switch port can be configured to control how VLAN tags are handled for frames coming in and going out of the port.



PVID: This is the port's default VLAN ID. It is applied to frames which arrive at the port without a VLAN tag or with a priority-only VLAN tag (one which contains the special VLAN ID 0). Set the desired PVID to make sure your untagged packets for the port get forwarded to other ports in the desired VLAN.



NOTE: Switch management and configuration is only possible through the port if the PVID is set to 1 (the default). Setting the PVID to another value prevents the Switch from being managed/configured via that port (unless the system you are using to configure the Switch can explicitly tag frames for VLAN 1, the management VLAN).

Force: When this is checked, the PVID is forced on all frames coming in this port regardless of any existing tag.

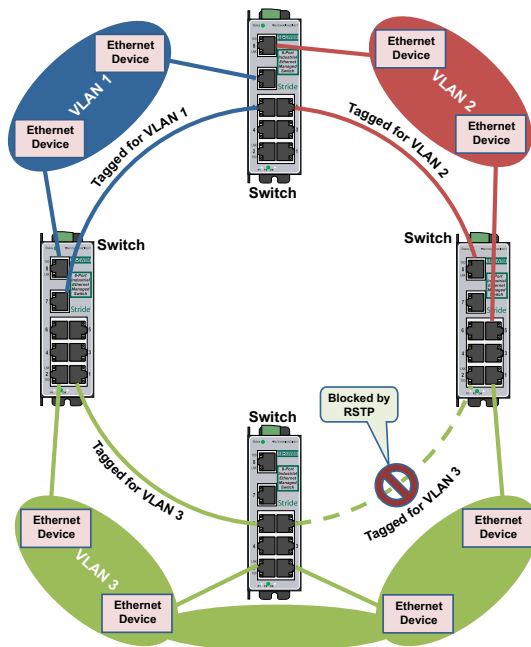
Type: The port type controls how tags are handled on frames exiting this port.

- **Network:** This is a Trunking port that connects to another switch. All frames exiting this port will be tagged. If no tag was present when the frame entered the switch, the source port's PVID will be used. Typically, a Network port will be a member of many or all tag-based LANs on a switch and is used to forward VLAN traffic to another switch which then distributes it to other network segments based on the tags. A Network port can only send packets for VLANs in which it is a member.
- **Edge:** This is an Access port that typically connects to an end device or perhaps an unmanaged switch. No frames exiting this port will be tagged. (Use this setting for ports leading to legacy or end devices without VLAN support.)
- **Transparent:** Frames will be forwarded unchanged.

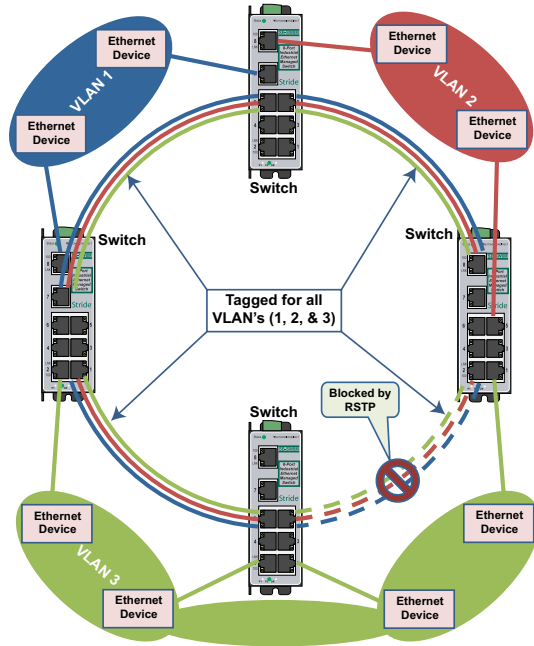
VLAN with RSTP

Extra care must be taken when enabling both VLANs and redundancy, or communications failures may occur.

The example shown in the following diagram depicts the problem with running the Rapid Spanning Tree Protocol (RSTP) and VLANs at the same time. The IEEE 802.1D based RSTP is not aware of the VLAN configuration. Therefore, in the example, one of the Network Ports for VLAN 3 is being blocked (see VLAN Port Settings topic in this section about Network type ports). This prevents VLAN 3 from being able to forward data to all its members.



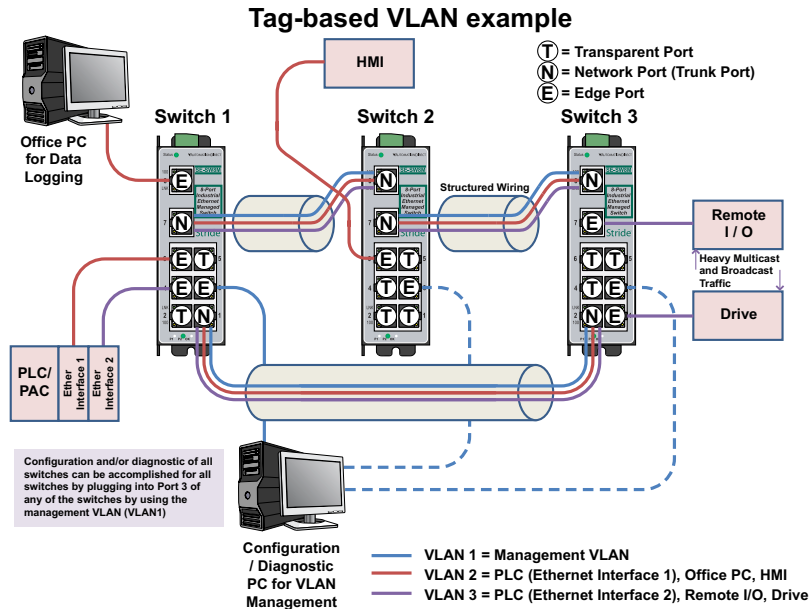
The solution to the problem above is to configure all “Network” type ports to carry all VLANs in the network. In other words, the Network Port should be a member of all VLANs defined in the switch. As seen from the example shown in the following diagram, VLAN 3 can forward to all its members through the other Network Port connections and is not affected by the block RSTP connection.



VLAN Examples

Shown below are two examples of using VLANs and how they can solve common network problems found in a factory automation facility. Note that the end devices used in these examples do not recognize nor originate VLAN tags.

Problem #1: The process requires a PLC, Remote I/O, Frequency Drive control, HMI access as well as a PC for Data Logging and a PC for configuration management. The Remote I/O device and drive communicate via Multicast and Broadcast messaging which an unmanaged switch cannot filter out. The PLC and the Remote I/O and Drive are remotely located from each other. Running multiple Ethernet connections would be costly and logistically complex so the customer wants to utilize existing wiring connections.



Solution: Use Stride managed switches, utilizing the VLAN feature to separate the broadcast and multicast traffic from all the devices except for the PLC. We will also wire the three switches into a Ring configuration so that we can take advantage of the redundancy feature of the switch. In this situation, we need to use Tag-based VLANs since the Ethernet packets will be traversing across multiple switches.

How to configure this setup:

We created 3 VLANs:

- VLAN 1 is the default VLAN and we leave it there and enable it on what we will call a 'management port' for each switch. In this way, we can plug our laptop into the management port of any switch and be able to access the other switches across this VLAN to tweak the configuration or view the diagnostics.
- VLAN 2 will contain one of the Ethernet interfaces of the PLC, the HMI and the Office PC.
- VLAN 3 will contain the other Ethernet interface of the PLC, the Remote I/O drop and the Drive.

Switch Setup: Switch1:

VLAN SETTINGS

Manage statically configured VLANs.

Attention: Extra care must be taken when enabling both VLANs and redundancy or communication failures may occur. The best practice is to make all switch to switch connections members of all VLANs. Refer to the documentation for more information.

VLAN mode Standard ▾
Core type 0x8100
Learning Shared ▾

Name	Type	ID	FID	Ports								MSTI	Delete			
Management	Tag-based	1	0	<input checked="" type="checkbox"/> CPU	<input checked="" type="checkbox"/> 1	<input type="checkbox"/> 2	<input checked="" type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	<input type="checkbox"/> 6	<input checked="" type="checkbox"/> 7	<input type="checkbox"/> 8	All	None		
PLC Network	Tag-based ▾	2	0	<input type="checkbox"/> CPU	<input checked="" type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	<input checked="" type="checkbox"/> 6	<input checked="" type="checkbox"/> 7	<input checked="" type="checkbox"/> 8	All	None	RSTP ▾	<input type="checkbox"/>
Remote I/O Network	Tag-based ▾	3	0	<input type="checkbox"/> CPU	<input checked="" type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input checked="" type="checkbox"/> 4	<input type="checkbox"/> 5	<input type="checkbox"/> 6	<input checked="" type="checkbox"/> 7	<input type="checkbox"/> 8	All	None	RSTP ▾	<input type="checkbox"/>

VLAN PORT SETTINGS

Specify port-specific VLAN settings.

Port	Name	PVID	Force	Type
1	port_1	1	<input type="checkbox"/>	Network ▾
2	port_2	1	<input type="checkbox"/>	Transparent ▾
3	port_3	1	<input type="checkbox"/>	Edge ▾
4	port_4	3	<input type="checkbox"/>	Edge ▾
5	port_5	1	<input type="checkbox"/>	Transparent ▾
6	port_6	2	<input type="checkbox"/>	Edge ▾
7	port_7	1	<input type="checkbox"/>	Network ▾
8	port_8	2	<input type="checkbox"/>	Edge ▾

Switch 2:

VLAN SETTINGS

Manage statically configured VLANs.

Attention: Extra care must be taken when enabling both VLANs and redundancy or communication failures may occur. The best practice is to make all switch to switch connections members of all VLANs. Refer to the documentation for more information.

VLAN mode: Standard
 Core type: 0x8100
 Learning: Shared

Name	Type	ID	FID	Ports	MSTI	Delete
Management	Tag-based	1	0	<input checked="" type="checkbox"/> CPU <input type="checkbox"/> 1 <input type="checkbox"/> 2 <input checked="" type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/> 6 <input checked="" type="checkbox"/> 7 <input checked="" type="checkbox"/> 8 <input type="checkbox"/> All <input type="checkbox"/> None		
PLC Network	Tag-based	2	0	<input type="checkbox"/> CPU <input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input checked="" type="checkbox"/> 6 <input checked="" type="checkbox"/> 7 <input checked="" type="checkbox"/> 8 <input type="checkbox"/> All <input type="checkbox"/> None	RSTP	<input checked="" type="checkbox"/>
Remote I/O Network	Tag-based	3	0	<input type="checkbox"/> CPU <input type="checkbox"/> 1 <input type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/> 6 <input checked="" type="checkbox"/> 7 <input checked="" type="checkbox"/> 8 <input type="checkbox"/> All <input type="checkbox"/> None	RSTP	<input checked="" type="checkbox"/>

VLAN PORT SETTINGS

Specify port-specific VLAN settings.

Port	Name	PVID	Force	Type
1	port_1	1	<input type="checkbox"/>	Transparent
2	port_2	1	<input type="checkbox"/>	Transparent
3	port_3	1	<input type="checkbox"/>	Edge
4	port_4	1	<input type="checkbox"/>	Transparent
5	port_5	1	<input type="checkbox"/>	Transparent
6	port_6	2	<input type="checkbox"/>	Edge
7	port_7	1	<input type="checkbox"/>	Network
8	port_8	1	<input type="checkbox"/>	Network

Switch 3:

VLAN SETTINGS

Manage statically configured VLANs.

Attention: Extra care must be taken when enabling both VLANs and redundancy or communication failures may occur. The best practice is to make all switch to switch connections members of all VLANs. Refer to the documentation for more information.

VLAN mode

Core type

Learning

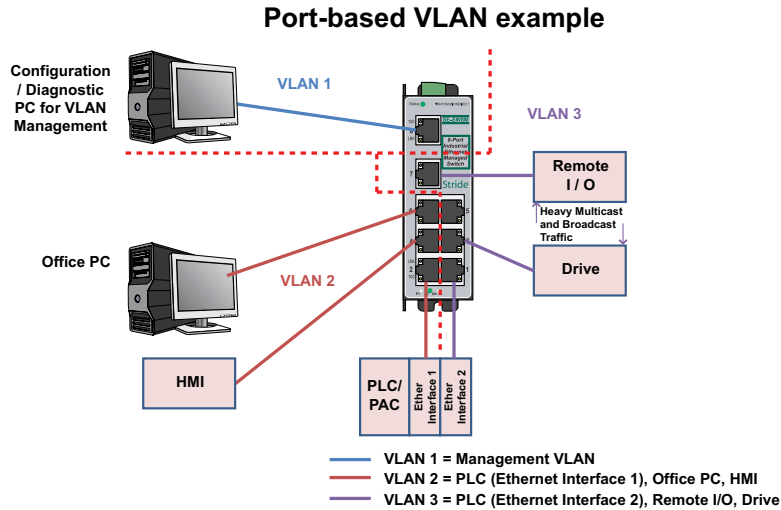
Name	Type	ID	FID	Ports	MSTI	Delete
Management	Tag-based	<input type="text" value="1"/>	<input type="text" value="0"/>	<input checked="" type="checkbox"/> CPU <input type="checkbox"/> 1 <input checked="" type="checkbox"/> 2 <input checked="" type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/> 6 <input type="checkbox"/> 7 <input checked="" type="checkbox"/> 8 <input type="text" value="All"/> <input type="text" value="None"/>		
PLC Network	<input type="text" value="Tag-based"/>	<input type="text" value="2"/>	<input type="text" value="0"/>	<input type="checkbox"/> CPU <input type="checkbox"/> 1 <input checked="" type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/> 6 <input type="checkbox"/> 7 <input checked="" type="checkbox"/> 8 <input type="text" value="All"/> <input type="text" value="None"/>	<input type="text" value="RSTP"/>	<input checked="" type="checkbox"/>
Remote I/O Network	<input type="text" value="Tag-based"/>	<input type="text" value="3"/>	<input type="text" value="0"/>	<input type="checkbox"/> CPU <input checked="" type="checkbox"/> 1 <input checked="" type="checkbox"/> 2 <input type="checkbox"/> 3 <input type="checkbox"/> 4 <input type="checkbox"/> 5 <input type="checkbox"/> 6 <input checked="" type="checkbox"/> 7 <input checked="" type="checkbox"/> 8 <input type="text" value="All"/> <input type="text" value="None"/>	<input type="text" value="RSTP"/>	<input checked="" type="checkbox"/>

VLAN PORT SETTINGS

Specify port-specific VLAN settings.

Port	Name	PVID	Force	Type
1	port_1	<input type="text" value="3"/>	<input type="checkbox"/>	<input type="text" value="Edge"/>
2	port_2	<input type="text" value="1"/>	<input type="checkbox"/>	<input type="text" value="Network"/>
3	port_3	<input type="text" value="1"/>	<input type="checkbox"/>	<input type="text" value="Edge"/>
4	port_4	<input type="text" value="1"/>	<input type="checkbox"/>	<input type="text" value="Transparent"/>
5	port_5	<input type="text" value="1"/>	<input type="checkbox"/>	<input type="text" value="Transparent"/>
6	port_6	<input type="text" value="1"/>	<input type="checkbox"/>	<input type="text" value="Transparent"/>
7	port_7	<input type="text" value="3"/>	<input type="checkbox"/>	<input type="text" value="Edge"/>
8	port_8	<input type="text" value="1"/>	<input type="checkbox"/>	<input type="text" value="Network"/>

Problem #2: This scenario is very similar to the first. We have the same problem to solve but the logistics are simpler, in that all of the devices are local and can be wired into the same switch.



Solution: We will use a Stride managed switch, utilizing the Port-based VLAN feature. The question could be posed, “Why not just use two unmanaged switches?” While this would work, the customer wants to use as few components in the system as possible to minimize points for possible equipment faults and he would like the enhanced diagnostic capabilities that a managed switch provides.

Switch Setup:

VLAN SETTINGS

Manage statically configured VLANs.

Attention: Extra care must be taken when enabling both VLANs and redundancy or communication failures may occur. The best practice is to make all switch to switch connections members of all VLANs. Refer to the documentation for more information.

VLAN mode: Port-based
 Learning: Shared

Name	Type	ID	FID		Ports								Delete	
Management	Tag-based	1	0	√ CPU	<input type="checkbox"/> 1	<input type="checkbox"/> 2	<input type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	<input type="checkbox"/> 6	<input type="checkbox"/> 7	<input checked="" type="checkbox"/> 8	All	None
HMI_DataLogger	Port-based			<input type="checkbox"/> CPU	<input type="checkbox"/> 1	<input checked="" type="checkbox"/> 2	<input type="checkbox"/> 3	<input checked="" type="checkbox"/> 4	<input type="checkbox"/> 5	<input checked="" type="checkbox"/> 6	<input type="checkbox"/> 7	<input type="checkbox"/> 8	All	None
RemotelIO_Drive	Port-based			<input type="checkbox"/> CPU	<input checked="" type="checkbox"/> 1	<input type="checkbox"/> 2	<input checked="" type="checkbox"/> 3	<input type="checkbox"/> 4	<input type="checkbox"/> 5	<input type="checkbox"/> 6	<input checked="" type="checkbox"/> 7	<input type="checkbox"/> 8	All	None

Add VLAN
Commit Changes

When using port-based VLANs, VLAN tags don't determine which VLAN a port is in so it is not necessary to configure the ports.

Security Settings

The managed switch offers several ways to secure access to the management functions. It can be remotely managed (monitored and configured) via the following methods:

- **Telnet:** This accesses the terminal or CLI interface (same as you would get through the console serial port) but over the Ethernet network. This type of access offers only password protection (authentication) but no encryption.
- **SSH:** Secure Shell, like Telnet, accesses the terminal or CLI interface over the Ethernet network. It offers both password protection and encryption.
- **SNMP/SNMPv3:** This method accesses the Management Information Bases (MIBs) using an SNMP server or master utility. Standard SNMPv1 or SNMPv2 has password security. SNMPv3 adds encryption.
- **HTTP/HTTPS:** This method accesses the web interface. Standard HTTP has password security. The more secure HTTPS adds encryption through SSL (Secure Socket Layers) or TLS (Transport Layer Security).



NOTE: The best security policy is to turn off or disable any access methods that you are not using.

Remote Access Security

See the “Remote Access Security” selection under the “Main Settings”.

Port Security Enables and Port Security MAC Entries



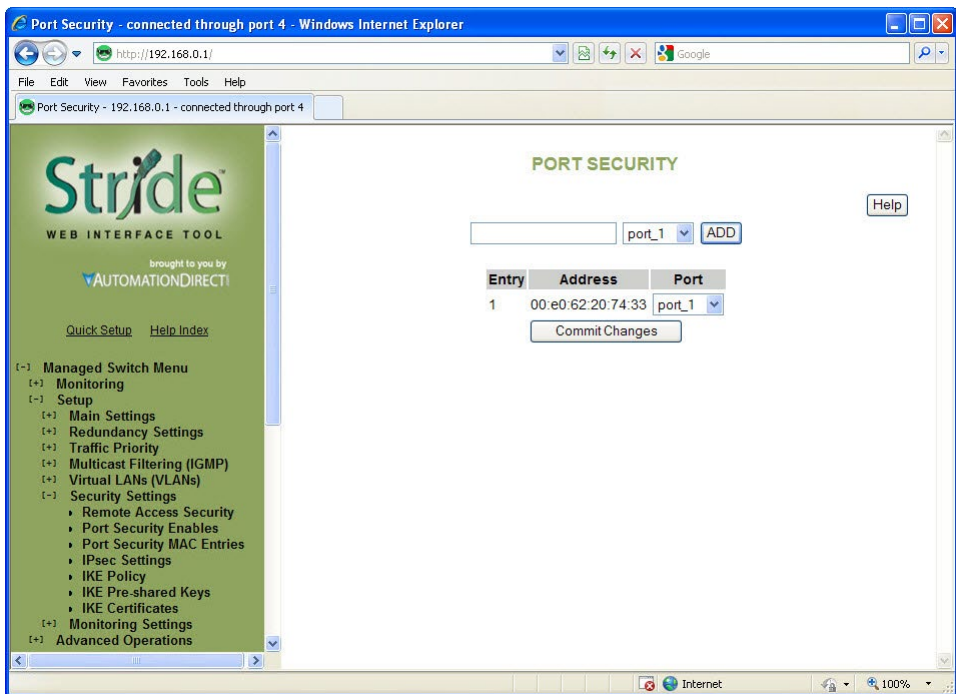
NOTE: This feature is not supported in the 5-port models

Port Security Enables and Port Security MAC Entries settings must be used in conjunction with one another.

The Port Security feature will drop packets from devices that are NOT entered in to the Port Security MAC Entries table. The security can be enabled for each port individually. The “Global Port Security Enable” selection must be enabled for the switch to start using the MAC Entries table.

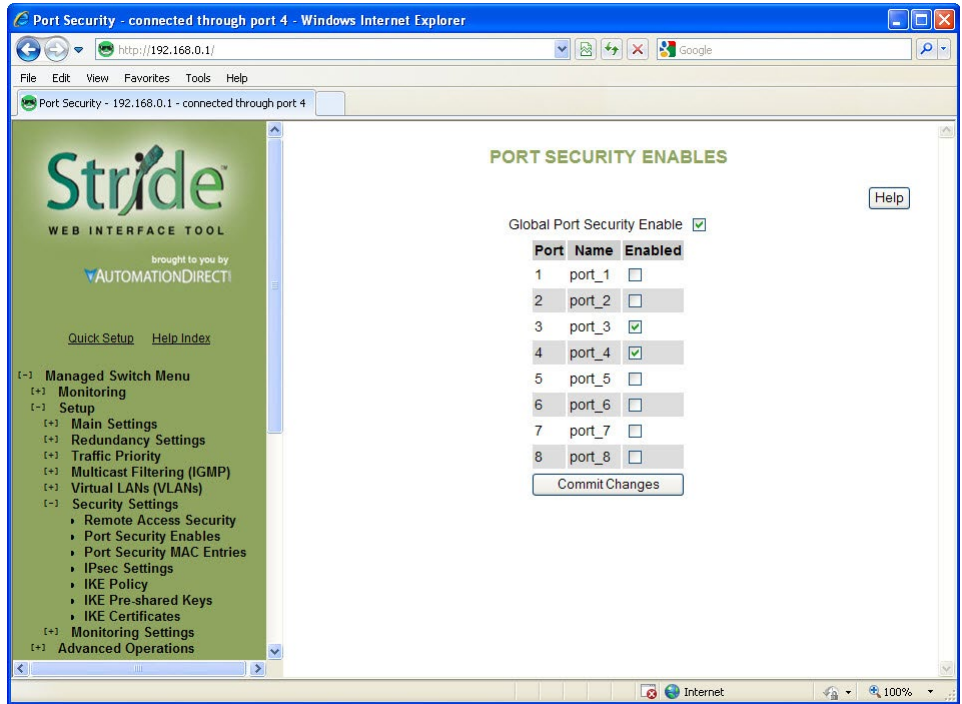
First, on the Port Security MAC Entries page, create the table of MAC addresses allowed on each port and enter Commit Changes.

- The MAC address must be entered in the format 12:34:56:78:9A:BC.
- If a MAC address is configured to be allowed on one port AND that port is enabled on the Port Security Enables page, that MAC address is disallowed access on any other port, including ports for which security is not enabled on the Security Enables page. For example: If the MAC address for Device A has been configured for Port 1 in the MAC Entries table and Device A is plugged in to Port 5, the messages for Device A will be dropped even if Port 5 does not have security enabled.
- More than one MAC address may be configured for a port.
- A MAC address may be configured for only one port.
- If no MAC addresses are entered on the Port Security MAC Entries page AND that port is enabled on the Port Security Enables page, the port is effectively shut down and all packets will be dropped at that port.



Second, to enable the MAC address security for the ports configured, select the ports and the Global Port Security selection on the “Port Security Enables” page.

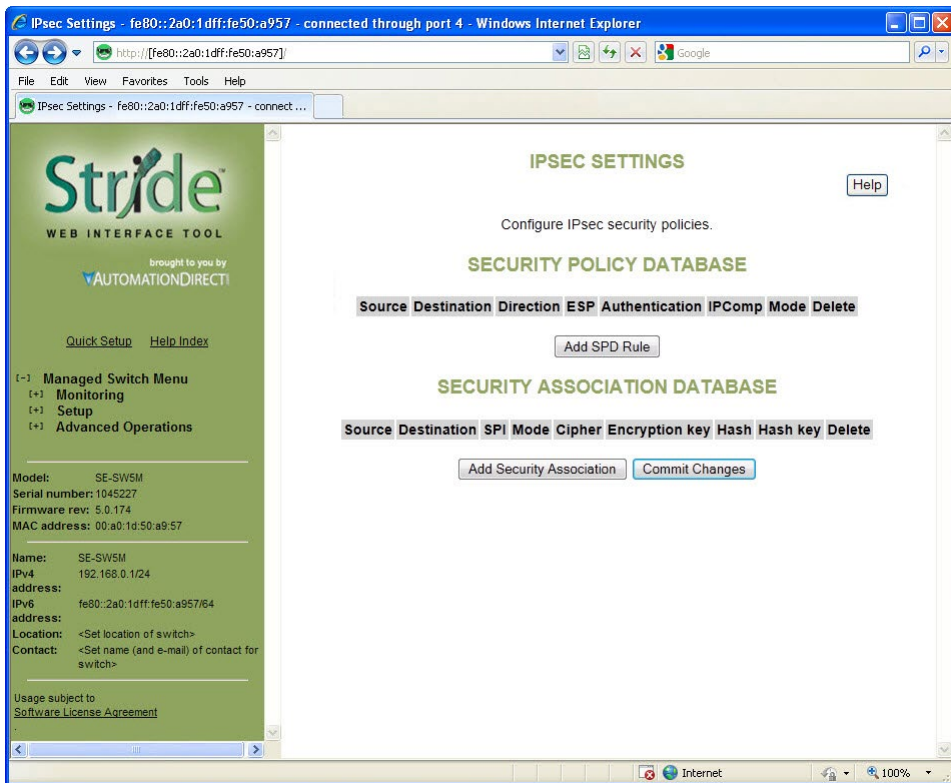
Finally enter Commit Changes to write the configuration to the switch. The switch will then begin limiting access according to the configuration on these two pages.



Once an entry has been configured and committed to the switch, a power cycle will be necessary after deletion of an entry in order for that security to be removed.

IPsec Settings

IPsec can authenticate, encrypt or compress IPv6 traffic to or from a switch. The IPsec software in this switch only affects management traffic addressed to or sent from the switch.



NOTE: IPsec can only be used when the Switch's primary access address is configured with an IPv6 address. To connect to the switch via IPv6 with Internet Explorer, you must surround the address with http://[...]. Example: http://[fe80:0000:0000:0000:02a0:1dff:fe50:bica]



Warning: Misconfiguration on this screen may block network access to the Switch's configuration interface.

Configuration is done via two databases. The SPD (Security Policy Database) sets the required IPsec protocols for traffic going from or to configured hosts or networks. The SAD (Security Association Database) contains the encryption, compression and hash parameters needed to implement the policies required by the SPD for traffic between specific hosts.

The AH IPsec protocol is used for authentication. It uses cryptography to detect that the sender has the same hash key the receiver does. It does not provide any secrecy in transit. The ESP protocol is used for encryption. It uses cryptography to hide the contents of traffic in transit from anyone who does not have the secret key it was encrypted with. IPComp is used to compress traffic. It does not provide any secrecy or authenticity guarantees.

Security Policy Database: This section is used to create, delete, and modify SPD entries.



CAUTION: Take care when configuring SPD entries. If you do not configure appropriate SAD entries to go along with them and an SPD entry affects the host you are using to configure the Switch, you may find yourself unable to communicate with the Switch

To create an SPD entry, click “Add SPD Rule” and set the source, destination, direction, and protocol requirements as appropriate. To save your changes, click Commit Changes.

To delete an SPD entry, click the ‘X’ button at the end of the row and click Commit Changes.

To modify an SPD entry, change parameters as desired and click Commit Changes.



NOTE: *SPD entries will not apply to ICMPv6 Neighbor Discovery traffic. This allows Neighbor Discovery to function together with IKE. (Internally, the system adds high-priority rules bypassing IPsec for Neighbor Advertisement and Neighbor Solicitation packets.)*

- **Source:** An address of the form address, address/prefixlen, address/prefixlen[port], or address[port]. This specifies the source host or hosts that this policy will affect.
- **Destination:** An address in one of the same forms accepted by the Source field. This specifies the destination host or hosts that this policy will affect.
- **Direction:** The direction traffic is traveling through the switch. If the switch’s address is specified in the source field, the direction should be Out. If the switch’s address is in the destination field, the direction should be In.
- **ESP:** Whether to require encryption for communication between the specified hosts.
- **Authentication (AH):** Whether to require authentication for communication between the specified hosts.
- **IPComp:** Whether to require compression for communication between the specified hosts.
- **Delete:** When the button is clicked, this SPD entry will be deleted when changes are committed.

Security Association Database:



CAUTION: Take care when configuring SAD entries. If the keys and SPI values are not the same on two communicating hosts and their security policies require encryption or authentication they will be unable to successfully communicate. You may find yourself unable to communicate with the Switch.

To create an SAD entry, click “Add Security Association” and set the source, destination, SPI, mode, cipher, hash algorithm, and keys as appropriate. To save your changes, click Commit Changes.

To delete an SAD entry, click the 'X' button at the end of the row and click Commit Changes.

To modify an SAD entry, change parameters as desired and click Commit Changes.

- **Source:** An address of the form address or address[port]. This specifies the source host (and optionally port) for the security association.
- **Destination:** An address of the form address or address[port]. This specifies the destination host (and optionally port) for the security association.
- **SPI:** A locally unique value identifying this security association. This is assigned locally and may be specified in hex or decimal formats. This should be at least 0x100 (256 decimal) and must be the same on both peers in an association.
- **Mode:** The IPsec mode to use: ESP, AH, ESP and AH, or IPComp.
- **Cipher:** The cipher to use when an ESP mode is selected.
- **Encryption key:** The key to use when ESP is enabled. This must be specified in hexadecimal (beginning with 0x) and should be 24 bytes (48 digits) long for 3DES or 16, 24 or 32 bytes (32, 48, or 64 digits) long for AES.
- **Hash:** The hash algorithm to use when an AH mode is selected. MD5 is not recommended.
- **Hash key:** The hash key to use when AH is enabled. This must be specified in hexadecimal (beginning with 0x) and should be 20 bytes (40 digits) long for SHA1 or 32 bytes (64 digits) long for SHA256.
- **Delete:** When the button is clicked, this SAD entry will be deleted when changes are committed.

IKE Policy

This screen allows you to configure IKE policy for auto negotiating IPsec Security Associations over IPv6.

The screenshot shows the Stride Web Interface Tool configuration page for IKE Policy. The left sidebar contains a navigation menu with the following items: Managed Switch Menu, Monitoring, Setup (Main Settings, Redundancy Settings, Traffic Priority, Multicast Filtering (IGMP), Virtual LANs (VLANs), Security Settings (Remote Access Security, IPsec Settings, IKE Policy, IKE Pre-shared Keys, IKE Certificates)), Monitoring Settings, and Advanced Operations. The main content area is titled 'IKE POLICY' and includes a 'Help' button. Below the title are sections for 'IKE PHASE 1 POLICIES', 'IKE PHASE 2 POLICIES', and 'IKE PHASE 2 ALGORITHMS'. The 'IKE PHASE 1 POLICIES' section has a table with columns: Address, Preferred Exchange Mode, Main, Aggressive, Base, Cipher, Hash, Generate Policy, Authentication Method, and DH Group. Below this table is an 'Add Remote' button. The 'IKE PHASE 2 POLICIES' section has a table with columns: Source, Destination, PFS Group, Lifetime, and Delete. Below this table is an 'Add SA Policy' button. The 'IKE PHASE 2 ALGORITHMS' section has a table with columns: Category, Short Name, Name, and Enabled. Below this table is a 'Commit Changes' button. The bottom of the page shows the URL 'http://192.168.0.1/cgi-bin/ikepolicy.cgi' and the Internet Explorer browser interface.



Warning: Misconfiguration on this screen may block network access to the Switch's configuration interface.

IKE Phase 1 Policies: This section may be used to create, delete, and modify ISAKMP (IKE phase 1) policies. Phase 1 is used to securely authenticate peers.

- **Address:** The address of the peer the policy will apply to. A policy for “anonymous” will apply to all peers without a more specific policy.
- **Preferred Exchange Mode:** The preferred exchange mode is the one that will be sent in any proposal to a peer. If other exchange modes are specified, they will be accepted in received proposals. With Aggressive, the DH Group in the sent proposal must exactly match the peer's configuration.

- **Cipher:** The cipher used to encrypt proposal exchanges. You must choose a cipher.
- **Hash:** The hash used to authenticate proposal exchanges. You must choose a hash algorithm.
- **DH Group:** The Diffie-Hellman group used for exponentiations. Larger groups should be more secure, but may take so long to compute that completing negotiation becomes impossible due to timeouts, preventing connectivity to the switch management interface. This should generally be set to the same value on both peers in a connection.

IKE Phase 2 Policies: This section, together with IKE Phase 2 Algorithms is used to configure the parameters used to establish Security Associations between peers once they have authenticated each other in phase 1.

The policy to use is selected using the source and destination selectors from the Security Policy Database entry or the ID payload from the received IKE packet which triggered the negotiation. The match for any values other than “anonymous” must be exact.

- **Source:** The source address to match against. The address specified should exactly match the Destination address field in a phase 2 policy on the peer, unless either value is “anonymous”. The value “anonymous” matches sources not handled by other rules.
- **Destination:** The destination address to match against. The address specified should exactly match the Source address field in a phase 2 policy on the peer, unless either value is “anonymous”. The value “anonymous” matches the destinations not handled by other rules.
- **PFS Group:** The Diffie-Hellman exponentiation group used for Perfect Forward Secrecy. This may be disabled if not required, but any proposal suggesting it will still be accepted. Larger groups may require an excessive amount of processing time during negotiation, causing timeouts.

IKE Phase 2 Algorithms: This section is used to configure the algorithms which may be used for phase 2. The exact algorithms chosen will be an intersection between the sets specified here and on a peer.

You must enable at least one algorithm from each category (cipher, hash, and compression), even if the switch’s IPsec policies do not require one of the given protocols to be used.

The default values should be compatible with most installations.

AES (default = Enabled) Cipher

3DES (default = Enabled) Cipher

SHA1 (default = Enabled) Hash

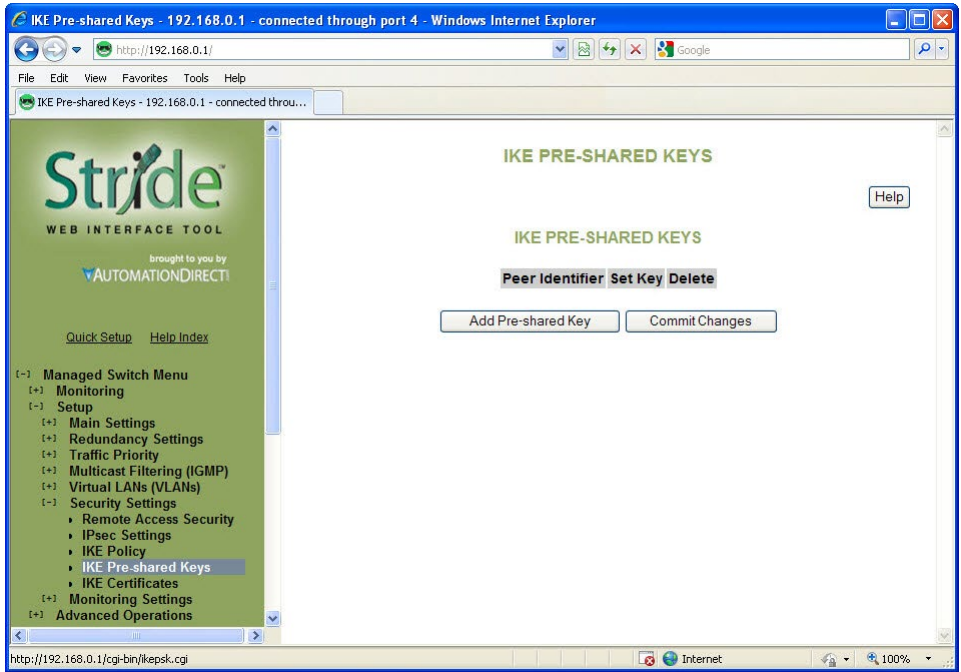
SHA256 (default = Enabled) Hash

MD5 (default = Disabled) Hash MD5 is known to be insecure and is included only for compatibility with old implementations.

Deflate (default = Enabled) Compression

IKE Pre-shared Keys

This screen allows you to configure IKE PSKs (pre-shared keys) used to negotiate with the IKE peers with which the switch communicates over IPv6.



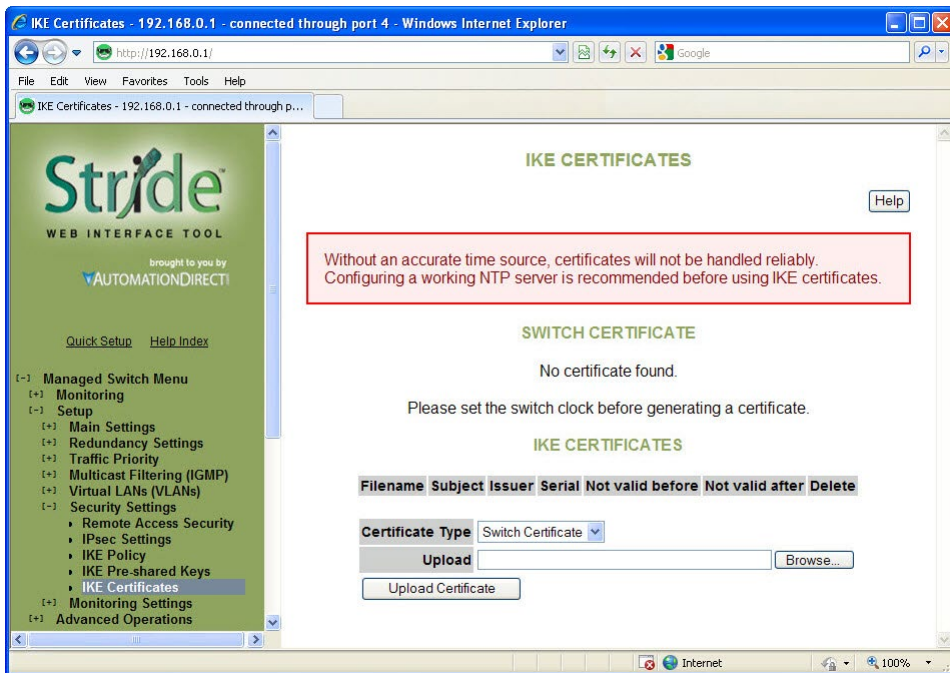
Warning: Misconfiguration on this screen may block network access to the Switch's configuration interface.

The same pre-shared key must be set for both peers. For example, if communicating between two hosts fe80::1 and fe80::2 with a pre-shared key “secret”, fe80::1 must have “secret” set as the pre-shared key for peer fe80::2, and fe80::2 must have “secret” set as the pre-shared key for peer fe80::1.

- **Peer Identifier:** The identifier of the peer with which this pre-shared key should be used. Typically this will be the peer's address.
- **Set Key:** The value to set the pre-shared key to. If left blank, the current value will be preserved.
- **Delete:** Mark this pre-shared key for removal when changes are committed.

IKE Certificates

This screen allows you to configure IKE certificates used to identify the switch and IKE peers with which it communicates over IPv6.



Warning: Misconfiguration on this screen may block network access to the Switch's configuration interface.

Providing a reliable time source, such as NTP, is highly recommended, as IKE will reject certificates which are not valid according to the system time, whether it is before the 'not valid before' time or after the expiration time. If NTP is used, pre-shared keys or hard-wired Security Associations should be used for IPsec communications with the NTP server or updating the clock will fail.

The HTTPS certificate used by the switch's Web interface cannot be changed on this screen.

Switch Certificate: This section may be used to generate or view the details of an X.509 certificate which the switch uses to identify itself via IKE.

A certificate request which can be provided to a third-party Certificate Authority (CA) is also generated. A CA-signed certificate can be uploaded using the form at the bottom of the page and will replace the self-signed certificate used by the switch for IKE. Note that the certificate provided should be generated from the certificate request generated by the switch.

- **Subject:** The DN (distinguished name) identifying the holder of the certificate.
- **Issuer:** The DN (distinguished name) identifying the issuer of the certificate.
- **Serial:** The certificate's serial number.
- **Certificate:** A link which can be used to download the certificate for inspection.
- **Request:** A link which can be used to download a certificate request to be signed by a CA.
- **Not valid before:** The earliest time for which the certificate is valid.
- **Not valid after:** The latest time for which the certificate is valid.
- **Delete:** Pressing this button will delete the certificate and private key, allowing a new one to be generated. This operation cannot be undone.

When no IKE certificate is present on the switch, a certificate and key may be generated. The following options may be set.

- **Common Name:** The CN to use as the subject of the new certificate. This should identify the switch and is typically a hostname or IP address. It defaults to the switch's hostname.
- **Bits:** The size of the private key to create, in bits.
- **Expires:** The number of days the certificate will be valid for, starting from the current day according to the switch's clock. This setting is used only for the self-signed certificate; CAs provides their own expiration dates for certificates they produce.

IKE Certificate: This section is used to add, delete, and view certificates which are trusted by the switch during IKE negotiation.

- **Subject:** The DN (distinguished name) identifying the holder of the certificate.
- **Issuer:** The DN (distinguished name) identifying the issuer of the certificate.
- **Serial:** The certificate's serial number.
- **Not valid before:** The earliest time for which the certificate is valid.
- **Not valid after:** The latest time for which the certificate is valid.
- **Delete:** Pressing this button will delete the certificate.

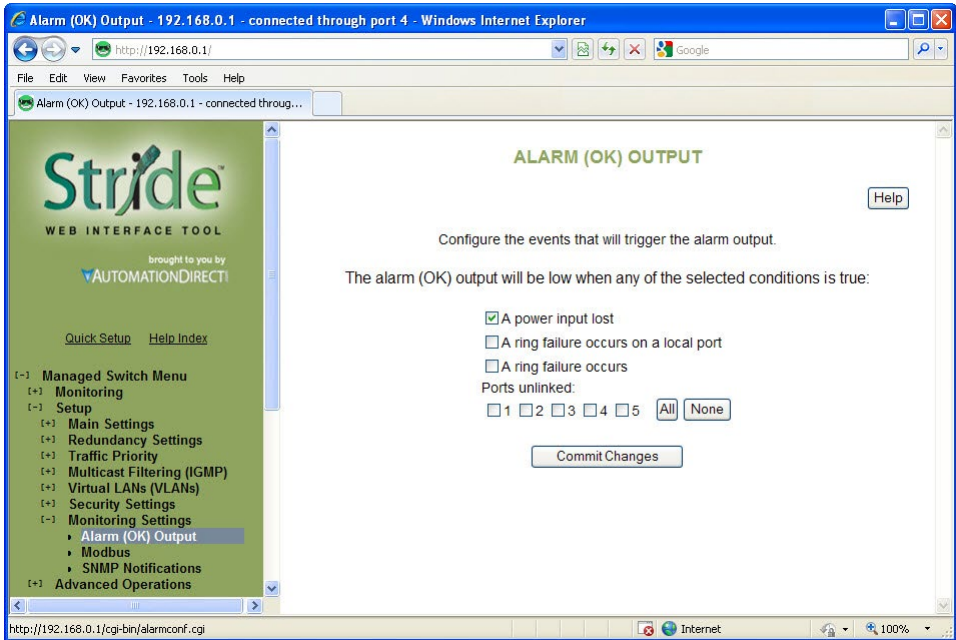
Certificates can be added to the switch using the upload form.

- **Certificate Type:** Whether the uploaded certificate is to be used as the switch's identity ("Switch Certificate"), or to be added to the certificates trusted by the switch when negotiating with IKE peers ("CA Certificate"). The CA Certificate option may also be used to trust self-signed certificates from peers.
- **Upload:** The certificate to upload.

Monitoring Settings

Alarm (OK) Output

These settings control the events that will trigger the alarm output. The OK discrete output is on during normal conditions and turned off in the event of an alarm condition.



Both Power Inputs On: An alarm condition will be triggered if power is not on for both power inputs.

Ring Failure: An alarm condition will be triggered when a ring failure occurs.

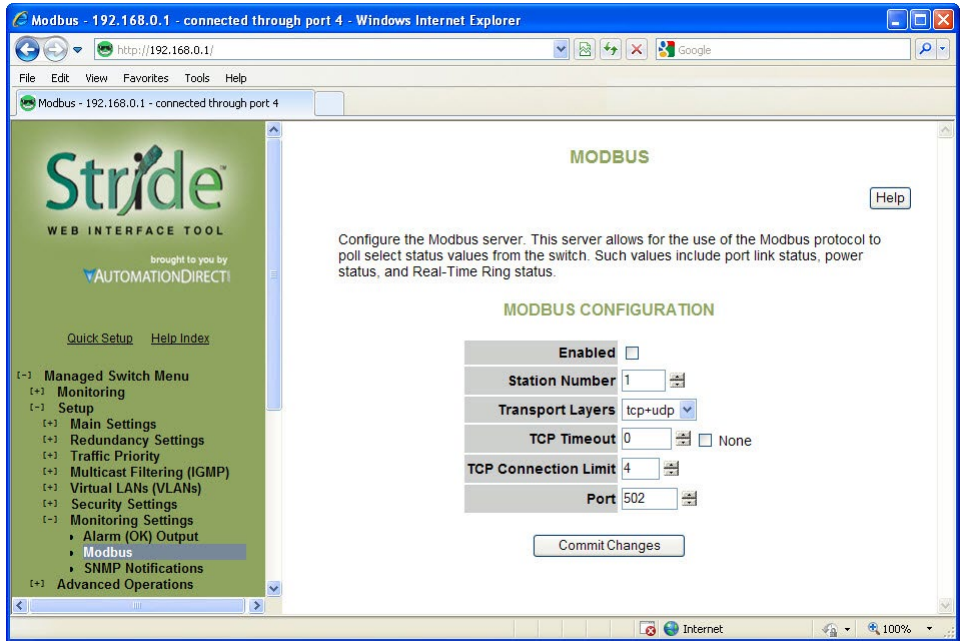
Ring failure on a local port will be triggered when one of this switch's neighbors in the ring goes down; the general ring failure option will be triggered when any switch in the ring goes down.

The general ring failure option implies that local ring port failure is also detected.

Ports Linked: An alarm condition will be triggered whenever any of the selected ports are not linked.

Modbus

These settings control whether and how the switch will respond to Modbus requests. Modbus registers are available for monitoring link status on each Ethernet port, the power and OK status, and the status of each configured Real-Time Ring.



Enabled: If selected, the switch will respond to Modbus requests.

Station Number: The Modbus station number that the switch will respond as.

Transport Layers: The switch will respond to Modbus requests only on the chosen transport layers.

TCP Timeout: If a new TCP connection is received when there are no more free connections (see the TCP Connection Limit), this determines what happens:

0: The least recently active connection will be dropped in favor of the new connection.

>0: The least recently active connection will be dropped in favor of the new connection, but only if the least recently active connection has been inactive for at least this many seconds.

None: The new connection will be dropped immediately after it is accepted.

TCP Connection Limit: The maximum number of active TCP connections that the Modbus server will maintain. Above this limit, the TCP Timeout value will be used to decide how new connections should be handled.

Port: The TCP/UDP port number on which to listen for new connections/requests.

Register Mapping:

The Modbus registers (all discrete inputs) that may be polled for switch status are:

Link Status for Ports 1-16:

10001 Link status of port 1 (1 = link present, 0 = no link present)

10002 Link status of port 2

...10016 Link status of port (register - 10000)

Real-Time Ring Status for Rings 1-4:

10017 Ring 1: Ring is complete (1 = complete, 0 = broken)

10018 Ring 1: First port is passing data (1 = active, 0 = blocked)

10019 Ring 1: Second port is passing data (1 = active, 0 = blocked)

10020 Ring 2: Ring is complete

10021 Ring 2: First port is passing data

10022 Ring 2: Second port is passing data

10023 Ring 3: Ring is complete

10024 Ring 3: First port is passing data

10025 Ring 3: Second port is passing data

10026 Ring 4: Ring is complete

10027 Ring 4: First port is passing data

10028 Ring 4: Second port is passing data

Switch Status:

10030 OK output (1 = on/no alarm, 0 = off/alarm)

10031 First power input active (1 = P1 on, 0 = P1 off)

10032 Second power input active (1 = P2 on, 0 = P2 off)

Extended Link Status for Ports 1-99:

10101 Link status of port 1 (1 = link present, 0 = no link present)

10102 Link status of port 2

10199 Link status of port (register - 10100)

Extended Switch Status:

- 10300 OK output (1 = on/no alarm, 0 = off/alarm)
- 10301 First power input active (1 = P1 on, 0 = P1 off)
- 10302 Second power input active (1 = P2 on, 0 = P2 off)

SNMP Notifications

SNMP (Simple Network Management Protocol) and RMON (Remote Monitoring) provide a means to monitor and manage your network. Each SNMP device maintains Management Information Bases (MIBs) containing information about the operation and configuration of the device.



NOTE: This product uses Net-SNMP (available from www.net-snmp.org) which is subject to the copyrights and license found at: <http://www.net-snmp.org/COPYING.txt>

The MIBs can be accessed with SNMP tools ranging from simple command-line tools like `snmpwalk` and `snmpget` (part of the open source Net-SNMP package available at <http://www.net-snmp.org>) to commercial network management products from various vendors. Key information from the MIBs is also available via the switch's terminal and web interfaces.

The MIBs are divided into groups of related objects. Objects may be scalar (having only a single value) or tabular (having a list of values varying over time, by port number, etc.).

SNMP Security:

SNMP provides several options for securing access to MIBs. SNMPv1 and SNMPv2 provide only weak authentication. SNMPv3 uses encryption to add stronger authentication as well as privacy. In all versions, you may configure read-only and read/write users.

SNMPv1 and SNMPv2 authenticate users with a “community string” which is sent in clear text (unencrypted) and no password is required. Some measure of security can be achieved by setting long, obscure community strings.

SNMPv3 provides three levels of security and encryption:

- **None:** No password is required to read or write values in the MIB.
- **Authentication:** A password is required and is used to encrypt the user credentials so that security information is not sent in clear text. A variation of MD5 is used for encryption.
- **Privacy:** A password is required and is used to encrypt the user credentials. A second password is used to encrypt the details of the SNMP request using DES encryption.

For SNMPv3 access, the managed switch requires authentication and allows privacy. Only one password is configurable and it is used for both authentication and privacy.

The following examples use `snmpget` from the Net-SNMP tools to illustrate the use of authentication and privacy when accessing the managed switch.

If SNMPv2 access is enabled, values may be read without a password with a command like:

```
snmpget -v 2c -c public 10.2.0.1 system.sysDescr.0
```

If SNMPv3 access is enabled, values may be read with a command like the following (entered all on one line):

```
snmpget -v 3 -u public -l authNopriv -a MD5 -A publicpwd 10.2.0.1 system.sysDescr.0
```

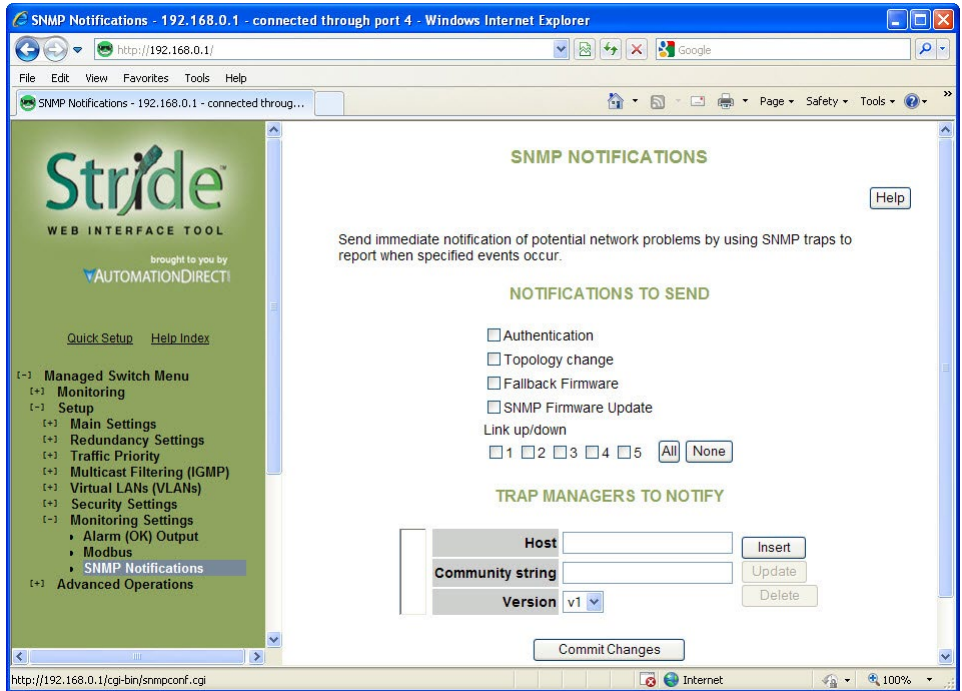
Finally, if SNMPv3 access is enabled, an authenticated, private request could be made with a command like the following:

```
snmpget -v 3 -u public -l authpriv -a MD5 -A publicpwd -x DES -X publicpwd 10.2.0.1 system.sysDescr.0
```

The switch supports SNMPv1, v2, and v3. SNMPv1 and v2 access are essentially the same from a security standpoint and are enabled and disabled together. SNMPv3 security may be separately controlled. Thus you may prevent unauthenticated access to your switch by disabling SNMPv1/v2 access entirely while retaining password-secured access via SNMPv3.

SNMP Notifications:

Use the SNMP Notifications Menu to enable traps to be sent when the state of the switch changes. Access this menu by selecting Setup from the Main Menu, and then selecting Main Settings.



Use the SNMP Notifications Menu to enable traps to be sent when the state of the switch changes. Access this menu by selecting Setup from the Main Menu, and then selecting Main Settings.

- **Authentication:** Traps can be sent when invalid credentials (such as an unrecognized community string) are presented to the SNMP agent. Enable this setting to generate authentication traps.
- **Topology change:** Traps can be sent when the topology of the spanning tree changes. Enable this setting to generate topology change traps.
- **Failback Firmware:** Check this box to send a trap when the switch resets into the non-default firmware image. This can happen if the switch loses power while booting, or if the default firmware image somehow becomes corrupt and is no longer bootable.
- **SNMP Firmware Update:** Check this box to send a trap when the switch has completed an SNMP-initiated firmware update. The trap will trigger regardless of whether the firmware update succeeded. Check the firmware Health entry in the firmware Table over SNMP to determine whether the update was successful. If it lists the non-running image as Healthy (1), then the update succeeded. Otherwise, it failed.
- **Link 1 up/down-Link 18 up/down:** Traps can be sent when a link goes up or down (the same state reflected in the LED for each port). Enable these settings to generate link up/down traps.

Trap Managers to Notify:

Use the Trap Managers Menu to specify where traps will be sent. The Trap Managers Menu can be accessed by selecting Setup from the Main Menu and then selecting Main Settings. Up to five trap managers may be configured. For each one, the following values may be specified.

- **Host:** The IP address of the host where the trap manager is located.
- **Community String:** The community string to use when contacting the trap manager on the host.
- **Version:** The SNMP trap version to send.



NOTE: There are two system traps that cannot be disabled and will be sent to any configured trap managers. A coldStart trap will be sent whenever the SNMP agent starts up (usually, this is only when the Switch is reset). A NotifyRestart trap will be sent whenever the SNMP agent's configuration changes and is reloaded. This will happen, for example, when you commit changes on a configuration menu that includes SNMP settings.

MANAGED SWITCH SOFTWARE ADVANCED OPERATIONS

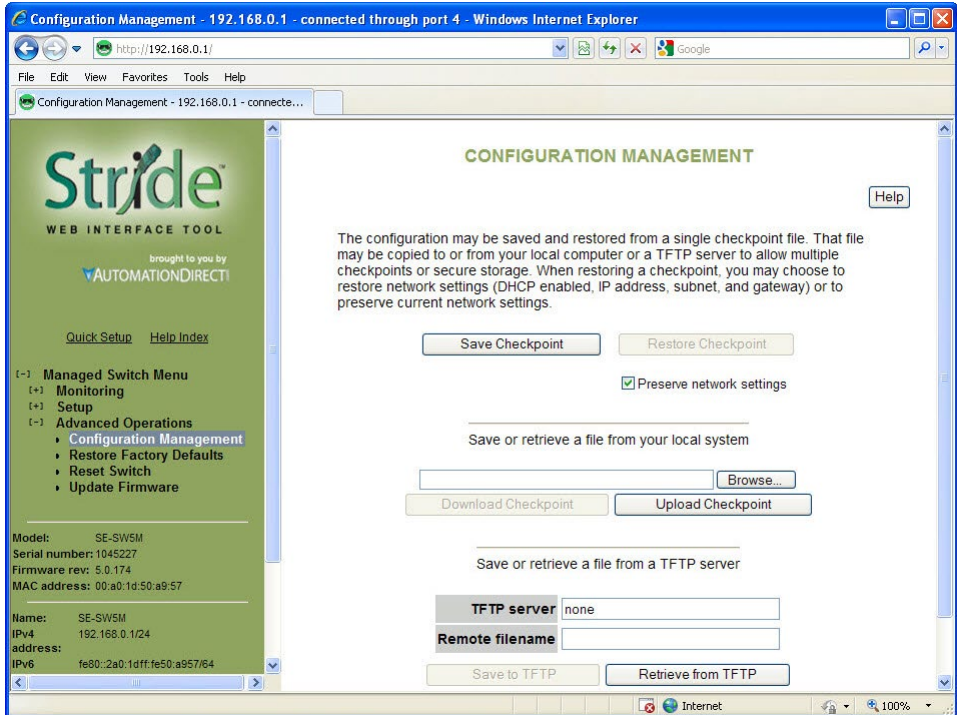


In This Chapter...

Configuration Management	5-2
Restore Factory Defaults	5-4
Reset Switch	5-5
Update Firmware	5-6
Update Firmware using a TFTP Server:	5-6

Configuration Management

One “checkpoint” (backup) version of the switch’s configuration can be stored in a local file on the switch. Unlimited backups can also be saved to your local system (web interface only) or to a TFTP server elsewhere on the network.



Save Checkpoint: Saves a checkpoint configuration in the switch, which may be used later to revert back to the current state if changes lead to an undesirable configuration.

Restore Checkpoint: Reverts to the settings in the saved checkpoint. You can choose to keep your current network settings or use the ones in the checkpoint file.



NOTE: The current administrator’s password will remain in effect after the restoration. SNMP passwords will be restored to the values in the checkpoint.

Download Checkpoint: Saves a zipped file of the current configuration file external to the switch

Upload Checkpoint: Unzips the selected file and stores a copy on the switch. It must be restored via Restore Checkpoint to be written as the switch configuration.

TFTP Configuration: Specifies the name or IP address of the TFTP (Trivial File Transfer Protocol) server where configuration checkpoints may be stored.

Save to TFTP: Saves the current configuration checkpoint file to the defined TFTP server. You must specify the name of a file on the server.

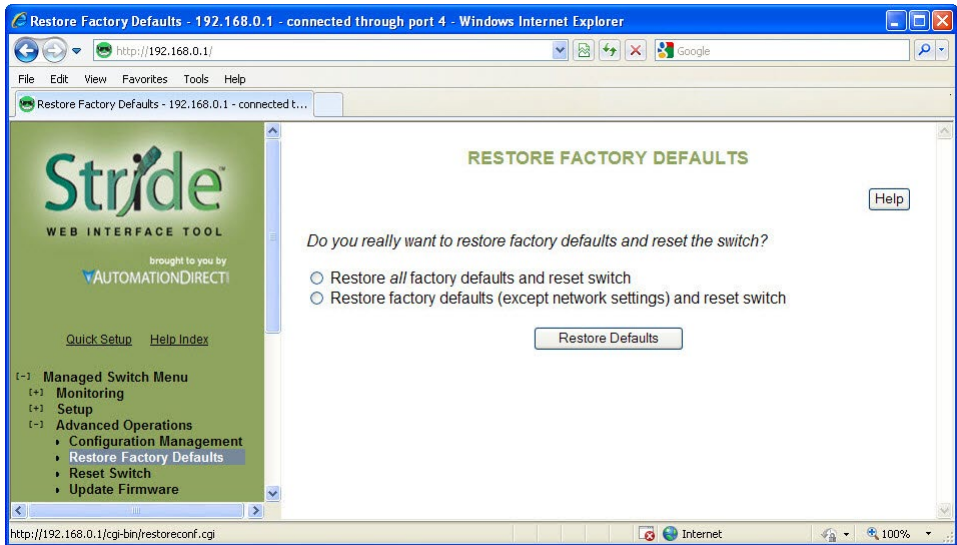
Retrieve from TFTP: Retrieves a previously saved configuration checkpoint file from the defined TFTP server. After retrieval, the configuration still must be restored to be made active.



NOTE: *The web interface also allows you to download (save) and upload (retrieve) files directly from your local system. No TFTP server is needed.*

Restore Factory Defaults

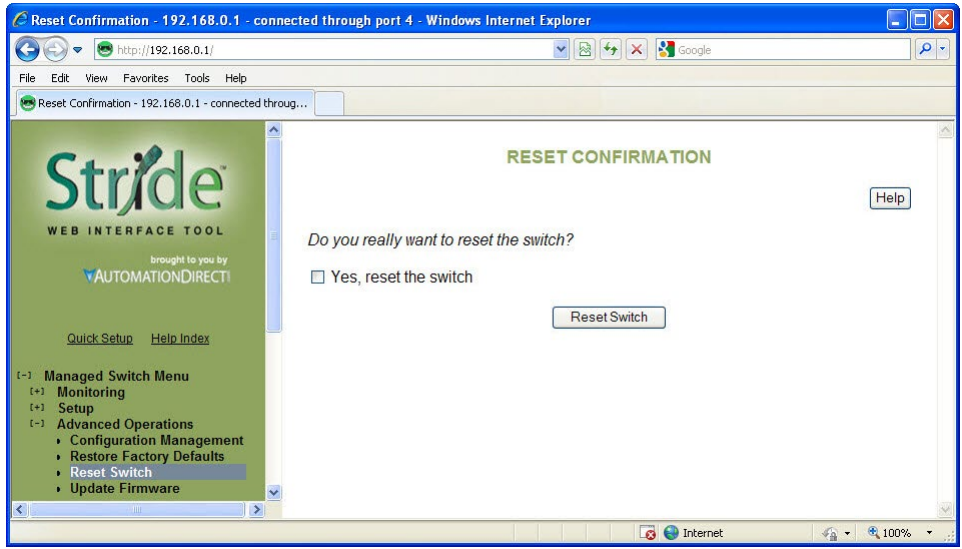
This option sets the switch back to factory default settings. The switch will automatically restart (reset) to put the default settings into effect.



You can optionally choose to maintain the IP address configuration of the switch in order to more easily reconnect to the switch for configuration after resetting the defaults.

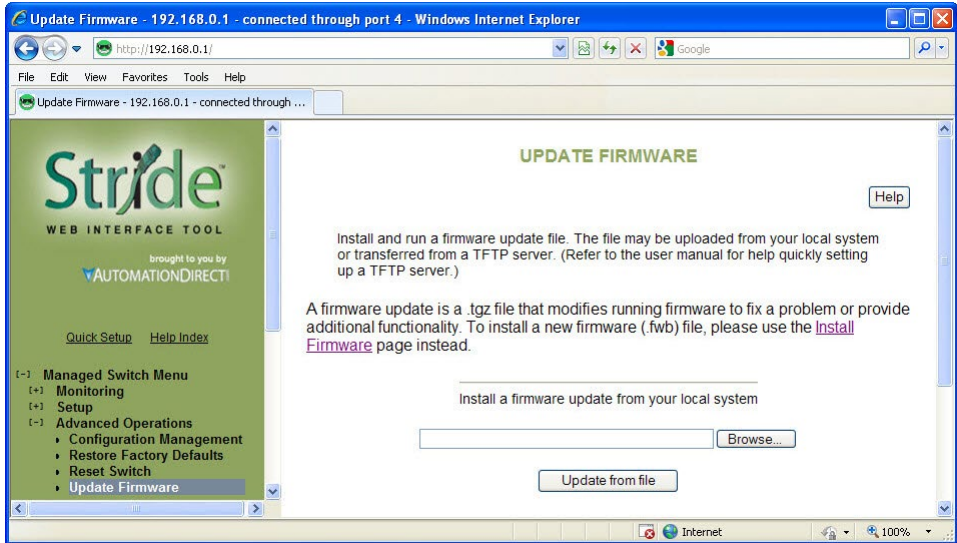
Reset Switch

This feature will cause the switch to perform a “soft” restart (software reset). A software reset may take 30 seconds or more depending on what features are enabled in the switch.



Update Firmware

Use Manage Firware to install a complete firmware file with a *.tgz filename. The Update Firware page is used for incremental changes to firmware versions applied by a file with a *.fwb filename. Firmware updates are released periodically to add features and fix problems. The recommended and easiest way to update firmware is from the web interface. It allows you to Browse and select the firmware update package from your local computer or a computer on your local network. Then just click the Update from File button to load and install the latest firmware files.



This method of updating the firmware will retain all your settings. However, it is still recommended that you save a “checkpoint” configuration as a backup.

Update Firmware using a TFTP Server:

Another option for updating firmware is via a TFTP server elsewhere on the network. Simply specify the IP address of the remote TFTP server and the filename of the update. If necessary, the switch will automatically reboot after installing the new firmware files. After the reboot you may see an “Internal Server Error” message. Simply click refresh on your browser to reestablish communications with the switch.

This method of updating the firmware will retain all your settings. However, it is still recommended that you save a “checkpoint” configuration as a backup.

TROUBLESHOOTING



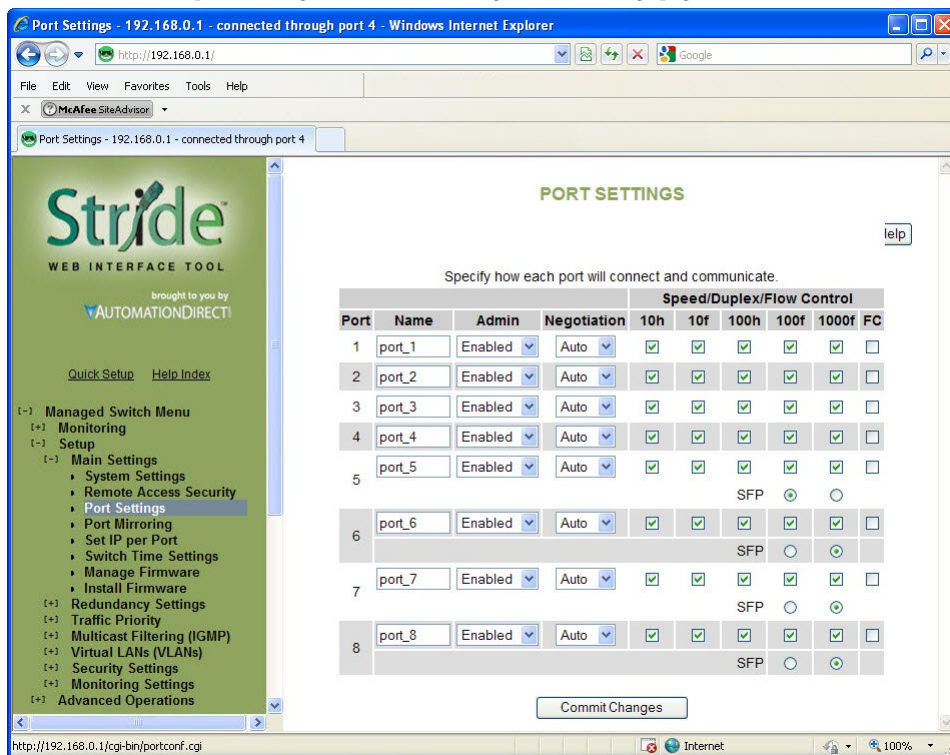
In This Appendix...

Troubleshooting Fiber Connections:	A-2
Troubleshooting Real-Time Ring.	A-4
Troubleshooting VLANs.	A-6
Installing Switch Firmware	A-8

Troubleshooting Fiber Connections:

1. If you are using a 100Mbps SFP in a Stride switch, you must manually change the port speed on the Port Settings page of the Switch Setup interface. Note that if matching 100Mbps SFPs are installed and connected by a proper mode-type patch cable but the Port Setting has not been changed from the default 1000Mbps (Gigabit speed), the Port Status and RSTP Port Status pages will not indicate the port speed mismatch. That is, the browser interface will not alert the user to this speed mismatch.

- Verify the type of SFP.
- Verify the port number.
- Verify the Port Speed Setting on the Main Settings – Port Settings page:



2. Make sure that the speeds of both ends of a link match: a 100Mbps SFP on one switch must connect to a 100Mbps connection on the other switch or end device. Fiber ports do not negotiate speed.

3. Ensure that the cable type you are using matches the transceiver type. That is, Multimode cable requires Multimode transceivers, and Single-mode cable requires Single-mode transceivers.

4. Additionally, it is important that 62.5um is used with 62.5um and 50um used with 50um.

If the fiber cores are not aligned correctly significant attenuation will occur.

5. Make sure that all of your connectors are clean. Even a little bit of dust, dirt or grease on a connector face can significantly degrade a fiber signal. This includes the main fiber optic link as well as any patch cables that you may be using. When cleaning, it is important to use lint-free swabs or wipes, preferably of a clean room quality. These can be used dry or wet (with 99% isopropyl alcohol solutions).

- Make certain that you are not cleaning an active fiber, as the laser can cause permanent damage to your eyes should you look into the end face.
- Additionally, it is not necessary to scrub the end face, rather to just gently wipe it clean and then double-check the link. If additional cleaning is required simply repeat this process.

6. Make sure that all connectors are plugged completely into their proper ports. Again, if end faces are not lined up correctly with transceivers and/or mated fiber ends, the system may fail due to excess attenuation.

7. Make sure that the transmit cable at the near end is the receive cable at the far end. There needs to be a crossover for a fiber link to work correctly. Be sure to factor in all patch cords that may be used.

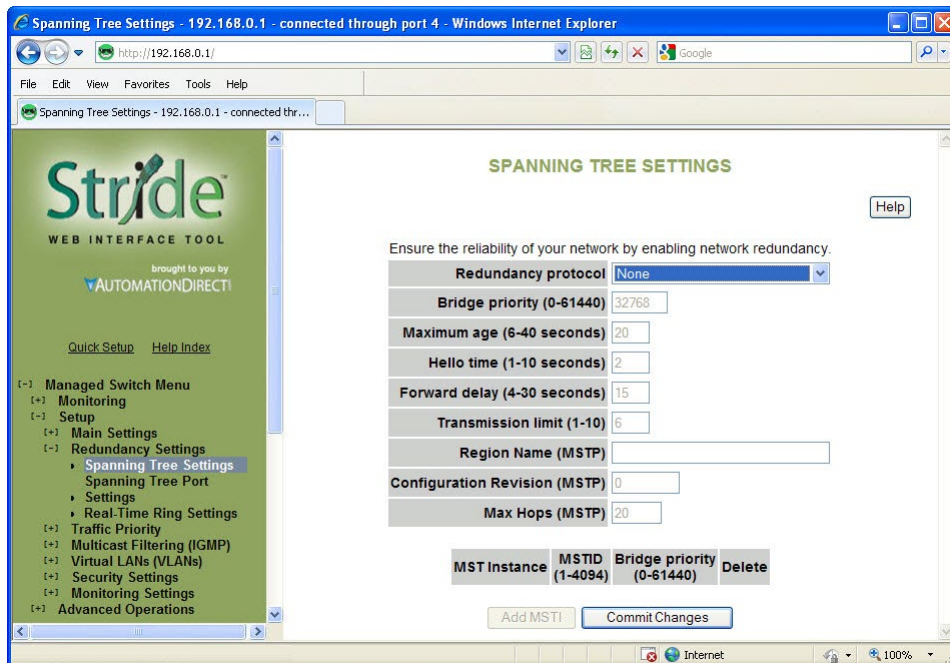


NOTE: *The physical connectors on the ends of a fiber cable do NOT need to match: a link may use an LC connector on one end and an SC connector on the other end.*

Troubleshooting Real-Time Ring

1. Typically a switch will be protected by either Real-Time Ring or RSTP. If Real-Time Ring is configured on a switch, disable RSTP.

- On the Redundancy Settings – Spanning Tree Settings page, set Redundancy protocol to “None”



2. It is possible for Real-Time Ring and RSTP to coexist on a switch. If a switch participates in both a Real-Time Ring and a spanning tree, exclude the Real-Time Ring ports from spanning tree:

- On the Redundancy Settings – Spanning Tree Port Settings page, check the boxes to exclude the Real-Time Ring ports from Spanning Tree

Spanning Tree Port Settings - 192.168.0.1 - connected through port 4 - Windows Internet Explorer

http://192.168.0.1/

Spanning Tree Port Settings - 192.168.0.1 - connecte...

Stride
WEB INTERFACE TOOL
brought to you by
AUTOMATIONDIRECT

Quick Setup Help Index

- [-] Managed Switch Menu
 - [+] Monitoring
 - [-] Setup
 - [+] Main Settings
 - [-] Redundancy Settings
 - Spanning Tree Settings
 - Spanning Tree Port Settings**
 - Settings
 - Real-Time Ring Settings
 - Traffic Priority
 - Multicast Filtering (IGMP)
 - Virtual LANs (VLANs)
 - Security Settings
 - Monitoring Settings
 - Advanced Operations

SPANNING TREE PORT SETTINGS Help

Optimize your network redundancy and maximize reliability by specifying spanning tree protocol parameters for each port.

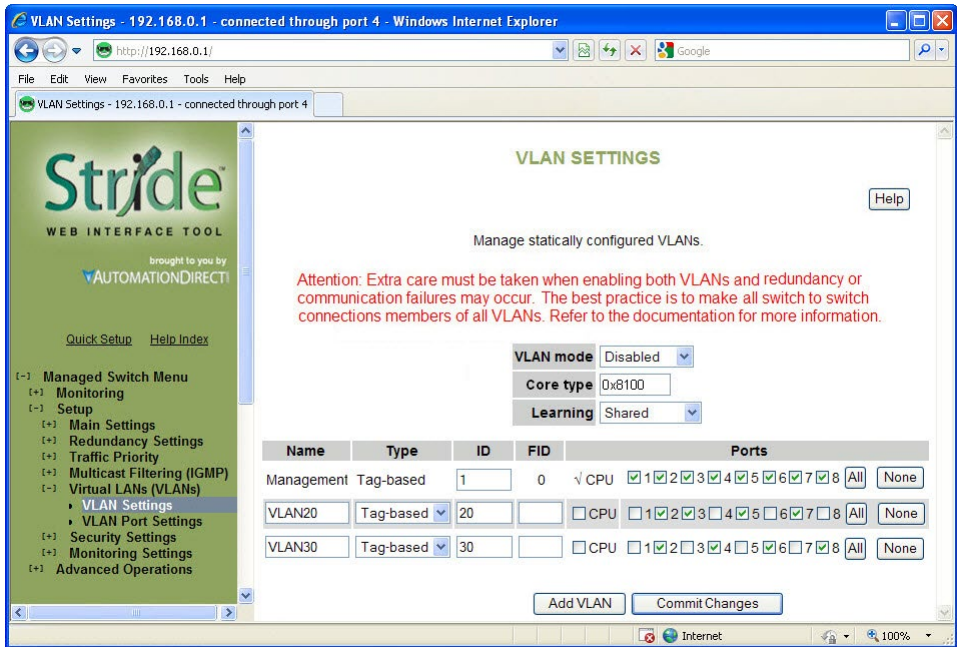
RSTP PORT SETTINGS

Port	Port Name	Exclude	Priority	Path Cost	Type	Point-to-Point
1	port_1	<input type="checkbox"/>	128	<input type="radio"/> Auto <input checked="" type="radio"/> 20000	Auto	Auto
2	port_2	<input type="checkbox"/>	128	<input type="radio"/> Auto <input checked="" type="radio"/> 20000	Auto	Auto
3	port_3	<input type="checkbox"/>	128	<input type="radio"/> Auto <input checked="" type="radio"/> 20000	Auto	Auto
4	port_4	<input type="checkbox"/>	128	<input type="radio"/> Auto <input checked="" type="radio"/> 20000	Auto	Auto
5	port_5	<input type="checkbox"/>	128	<input type="radio"/> Auto <input checked="" type="radio"/> 20000	Auto	Auto
6	port_6	<input type="checkbox"/>	128	<input type="radio"/> Auto <input checked="" type="radio"/> 20000	Auto	Auto
7	port_7	<input checked="" type="checkbox"/>	128	<input type="radio"/> Auto <input checked="" type="radio"/> 20000	Auto	Auto
8	port_8	<input checked="" type="checkbox"/>	128	<input type="radio"/> Auto <input checked="" type="radio"/> 20000	Auto	Auto

Commit Changes

Troubleshooting VLANs

The most common VLAN is the Tag-based VLAN. A typical tag-based VLAN implementation requires configuring the VLANs on the VLAN Settings page AND configuring the ports for each VLAN on the VLAN Port Settings page:



For a Tag-based VLAN (commonly referred to as an 802.1q or a Dot 1q VLAN)

On the VLAN Settings page:

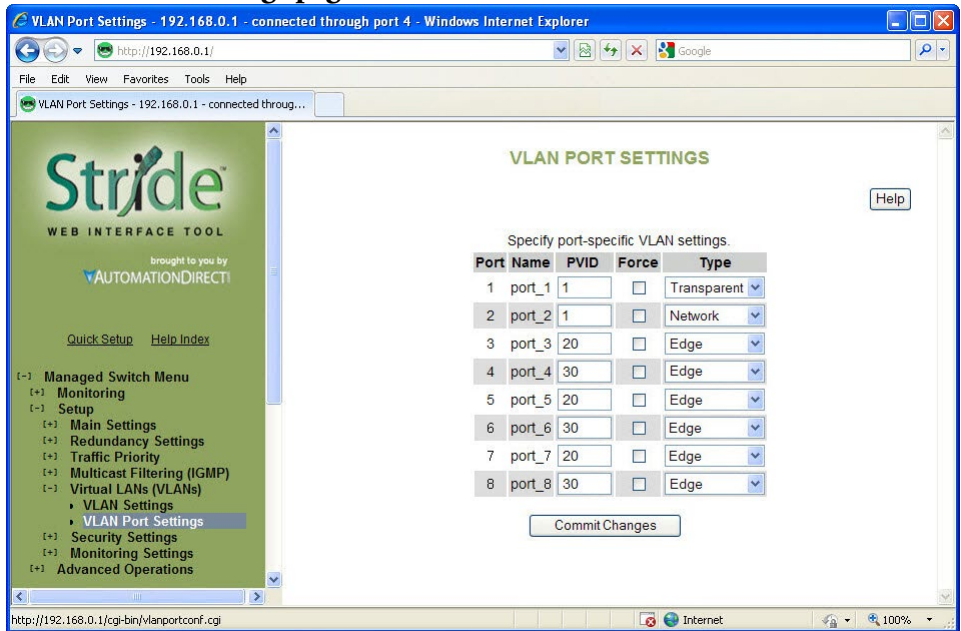
Set VLAN mode to Standard

Add the VLANs you wish to have configured, leaving the Type selection “Tag-based.” In our example, we are creating two VLANs called VLAN 20 and VLAN 30. The names are for your convenience. The IDs on this page will match the PVIDs we configure on the VLAN Port Settings page and will determine VLAN participation.

We will configure port 2 as a Network (Trunking) port on the VLAN Port Settings page, so here on the VLAN Settings page we include Port 2 in both of our VLANs.

For security, we have chosen to reserve Port 1 as the only port through which the Switch Configuration utility can be accessed; we have eliminated all other ports from the Management VLAN and we have not included port 1 in the other VLANs.

On the VLAN Port Settings page:



Set Port 2's type to Network. We will connect another managed switch configured with VLANs 20 and 30 to port 2.

For ports 3 through 8, enter the PVID (Port VLAN ID) to match the VLAN ID that each port was configured to participate in on the VLAN Settings page. In our example, a device such as a PLC, HMI, etc is assumed to be connected to ports 3-8; no managed switch is connected to these ports. So they are identified as Edge ports here.

With this configuration committed to the switch, a device on port 3 can communicate with devices on ports 5 and 7 as well as devices on the VLAN 20 ports from the switch connected to port 2. None of those devices (ports 3, 5 or 7 here or any device on a VLAN 20 port on the switch connected to port 2) can communicate with devices connected to ports 4,6 or 8, or VLAN 30 ports on the switch connected to port 2.

Devices on ports 4, 6 and 8 can communicate with each other and with devices connected to VLAN 30 ports on the switch connected to port2, but not to the VLAN 20 devices.

Port 1 is reserved for switch management and is assumed to have a laptop occasionally connected for that purpose

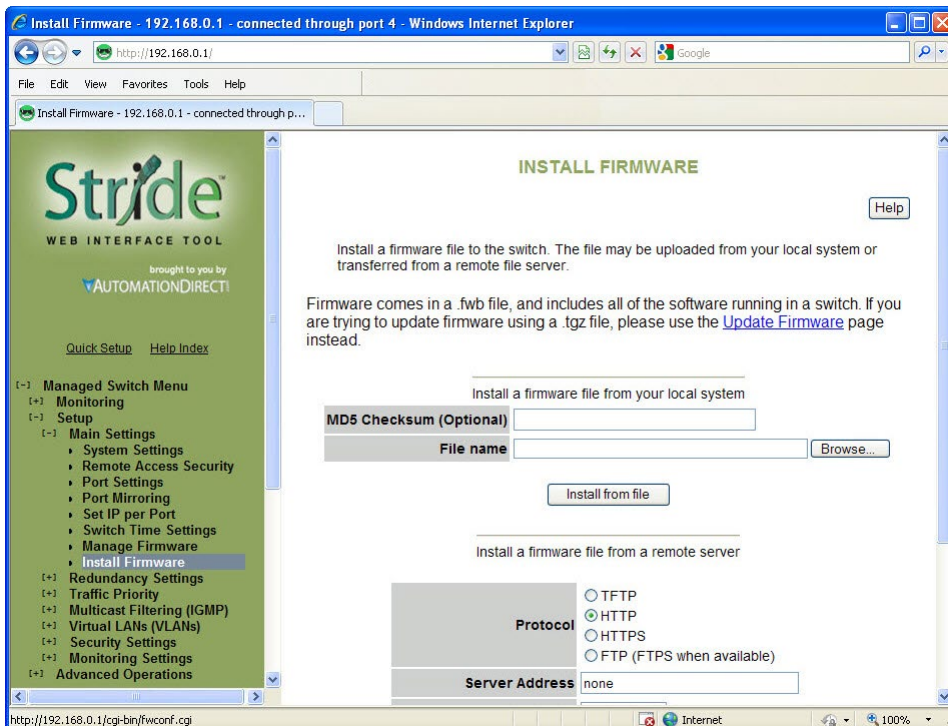
Although the tag-based VLANs are the most common and most versatile, the Port-based VLANs are the simplest. The Port-based VLANs are restricted to ports on this one switch. There is no Network (trunking) port to carry the VLANs across multiple switches.

Set VLAN mode to Port-based and Add VLANs with Type set to Port-based. Select which ports belong to each VLAN. A port should belong to only one Port-based VLAN. CPU should be checked for each Port-based VLAN.

Installing Switch Firmware

Installing switch firmware from the browser interface requires 3 steps:

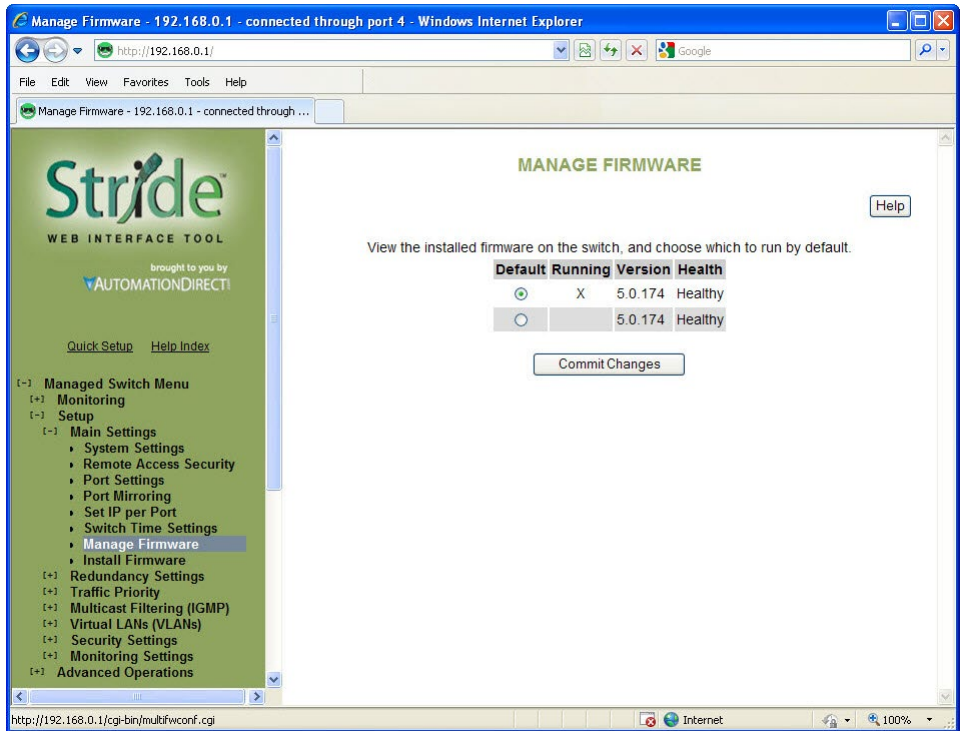
1. Install the firmware .fwb file from the Main Settings – Install Firmware page



Browse to the file either on your local system or from a remote server. The MD5 Checksum is an error detection value that your IT department may calculate and give you, especially when they install firmware from a remote server. It is not required. The purpose of the Checksum is to verify the file you are using to upgrade exactly matches the version sent.

Click the Install from File or Install from Server button

2. After the firmware file has been installed, go to the Main Settings - Manage Firmware page:



Set the Default radio button to the new version you installed

3. Either power cycle the switch or go to the Advanced Operations – Reset Switch page. There, click the Yes check box then click the Reset Switch button.

After the switch has been reset, the new firmware version will be identified on the Manage Firmware page as the Running version.



APPENDIX

B

GLOSSARY

In This Appendix...

Glossary of TermsB-2

Glossary of Terms

802.1p: The IEEE standard that specifies QoS

802.1q: The IEEE standard that specifies VLANs

BPDU: Bridge Protocol Data unit

Broadcast: Communicating one-to-all

CA: Certificate Authority

CIDR: Classless inter-domain routing

CLI: command line interface

CoS: IEEE 802.1p Class of Service

CRC: Cyclic redundancy check

Default gateway: The node on the computer network that the network software uses when an IP address does not match any other routes in the routing table.

DHCP: Dynamic Host Control Protocol

DiffServ: Differentiated Services – class based network traffic management

DNS: Domain Name System

DNS server: Resolves domain names and host names into IP addresses

FCS: Frame check sequence

Frame: A single unit of data received and transmitted by a switch

FTP: File Transfer Protocol

IGMP: Internet Group Management Protocol

IKE: Internet Key Exchange, a protocol in IPSec, results in a Security Association between two devices that will communicate over IP

IKE policy: The parameters that will be allow communication between two devices

IP: Internet Protocol

IP address (IPv4): A 32 bit number assigned to each device on a network communicating via IP version 4. Typically written in dotted-decimal notation, e.g. 192.168.0.1

IP address (IPv6): A 128 bit number assigned to each device on a network communicating via IP version 6. Typically written in hexadecimal notation, e.g. fe80:0000:0000:2a0:1dff:fe51:f5da

IPSec: A group of protocols to provide security for IP communications, including authentication and encryption at the packet level

IPv4: Internet Protocol version 4

IPv6: Internet Protocol version 6

Jabber: A frame greater than the Ethernet maximum 1518 bytes with a bad CRC. Jabber is often cause by a failing NIC.

LAN: Local area network

MAC address: Media Access Control address - hardware identifier

Modbus/TCP: A Modbus protocol over Ethernet

MSTI: Multiple Spanning Tree Instance, sometimes written “MST instance”

MSTP: Multiple Spanning Tree Protocol

Multicast: communicating one-to-many

NIC: Network Interface Card

NTP: Network Time Protocol

Octet: Eight bits

Packet: A single unit of data received and transmitted by a router

PVID: Per-VLAN identifier

QoS: Quality of Service

Real-time ring: Proprietary redundancy protocol

RMON: Remote network monitoring

Root bridge: In STP and RSTP, bridge with the smallest Bridge ID

Root port: The port on a switch facing the root bridge.

RSA: The RSA fingerprint for the managed Switch’s encryption key is: 1e:0f:31:39:26:3f:23:8c:ba:7e:e9:d1:56:ff:98:f6

RSTP: Rapid Spanning Tree Protocol

RSTP terms:

- **Discarding** = In this state, station location information is not added to the Filtering Database (MAC table) because any changes in port role will make the Filtering Database information inaccurate.
- **Learning** = In this state, information is being added to the Filtering Database under the assumption that the port role is not changing. Gathering information before frame relay (forwarding state) will reduce the number of frames sent out when entering the forwarding state.
- **Forwarding** = Frames will be forwarded to and from the particular port that is in the forwarding state. In addition, during the forwarding state, the learning process is still incorporating station information

RSTP recovery time: Time to start forwarding messages on the backup port.

SAD: Security association database

SFP: Small form-factor pluggable

SNMP: Simple Network Management Protocol

SPD: Security policy database

SQE: Signal Quality Error

SSH: Secure Shell protocol

STP: Spanning Tree Protocol

STP terms:

- **Blocking** = A port in this state does not participate in frame relay (pass frames received to other locations). Once a port is in this state, it is prevented from the possibility of frame duplication caused by multiple paths in an active topology.
- **Listening** = A port in this state is about to participate in frame relay, but is not involved in any relay of frames (no frames will be forwarded). The reason for not entering frame relay immediately is to ensure that there are no temporary loops introduced when the network topology is changing. During this state, the bridge will disable all learning states on its ports to prevent the race conditions when ports are changing roles and the forwarding process will discard all frames and not submit any frames for transmission. Meanwhile BPDUs can still be received and forwarded to keep the algorithm running.
- **Learning** = A port in this state is about to participate in frame relay, but it is not involved in any relay of frames. Frame relays are not performed to prevent the creation of temporary loops during the active topology of a changing bridged LAN. In addition, the forwarding process will discard all frames and not submit any frames for transmission. The reason for enabling learning is to acquire information prior to any frame relay activities. Information gathered will be used and placed in the filtering database (MAC table) to reduce the number of frames being unnecessarily relayed.
- **Forwarding** = A port in the forwarding state is currently participating in frame relay. BPDUs will include the forwarding port in the computation of the active topology. BPDUs received are processed according to the Spanning Tree algorithm and transmitted based on the hello time or BPDU information received.

Subnet mask: A number representing the digits that identify the network portion of an IP address that includes network and host identification.

TCP: Transmission Control Protocol

Telnet: Means of accessing the CLI

TFTP: Trivial File Transfer Protocol

TOS: Type of Service

UDP: User Datagram Protocol

VLAN: Virtual Local Area Network

SWITCH SETTINGS - SWITCH CONFIGURATION RECORDS



In This Appendix...

General Switch Information	C-2
Alarm Configuration	C-3
Mirror Configuration	C-3
VLAN Configuration	C-3
Port Configuration	C-3
QOS Configuration	C-4

General Switch Information

Installation Date	Date
Model	Model
Description	Description
System Name	System
Switch Location	Location
Contact	Contact Name
IPv4 Address	IPv4 address
DHCP	DHCP
IPv6 Address	IPv6 address
Default Gateway	Default Gateway
Primary DNS	DNS
Secondary DNS	Secondary DNS
Domain	Domain
Serial Number	Serial number
Firmware Revision	Firmware revision
MAC Address	MAC address
IGMP Mode	Active IGMP handling
Multicast Suppression	All unreserved multicast
IGMP Version	2
Redundancy Protocol	RSTP
Bridge Priority	32768
Max Message Age	20
Hello Timer	2
Forwarding Delay	15
Transmission Limit	6
MSTP Region Name	
MSTP Configuration Revision	0
MSTP Max Hop Count	20
Topology Change Trap	Disabled
Telnet	Unknown
Terminal Mode	both
Web Mode	both
SNMP Version	both
Command-Line Interface	Enabled
User Interface Timeout	0
NTP Server	none

Alarm Configuration

A power input lost	Enabled								
		Port 1	Port 2	Port 3	Port 4	Port 5	Port 6	Port 7	Port 8
link down		Disabled	Disabled	Disabled	Disabled	Disabled	Disabled	Disabled	Disabled

Mirror Configuration

Monitor Port	1								
		Port 1	Port 2	Port 3	Port 4	Port 5	Port 6	Port 7	Port 8
Direction		none	none	none	none	none	none	none	none
Ports to Monitor									

VLAN Configuration

VLAN Mode	Disabled								
Number of VLAN's	0								
		Port 1	Port 2	Port 3	Port 4	Port 5	Port 6	Port 7	Port 8
PVID		1	1	1	1	1	1	1	1
Force		Disabled	Disabled	Disabled	Disabled	Disabled	Disabled	Disabled	Disabled

Port Configuration

Name		Port 2	Port 3	Port 4	Port 5	Port 6	Port 7	Port 8
Admin	Enabled	Enabled	Enabled	Enabled	Enabled	Enabled	Enabled	Enabled
Negotiation	Enabled	Enabled	Enabled	Enabled	Enabled	Enabled	Enabled	Enabled
Speed / Duplex	00080f	00080f	00080f	00080f	00080f	00080f	00080f	00080f
Flow Control	Disabled	Disabled	Disabled	Disabled	Disabled	Disabled	Disabled	Disabled
Exclude	Included	Included	Included	Included	Included	Included	Included	Included
Priority	128	128	128	128	128	128	128	128
Path Cost	200000	200000	200000	200000	200000	200000	200000	200000
Type	Disabled	Disabled	Disabled	Disabled	Disabled	Disabled	Disabled	Disabled
Point-to-Point	Auto	Auto	Auto	Auto	Auto	Auto	Auto	Auto
Path Cost Auto	Disabled	Disabled	Disabled	Disabled	Disabled	Disabled	Disabled	Disabled

QOS Configuration

Schedule	strict								
Tag 0 Priority	1								
Tag 1 Priority	0								
Tag 2 Priority	0								
Tag 3 Priority	1								
Tag 4 Priority	2								
Tag 5 Priority	2								
Tag 6 Priority	3								
Tag 7 Priority	3								
		Port 1	Port 2	Port 3	Port 4	Port 5	Port 6	Port 7	Port 8
Use 802.1p Tag Priority		Enabled	Enabled	Enabled	Enabled	Enabled	Enabled	Enabled	Enabled
Use IP ToS/DiffServ		Enabled	Enabled	Enabled	Enabled	Enabled	Enabled	Enabled	Enabled
Priority Precedence		tag	tag	tag	tag	tag	tag	tag	tag
Default Out Q		1	1	1	1	1	1	1	1
Path Cost Auto		normal	normal	normal	normal	normal	normal	normal	normal

CLI COMMANDS



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CLI Commands

Introduction

The command-line interface (CLI) is constructed with an eye towards automation of CLI-based configuration. The interaction is modeled on that used in many Internet protocols such as Telnet, FTP, and SMTP. After each command is entered and processed, the switch will issue a reply that consists of a numeric status code and a human-readable explanation of the status. See, for example, the SMTP protocol specification in RFC 821 – Simple Mail Transfer Protocol (<http://www.faqs.org/rfcs/rfc821.html>), specifically, “Appendix E – Theory of Reply Codes.” for more details.

The general format of commands is:

section parameter [value]

where:

- **section** is used to group parameters.
- **parameter** will specify the parameter within the section. For example, the network section will have parameters for DHCP, IP address, subnet mask, and default gateway.
- **value** is the new value of the parameter. If value is omitted, the current value is displayed.



NOTE: *The new values will not take effect until explicitly committed.*

Sections and parameter names are case sensitive (e.g., “Network” is not the same as “network”).



NOTE: *Any commands in the CLI commands section of this section, with the exception of the global commands, must be prefaced with the name of the section they are in. For example, to change the IP address of the Switch, you would type:*

network address <newIP>

This is because the address command is in the Network Configuration section of this Appendix.

Accessing the CLI

To access the CLI, establish an Ethernet or serial connection to the switch.

To connect by Ethernet, open a command prompt window and type:

```
telnet <switchIP> (where <switchIP> is the IP address of the switch) eg. telnet 192.168.0.1
```

At the login prompt, type “cli” for the username and “admin” for the password. The switch will respond with “Managed Switch configuration CLI ready”.

Likewise, for serial access, via Tera Term for example, use...

```
login: cli
```

```
password: admin
```

CLI Commands:

Global Commands:

The following global commands are available anywhere in the CLI:

Command	Effect
commit	10% of link capacity/Values are inter-validated as needed. If valid, values are committed. Please note that this may take some time depending on changes.
defaults	Restore factory defaults
quit	CLI is exited. Uncommitted changes are discarded without prompting.
reset	Reset the Switch.
help	Print a help message.
prompt	Enable/disable the prompt (usage: "prompt enabled" or "prompt disabled")

When restoring factory defaults, network settings may be maintained by adding a "savenw" option. In other words:

```
defaults
```

restores all values, but

```
defaults savenw
```

restores all defaults except the current settings for DHCP, IP address, etc...

Access Configuration:

The following administrative access settings are settable via the CLI:

Access Configuration		
Parameter	Default	Allowable Values
snmp	both	none, snmpv2, snmpv3, both
terminal	both	none, telnet, ssh, both
web	both	none, http, https, both
cli	1	0, 1
uitimeout	0	0 - 999
rouser	public	Any valid user name
rwuser	private	Any valid user name
ropass	none	A password, followed by the same password repeated
rwpass	none	A password, followed by the same password repeated
adminpass	admin	A password, followed by the same password repeated
fwload	serial	"serial" for serial firmware loading or "network" to enable Ethernet only

Alarm Configuration:

Alarm Configuration		
Parameter	Default	Allowable Values / Description
list	n/a	No value, view all current alarm settings
powerloss	enabled	'enabled', 'disabled' / alarm output will be low if a power input is lost
ringfailure	disabled	'enabled', 'disabled' / alarm output will be low if a power input is lost
<i>These settings require a port number, usage: alarm <parameter> <port #> [<new value>]</i>		
linkloss	disabled	0 - 'enabled', 'disabled' / alarm output is triggered when link is down on the specified port

Modbus Configuration:

Modbus Configuration		
Parameter	Default	Allowable Values / Description
enabled	0	0 or 1, 1 meaning enabled
stanum	1	1 to 247, used to get or set modbus station number
transport	tcp+udp	tcp / udp / tcp+udp, used to specify allowed transport layer for modbus
timeout	0	0 to 3600 or none, time is in seconds
maxcon	4	1 to 20, sets maximum number of concurrent connections
port	502	1 to 65535, set port number to listen for Modbus polling requests

Info Configuration:

Info Configuration		
Parameter	Default	Allowable Values / Description
fwversion	n/a	View the current firmware version
cfgversion	n/a	View the configuration version number
macaddr	n/a	View the MAC address of the Switch
link	n/a	'all', port# / show specified port (s) link status
support	n/a	displays useful support information (IP, etc.)
<i>These settings require a filter to be specified: info <parameter> <filter> [<value>]</i>		

For the info **mactable** command, the filter parameters are:

id = {*|#} Show all/one specific filtering database by ID

port = {*|#[,#[,...]]} Show all/one/multiple specific port(s)

NOTE: port 33 is the switch CPU.

mac = {*|xx};{*|xx};{*|xx};{*|xx};{*|xx};{*|xx} Show only MAC addresses matching the given pattern

Network Configuration:

The switch can have DHCP enabled or disabled. When it is enabled, settings for IP address, subnet mask, and default gateway may still be set. The values will be stored and used should DHCP be disabled in the future.

Info Configuration		
Parameter	Default	Allowable Values / Description
fwversion	n/a	View the current firmware version
cfgversion	n/a	View the configuration version number
macaddr	n/a	View the MAC address of the Switch
link	n/a	'all', port# / show specified port (s) link status
support	n/a	displays useful support information (IP, etc.)
These settings require a filter to be specified: info <parameter> <filter> [<value>]		

Port Security Configuration:

Port Security Configuration		
Parameter	Default	Allowable Values / Description
list	n/a	List all current port security information
enable	n/a	Enables MAC-based port security
disable	n/a	Disables MAC-based port security
add	n/a	Any valid MAC and port number / allow communication by the specified MAC on the specified port.
remove	n/a	Any valid MAC / remove a MAC address from the security table

Port Configuration:

Port Configuration		
Parameter	Default	Allowable Values / Description
list	n/a	No value, lists all settings for all ports
monitor	1	Any port number
These settings require a port number, usage: port <port #> <parameter> [<new value>]		
name	port_#	A string
admin	enabled	enabled, disabled
negotiation	enabled	enabled (auto-negotiation), disabled (fixed negotiation)
ratelimit	enabled	enabled, disabled
direction	none	none, egress, both
giveip	disabled	enabled, disabled
ipaddr	none	An IP address
Sfp	1000	100, 1000
speed	(see below)	(see below)

With auto negotiation, <speed> may be:

10H, 10F, 100H, 100F, 1000F or FC

With fixed negotiation, <speed> may be:

100H or 100F

Valid settings: 'enabled' (will automatically set other speeds to 'disabled')

The syntax for the port speed command is as follows:

```
port <port #> speed ...
(negotiation enabled)
speed 10H enabled
speed 10F disabled
...
```

Which act like check boxes on a web form.

Or, with negotiation disabled, the syntax is:

```
speed 10H enabled
speed 100F enabled
...
```

Which act like radio buttons on a web form.

Speed FC enabled/disabled is available in both modes.

For combo ports, the SFP speed may be set as follows:

```
port <port#> sfp <speed>
```

Ring Configuration:

Ring Configuration		
Parameter	Default	Allowable Values / Description
list	n/a	View the list of configured rings
master	auto	auto, 'this' / configure how the Switch determines the ring master
The settings below require a ring number, usage: ring <parameter> <ring #> [<new value>]		
enable	0	'0', '1' / view or change whether the ring is enabled
name	n/a	Any text value / View or change the specified ring name
ports	n/a	(see below) / View or change this ring's primary and backup ports

To set the primary and backup ports for a specified ring, the syntax is:

```
ring ports <ring#> <primary port #> <secondary port #>
```

RSTP Configuration:

RSTP Configuration		
Parameter	Default	Allowable Values / Description
protocol	none	none, stp, rstp or mstp / View or change the spanning tree protocol
priority	0	A multiple of 4096 in the range of 0 - 61440 / View or change the priority
mma	6	An integer in the range 6 - 40 / View or change the maximum message age
hellowtime	1	An integer in the range 1 - 10 / View or change the hello time
fwddelay	4	An integer in the range 4 - 30 / View or change the forwarding delay
Txlimit	1	An integer in the range 1 - 10 / View or change the transmission limit
region	n/a	any valid region name
cfgrevision	n/a	any valid revision number
maxhops	20	any number from 6 - 40
The settings below require a port number, usage: rstp <parameter> <port #> [<new value>]		
exclude	0	'2', '1', '0' / View or change whether this port is excluded from STP
pprio	0	An integer in the range of 0 - 240 / View or change this port's priority
pcost	none	'auto' or integer in the range of 0 - 200,000,000 / View or change this port's cost
type	1	'1', '0' / View or change this port's edge type
ptp	Auto	'ForceTrue', 'ForceFalse', 'Auto' / View or change this port's point-to-point setting

QoS Configuration:

QoS Configuration		
Parameter	Default	Allowable Values / Description
schedule	strict	'strict', 'fair' / View or change the fairness rule
The settings below require a port number, usage: qos <parameter> <port #> [<new value>]		
usetag	0	'0', '1' / View or change whether tag priorities are used
useip	n/a	'0', '1' / View or change whether IP priorities are used
pref	tag	'tag', 'ip' / View or change which to use if both tags and IP are enabled
priority	1	0 - 3 / Default priority to give to packets received on this port
type	normal	'normal', 'add', 'remove', 'double' / The type of connection to this port
The setting below requires a tag number, usage: qos tag <tag #> [<new value>]		
tag	(depends on the tag)	0 - 3 / View or change the priority of the specified tag

If <new value> is not present, the current setting will be displayed.

VLAN Configuration:

VLAN Configuration		
Parameter	Default	Allowable Values / Description
vlist	none	No value, lists all configured VLANs
plist	none	No value, lists the VLAN settings for each port
mode	disabled	'disabled', 'port', 'standard', 'secure' / View or change VLAN mode
coretype	none	Value in hexadecimal with a 0x prefix / View or set Ethertype for core tags
mgmtvlan	1	1 - 4094 / View or set the management VLAN ID
learning	shared	'shared', 'independent' / Change VLAN learning mode
mgmtports	all	1 - 9 / View or set the management VLAN port
The commands below require a vlan # from vlist		
name	n/a	A string of no more than 33 characters
vtype	n/a	'port', 'tag' / View or change the type of this VLAN
id	n/a	An integer between 1 and 4095 / View or change the ID of this VLAN
ports	n/a	Syntax: vlan ports <vlan#> <add/remove> <port#>
The commands below require a port #		
pvid	1	A VLAN # from vlist valid range of 1 - 4094
force	0	'0', '1'
add	(see below)	(see below)
remove	(see below)	(see below)

The examples below explain the syntax of the “port”, “add” and “remove” commands:

To add a Port Based VLAN:

```
vlan ports <vlan #> add <port #>
vlan ports <vlan #> remove <port #>
vlan add <name> port <port #> <port #> [...]
```

To add a Tag based VLAN:

```
vlan add <name> tag <vlan ID> <port #> <port #> [...]
```

To remove a VLAN:

```
vlan remove <vlan # or all>
```

IGMP Configuration:

IGMP Configuration		
Parameter	Default	Allowable Values / Description
rlist	n/a	No value / Lists router settings for all ports
mode	disabled	disabled, snoop, router / view or change IGMP mode
msupp	none	none, ip, all / view or change the multicast suppression method
version	2	1, 2 / IGMP version
robustness	2	1 - 99 / IGMP robustness
ginterval	125	60 - 125 / IGMP query interval
gresponse	10	1 - 30 / IGMP query response interval
The commands below require a port #		
router	0	0, 1 / identify ports which lead to IGMP routers
exclude	0	0, 1 / Exclude a port from the processing of IGMP requests and queries

Checkpoint Configuration:

Checkpoint Configuration		
Parameter	Default	Allowable Values / Description
save	n/a	None / saves a check point
restore	n/a	net, nonet / net saves current network settings, nonet discards them
ftpsave	n/a	a file name
ftprestore	n/a	a file name

Firmware Configuration:

Firmware Configuration		
Parameter	Default	Allowable Values / Description
default	n/a	1 or 2 / View or change the default firmware
running	n/a	View which firmware image is running
list	n/a	View list of currently available firmware images and corresponding health status
update	n/a	Followed by [showProgress] [md5=<md5>] <url> If the 'showProgress' argument is provided, progress printouts will be displayed. If the 'md5' argument is provided, the MD5 checksum of the received firmware will be tested against the provided MD5 checksum. The URL must be a valid HTTP or HTTPS address to which the Switch has direct access.
ftpload	n/a	Followed by the filename to be uploaded from the TFTP server

TFTP Configuration:

TFTP Configuration		
Parameter	Default	Allowable Values / Description
tftp	“ “	A valid fully-qualified domain name

Timezone Configuration:

Timezone Configuration		
Parameter	Default	Allowable Values / Description
list	(see below)	(see below)
value	none	A time zone from list



NOTE: To view a list of all timezones, use the command “tz list [<prefix>]” with the option to filter by timezones beginning with the characters in <prefix>.

MSTI Configuration:

MSTI Configuration		
Parameter	Default	Allowable Values / Description
list	n/a	Lists all MSTIs and their priorities
plist	n/a	Followed by mstid, used to show all ports in the specified MSTI with their costs and priorities
add	n/a	Followed by name mstid [priority]
remove	n/a	any valid MSTI, or all to remove all MSTIs
priority	32768	Followed by mstid [priority]
pprio	varies	Followed by mstid portno [pprio], used for per-MSTI port priorities
pcost	varies	Followed by mstid portno [pcost], used for per-MSTI port costs
name	n/a	Followed by mstid [name]
mstid	n/a	Followed by mstid [newmstid]
inherit	n/a	Any valid MSTI. Used to inherit from the CIST

General Configuration:

The following commands are general commands which are not part of another subsection:

General Configuration		
Parameter	Default	Allowable Values / Description
location	<set location of switch>	Any text value / location of the Switch
contact	none	Any text value / contact information of the network or site administrator

LICENSING AND POLICIES



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Overview

The following is a list of the license agreements of the software and libraries used in the development of the firmware.

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PCRE is a library of functions to support regular expressions whose syntax and semantics are as close as possible to those of the Perl 5 language.

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The basic library functions are written in C and are freestanding. Also included in the distribution is a set of C++ wrapper functions.

THE BASIC LIBRARY FUNCTIONS

Written by: Philip Hazel

Email local part: ph10

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University of Cambridge Computing Service,
Cambridge, England.

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- DES is now external, in the OpenSSL library
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