ARTISAN®
TECHNOLOGY GROUP

Your **definitive** source for quality pre-owned equipment.

**Artisan Technology Group**
(217) 352-9330 | sales@artisantg.com | artisantg.com

**Full-service, independent repair center**
with experienced engineers and technicians on staff.

**We buy your excess, underutilized, and idle equipment**
along with credit for buybacks and trade-ins.

**Custom engineering**
so your equipment works exactly as you specify.

- Critical and expedited services
- In stock / Ready-to-ship
- Leasing / Rentals / Demos
- ITAR-certified secure asset solutions

**Expert team | Trust guarantee | 100% satisfaction**

All trademarks, brand names, and brands appearing herein are the property of their respective owners.

Find the *Phoenix Contact FL SWITCH SFN 5TX* at our website: *Click HERE*

# FL SWITCH SFN…

## Five- and eight-port standard function Ethernet switches with narrow housings – Gigabit as an option



Data sheet
2732_en_F

© PHOENIX CONTACT 2017-09-05

## 1 Description

The FL SWITCH SFN… range of Factoryline switches with standard functions in numerous versions can be used for quick and cost-effective Ethernet network expansion to the field level. Due to their narrow housing design, the components are suitable for universal remote use in control cabinets and junction boxes. The switches have five or eight ports, up to two of which are glass fiber ports provided in SC or ST format. The switches support the auto negotiation function at the twisted pair ports and offer transmission speeds of 10/100/1000 Mbps depending on the switch version. Mixed operation for the connection of segments with different data transmission speeds is also supported. The glass fiber ports only support 100 Mbps or 1000 Mbps (Gigabit version).

The RJ45 ports offer an auto crossing function, which means it is not necessary to make a distinction between 1:1 and crossover cables.

The fiber optic ports can be used to extend the segment length up to 20 km. Unused RJ45 ports can be fitted with security caps to provide mechanical protection against unauthorized use.

The FL SWITCH SFN…GT… switches offer additional gigabit performance, alarm contact and redundant power input capability.

### 1.1 Features

- Increased network performance
  - Switched Ethernet reduces traffic and non predictable timing
  - Quality of Service: Pretagged high priority messages are forwarded before lower priority messages during periods of high network traffic loading
  - Gigabit options for data intensive applications
  - Gigabit switches support jumbo frames up to 9600 bytes per frame
- Easy network expansion
  - No configuration of the switch
  - Auto negotiation and autocross simplify cabling
  - Coupling copper network segments with different bit rates with automatic detection of the data transmission speed of 10 Mbps, 100 Mbps or 1000 Mbps depending on the switch version
- Fiber optic options extend distance and electrical noise immunity
  - 1- or 2-port options
  - SC or ST connector options
  - Multimode or singlemode option
- Low cost, low complexity security (optional)
- Connect Layer 1 security elements at the RJ45 port to restrict access or tampering
  - No software setup needed

Please note the different connection directions of the transmission media for **five-port switches**: copper cables are connected at the **front**, glass fiber cables at the **bottom**.

Make sure you always use the latest documentation.
It can be downloaded at phoenixcontact.net/products.

This document is valid for all products listed in the “Ordering data” on page 3

## Table of contents

1 Description ..... 1
1.1 Features ..... 1
2 Ordering data ..... 3
3 Technical data ..... 4
4 Overview ..... 7
4.1 5-port versions ..... 7
4.2 8-port versions ..... 8
4.3 Diagnostic and status indicators ..... 8
4.4 Data transmission speed LEDs (10/100 Mbps switches) ..... 8
4.5 Data transmission speed LEDs (10/100/1000 Mbps switches) ..... 8
5 Installation ..... 9
5.1 Assembly ..... 9
5.2 Removal ..... 9
5.3 Power connection ..... 9
5.4 Alarm contact ..... 10
5.5 Ethernet interface ..... 10
5.6 Fiber optic connection ..... 10
5.7 Using the FL SEC PAC kit for port security ..... 11
6 Switching characteristics ..... 11
7 Dimensions ..... 12
8 FL SWITCH SFN…GT… jumbo frame support ..... 12
8.1 FL SWITCH SFN…GT… jumbo frame capability ..... 12
8.2 Jumbo frame performance factors ..... 12
8.3 Application guidelines ..... 13
8.4 Calculating total network loading with cascaded (trunk topology) switches ..... 14

# 2 Ordering data

### Ethernet switches with 10/100 Mbps

| Description | Type | Order No. | Pcs./Pkt. |
|---|---|---|---|
| Ethernet switch with 5 RJ45 ports for 10/100 Mbps | FL SWITCH SFN 5TX | 2891152 | 1 |
| Ethernet switch with 4 RJ45 ports and 1 fiber optic port in SC format for 10/100 Mbps | FL SWITCH SFN 4TX/FX | 2891851 | 1 |
| Ethernet switch with 4 RJ45 ports and 1 fiber optic port in ST format for 10/100 Mbps | FL SWITCH SFN 4TX/FX ST | 2891453 | 1 |
| Ethernet switch with 8 RJ45 ports for 10/100 Mbps | FL SWITCH SFN 8TX | 2891929 | 1 |
| Ethernet switch with 7 RJ45 ports and 1 fiber optic port in SC format for 10/100 Mbps | FL SWITCH SFN 7TX/FX | 2891097 | 1 |
| Ethernet switch with 7 RJ45 ports and 1 fiber optic port in ST format for 10/100 Mbps | FL SWITCH SFN 7TX/FX ST | 2891110 | 1 |
| Ethernet switch with 6 RJ45 ports and 2 fiber optic ports in SC format | FL SWITCH SFN 6TX/2FX | 2891314 | 1 |
| Ethernet switch with 6 RJ45 ports and 2 fiber optic ports in ST format for 10/100 Mbps | FL SWITCH SFN 6TX/2FX ST | 2891411 | 1 |

### Ethernet switches with 10/100/1000 Mbps (Gigabit)

| Description | Type | Order No. | Pcs./Pkt. |
|---|---|---|---|
| Ethernet switch with 8 RJ45 ports for 10/100/1000 Mbps | FL SWITCH SFN 8GT | 2891673 | 1 |
| Ethernet switch with 7 RJ45 ports for 10/100/1000 Mbps and 1 fiber optic port in SC format (multi-mode), 850 nm up to 550 m distance | FL SWITCH SFN 7GT/SX | 2891518 | 1 |
| Ethernet switch with 6 RJ45 ports for 10/100/1000 Mbps and 2 fiber optic ports in SC format (multi-mode), 850 nm up to 550 m distance | FL SWITCH SFN 6GT/2SX | 2891398 | 1 |
| Ethernet switch with 6 RJ45 ports for 10/100/1000 Mbps and 2 fiber optic ports in SC format (single mode), 1310 nm up to 10 km distance | FL SWITCH SFN 6GT/2LX | 2891987 | 1 |
| Ethernet switch with 6 RJ45 ports for 10/100/1000 Mbps and 2 fiber optic ports in SC format (single mode), 1310 nm up to 20 km distance | FL SWITCH SFN 6GT/2LX-20 | 2891563 | 1 |

### Accessories

| Description | Type | Order No. | Pcs./Pkt. |
|---|---|---|---|
| Universal end clamp | E/NS 35 N | 0800886 | 50 |
| Dust protection caps for RJ45 female connectors | FL RJ45 PROTECT CAP | 2832991 | 10 |
| Patch angle with 2 ports in CAT 5e | FL PF 2TX CAT5E | 2891165 | 1 |
| Patch angle with 8 ports in CAT 5e | FL PF 8TX CAT5E | 2891178 | 1 |
| Patch angle with 2 ports in CAT 6 | FL PF 2TX CAT6 | 2891068 | 1 |
| Patch angle with 8 ports in CAT 6 | FL PF 8TX CAT6 | 2891071 | 1 |
| Patch angle with security elements for 2 ports in CAT 5e | FL PF SEC 2TX | 2832687 | 1 |
| Patch angle with security elements for 8 ports in CAT 5e | FL PF SEC 8TX | 2832690 | 1 |
| Patchbox 8 x RJ45 CAT 5e, pre-assembled, can be retrofitted | FL PBX 8TX | 2832496 | 1 |
| Patchbox 6 x RJ45 CAT 5e and 4 SC-RJ, glass pre-assembled, can be retrofitted | FL PBX 6TX/4FX | 2832506 | 1 |
| Patch cable, CAT 5, pre-assembled, 0.3 m long | FL CAT5 PATCH 0,3 | 2832250 | 10 |
| Patch cable, CAT 5, pre-assembled, 0.5 m long | FL CAT5 PATCH 0,5 | 2832263 | 10 |
| Patch cable, CAT 5, pre-assembled, 1.0 m long | FL CAT5 PATCH 1,0 | 2832276 | 10 |
| Patch cable, CAT 5, pre-assembled, 1.5 m long | FL CAT5 PATCH 1,5 | 2832221 | 10 |
| Patch cable, CAT 5, pre-assembled, 2.0 m long | FL CAT5 PATCH 2,0 | 2832289 | 10 |
| Patch cable, CAT 5, pre-assembled, 3.0 m long | FL CAT5 PATCH 3,0 | 2832292 | 10 |
| Patch cable, CAT 5, pre-assembled, 5.0 m long | FL CAT5 PATCH 5,0 | 2832580 | 10 |
| Patch cable, CAT 5, pre-assembled, 7.5 m long | FL CAT5 PATCH 7,5 | 2832616 | 10 |
| Patch cable, CAT 5, pre-assembled, 10.0 m long | FL CAT5 PATCH 10 | 2832629 | 10 |
| Security set for 4 RJ45 ports | FL SEC PAC 4TX | 2832865 | 4 |
| Security frame for SFN switch and patch fields, green | FL PLUG GUARD, GN | 2891615 | 20 |
| Security frame for SFN switch and patch fields, red | FL PLUG GUARD, RD | 2891712 | 20 |
| Security frame for SFN switch and patch fields, white | FL PLUG GUARD, WH | 2891819 | 20 |

Accessories (continued)

| Description | Type | Order No. | Pcs./Pkt. |
|---|---|---|---|
| Security frame for SFN switch and patch fields | FL PORT GUARD | 2891220 | 20 |
| Security frame for SFN switch and patch fields | FL PLUG GUARD KEY | 2891327 | 1 |
| Security element for FL CAT patch | FL PATCH SAFE CLIP | 2891246 | 20 |

# 3 Technical data

| General data | |
|---|---|
| Function | Switch/repeater; conforms to standard IEEE 802.3 |
| Latency of the communication processor | |
| FL SWITCH SFN…TX… | 8 µs plus frame time |
| FL SWITCH SFN…GT… | 3 µs plus frame time |
| Housing dimensions (width x height x depth) | |
| 5-port switch, without connectors | 30 x 120 x 100 mm (without COMBICON/without fiber optics) |
| 8-port switch, without connectors | 50 x 120 x 100 mm (without COMBICON/without fiber optics) |
| | |
| Operating temperature | |
| FL SWITCH SFN …TX… and FL SWITCH SFN 6GT/2LX-20 | 0 to 60°C |
| FL SWITCH SFN 8GT, FL SWITCH SFN 6GT/2SX,<br>FL SWITCH SFN 7GT/SX | -25 to 75°C<br>-40 to 75°C (Revised[1]) |
| FL SWITCH SFN 6GT/2LX | -25 to 60°C<br>-40 to 75°C (Revised[1]) |
| Storage temperature | |
| FL SWITCH SFN…TX… switches | -20 to 70°C |
| FL SWITCH SFN…GT… switches (not FL SWITCH SFN 6GT/2LX-20) | -35 to 85°C<br>-40 to 85°C (Revised[1]) |
| FL SWITCH SFN 6GT/2LX-20 | -20 to 70°C<br>-40 to 85°C (Revised[1]) |
| Degree of protection | IP20, DIN 40050, IEC 60529 |
| Protection class | Class 3 VDE 0106; IEC 60536 |
| Humidity (operation and storage) | 5% to 95%, no condensation |
| Air pressure (operation) | 86 kPa to 108 kPa, 1500 m above sea level |
| Air pressure (storage) | 66 kPa to 108 kPa, 3500 m above sea level |
| Mounting | NS 35 (EN 60715) |
| Preferred mounting position | Perpendicular to a standard DIN rail |
| Connection to protective ground | Snapped onto a grounded DIN rail |
| Weight, without connectors | |
| 5-port switch | 265 g |
| 8-port switch | 440 g |

[1] Revision levels specified in 2732...F (see “Differences compared to previous versions” on page 7)

| Supply voltage (US) | |
|---|---|
| Connection type | Removable COMBICON, screw-cage connector |
| Wire size (solid/stranded/AWG) | 0.2 to 2.5 mm²/0.2 to 2.5 mm²/24 to 12 AWG |
| Recommended PE wire size | 2.5 mm² |
| Nominal power supply | 12 or 24 V DC |
| Permissible ripple | 3.6 $V_{pp}$ within the permissible voltage range |
| Permissible voltage range | 9 V DC to 30.2 V DC |
| Test voltage | 500 V DC for one minute |
| Protection against polarity reversal | Present |

## Current consumption and inrush current

| | Current consumption (max.) | Inrush current |
|---|---|---|
| FL SWITCH SFN 5TX | 90 mA (24 V DC)/205 mA (9 V DC) | 2.3 A for 3 ms |
| FL SWITCH SFN 4TX/FX | 140 mA (24 V DC)/405 mA (9 V DC) | 2.4 A for 2 ms |
| FL SWITCH SFN 4TX/FX ST | 140 mA (24 V DC)/405 mA (9 V DC) | 2.9 A for 2 ms |
| FL SWITCH SFN 8TX | 140 mA (24 V DC)/340 mA (9 V DC) | 3.1 A for 2 ms |
| FL SWITCH SFN 7TX/FX | 190 mA (24 V DC)/480 mA (9 V DC) | 3.4 A for 2 ms |
| FL SWITCH SFN 7TX/FX ST | 190 mA (24 V DC)/480 mA (9 V DC) | 3.4 A for 2 ms |
| FL SWITCH SFN 6TX/2FX | 230 mA (24 V DC)/610 mA (9 V DC) | 3.6 A for 2 ms |
| FL SWITCH SFN 6TX/2FX ST | 230 mA (24 V DC)/610 mA (9 V DC) | 3.3 A for 2 ms |
| FL SWITCH SFN 8GT | 430 mA (24 V DC)/1010 mA (9 V DC)<br>280 mA (24 V DC)/820 mA (9 V DC)[1] | 3.1 A for 3 ms<br>6.2 A for 1.8 ms[1] |
| FL SWITCH SFN 7GT/SX | 320 mA (24 V DC)/900 mA (9 V DC)<br>286 mA (24 V DC)/857 mA (9 V DC)[1] | 4.2 A for 3 ms<br>5.9 A for 1.9 ms[1] |
| FL SWITCH SFN 6GT/2SX | 350 mA (24 V DC)/960 mA (9 V DC)<br>293 mA (24 V DC)/866 mA (9 V DC)[1] | 4.4 A for 3 ms<br>6.4 A for 1.7 ms[1] |
| FL SWITCH SFN 6GT/2LX | 360 mA (24 V DC)/950 mA (9 V DC)<br>309 mA (24 V DC)/929 mA (9 V DC)[1] | 4.4 A for 3 ms<br>6.5 A for 1.5 ms[1] |
| FL SWITCH SFN 6GT/2LX-20 | 360 mA (24 V DC)/990 mA (9 V DC)<br>299 mA (24 V DC)/911 mA (9 V DC)[1] | 4.4 A for 3 ms<br>6.1 A for 1.7 ms[1] |

[1] Revision levels specified in 2732...F (see “Differences compared to previous versions” on page 7)

## Interfaces

| | |
|---|---|
| Total number of RJ45 Ethernet interfaces | 5/8 |
| MAC Address Table Size (Entries) | 1 K (4, 5, 8 TX versions), 8 K (all others) |
| **Properties of RJ45 ports** | |
| Number | 4/5/6/7/8 |
| Connection format | 8-pos. RJ45 female connector on the switch |
| Connection medium | Twisted-pair cable with a conductor cross section of 0.14 $mm^2$ to 0.22 $mm^2$ |
| Cable impedance | 100 Ω |
| Transmission speed | 10/100 Mbps or 10/100/1000 Mbps |
| Maximum network segment length | 100 m |
| **Properties of Fiber Optic ports** | |
| Number | 0/1/2 |
| Connection format | |
| 100 Mbps | SC duplex or ST female connector |
| 1000 Mbps | SC duplex |
| Fiber type | Glass |
| Laser protection | Class 1 according to DIN EN 60825-1:2001-11 |
| **Properties of 100 Mbps multimode** | |
| Transmission rate | 100 Mbps full duplex |
| Wavelength | 1300/1310 nm |
| Maximum transmission length, including 3 dB system reserve and 1.5 dB connector loss | 5.4 km glass fiber with F-G 50/125 0.7 dB/km F1200<br>2.4 km glass fiber with F-G 50/125 1.6 dB/km F800<br>10.4 km glass fiber with F-G 62.5/125 0.7 dB/km F1000<br>2.8 km glass fiber with F-G 62.5/125 2.6 dB/km F600 |
| Transmission power (medium type) dynamic (average) | |
| Minimum | -23.5 dBm (50/125 µm)/-20 dBm (62.5/125 µm) |
| Maximum | -14 dBm (50/125 µm)/-14 dBm (62.5/125 µm) |
| Transmission power (medium type) static | |
| Minimum | -22.5 dBm (50/125 µm)/-19 dBm (62.5/125 µm) |
| Maximum | -14 dBm (50/125 µm)/-14 dBm (62.5/125 µm) |

## Interfaces (continued)

| | |
|---|---|
| Receiver sensitivity | |
| Minimum | -31 dBm (dynamic)/-31 dBm (static) |
| Maximum | -14 dBm (dynamic)/-14 dBm (static) |
| **Properties of 1000 Mbps multimode** | |
| Transmission rate | 1.25 Gbps full duplex |
| Wavelength | 850 nm |
| Maximum transmission length | 550 m (50/125 µm) |
| | 220 m (62.5/125 µm) |
| Transmission power | |
| Minimum | -9.5 dBm |
| Maximum | -4 dBm |
| Receiver sensitivity | |
| Minimum | -17 dBm |
| Maximum | -3 dBm |
| **Properties of 1000 Mbps single mode** | |
| Transmission rate | 1.25 Gbps full duplex |
| Wavelength | 1310 nm |
| Maximum transmission length | |
| FL SWITCH 6GT/2LX | 10 km (9/125 µm) |
| FL SWITCH 6GT/2LX-20 | 20 km (9/125 µm) |
| Transmission power | |
| Minimum | -10 dBm |
| Maximum | -3 dBm |
| Receiver sensitivity | |
| Minimum | -24 dBm |
| Maximum | -0 dBm |
| **Alarm contacts (FL SWITCH SFN…GT… only)** | |
| Voltage | 24 V DC typical |
| Current carrying capacity | 100 mA maximum including inrush |

## Mechanical tests

| | |
|---|---|
| Shock test according to IEC 60068-2-27 | Operation: 25g, 11 ms period, half-sine shock pulse<br>Storage/transport: 50g, 11 ms period, half-sine shock pulse |
| Vibration resistance according to IEC 60068-2-6 | Operation/storage/transport: 5g, 150 Hz, Criterion 3 |
| Free fall according to IEC 60068-2-32 | 1 m |

## Conformance with EMC directives

| | |
|---|---|
| Developed according to IEC 61000-6-2 | |
| IEC 61000-4-2 (ESD) | Criterion B |
| IEC 61000-4-3 (radiated-noise immunity) | Criterion A |
| IEC 61000-4-4 (burst) | Criterion A |
| IEC 61000-4-5 (surge) | Criterion B |
| IEC 61000-4-6 (conducted noise immunity) | Criterion A |
| IEC 61000-4-8 (noise immunity against magnetic fields) | Criterion A |
| EN 55022 (noise emission) | Class A |

## Approvals

| | |
|---|---|
| FL SWITCH SFN…TX… switch | ROHS EEE 2002/95/EC, WEEE 2002/96/EC,<br>Class I, Division 2, Groups A, B, C, D Temp Code T5<br>installed in minimum IP54 enclosure |
| FL SWITCH SFN…GT… switch | ROHS EEE 2002/95/EC, WEEE 2002/96/EC<br>Class I, Division 2, Groups A, B, C, D Temp Code T4<br>installed in minimum IP54 enclosure |

| Differences compared to previous versions |
|---|
| 7267 Version 00 - First version |
| 7267 Version 01 - Update Gigabit, supply voltage, current consumption, surge and approvals |
| 7267 Version 02 - Update 1000 Mbps multimode |
| 2732 Document number was 7267 - Added jumbo frame content, edited operating temperature ranges, updated approval information, reformatted |
| 2732B - Corrected transmission speed LED indications (Section 4.5) and clarified FL SWITCH SFN…GT… capability. |
| 2732F - Updated specifications for FL SWITCH SFN 8GT, FL SWITCH SFN 7GT/SX, and FL SWITCH SFN 6GT/2SX for VC05 and later.<br>Updated specifications for FL SWITCH SFN 6GT/2LX for VC06 and later.<br>Updated specifications for FL SWITCH SFN 6GT/2LX-20 for VC04 and later. |

# 4 Overview

## 4.1 5-port versions

The housings of the 5-port versions are identical. Port 5 is located on the bottom.

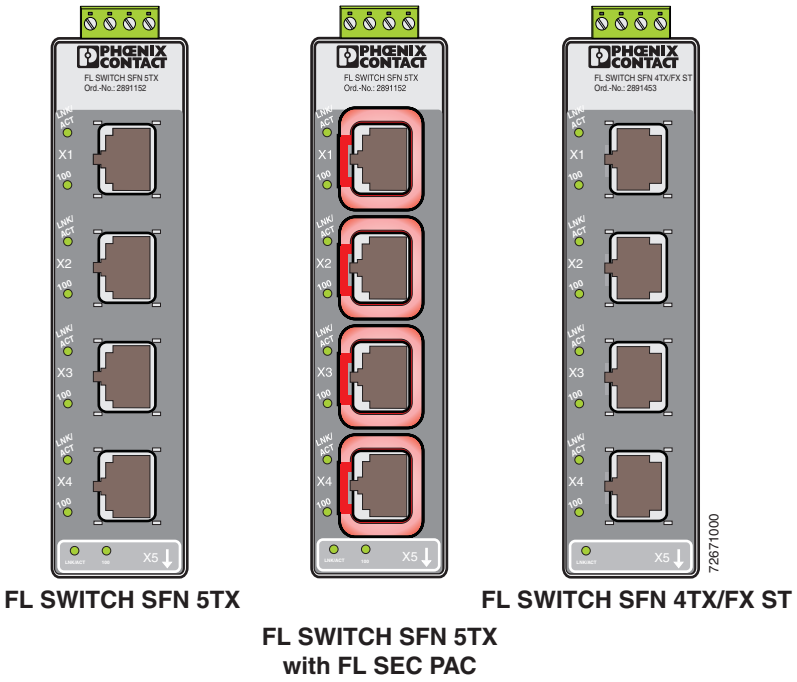
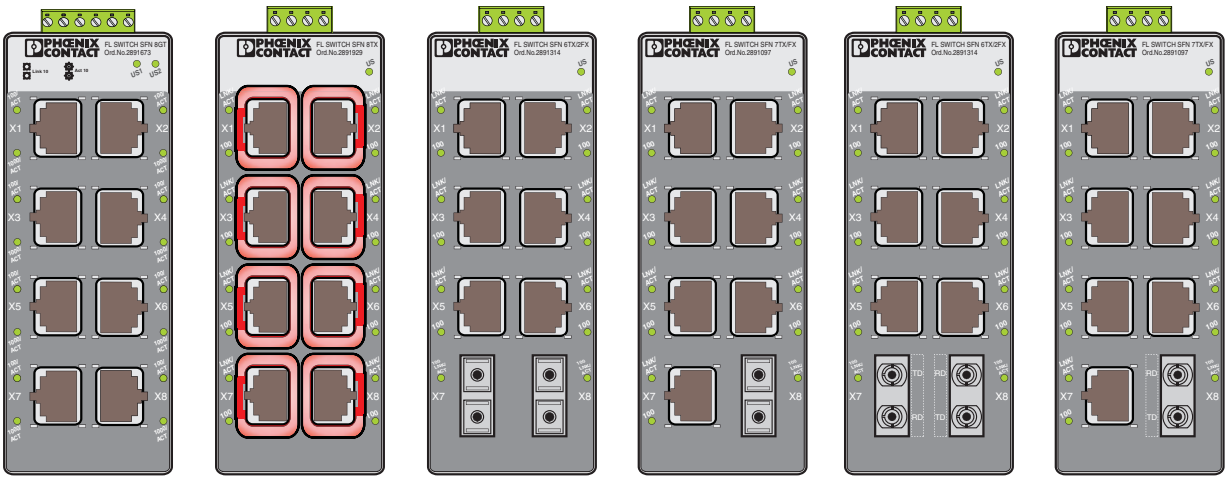



Figure 1 Housing examples for 5-port switches

### 4.2 8-port versions

The housings of the 8-port versions are identical. On the fiber optic versions, the connections for the fiber optic ports are at the front. The physical location of the ports on the FL SWITCH SFN…TX… and FL SWITCH SFN…GT… (Gigabit) switches are the same.



FL SWITCH SFN 8GT | FL SWITCH SFN 6TX/2FX | FL SWITCH SFN 6TX/2FX ST

Figure 2 Housing examples for 8-port switches

### 4.3 Diagnostic and status indicators

| Des. | Color | Status | Meaning |
|---|---|---|---|
| **US1 and US2** | green | ON | Supply voltage ($U_S$) in the tolerance range |
| | | OFF | Supply voltage ($U_S$) too low |

### 4.4 Data transmission speed LEDs (10/100 Mbps switches)

| | 10 Mbps | 100 Mbps |
|---|---|---|
| **LNK/ACT** | ON/blinking | ON/blinking |
| **100** | OFF | ON |

LNK/ACT LED:
ON: indicates an electrical link
Flashing: indicates network traffic (at high data rates the blinking is in a constant rate)

### 4.5 Data transmission speed LEDs (10/100/1000 Mbps switches)

| | 10 Mbps | 100 Mbps | 1000 Mbps |
|---|---|---|---|
| 100/ACT | ON/blinking | ON/blinking | OFF |
| 1000/ACT | ON/blinking | OFF | ON/blinking |

One LED/port ON or blinking:
ON: indicates an electrical link
Flashing: indicates network traffic at the data rate (x Mbps)

Both LEDs/port ON or blinking:
Both ON: indicates a 10 Mbps electrical link
Both flashing: indicates network traffic at 10 Mbps)

# 5 Installation

**CAUTION:**

Only qualified personnel may start up and operate this device. Qualified personnel are persons authorized to start up, ground and mark devices, systems, and equipment according to the standards of safety technology.

**NOTE:**

The FL SWITCH SFN… module is designed for SELV and PELV operation according to IEC 61140/EN 61140.

**WARNING:**

A.)THIS EQUIPMENT IS SUITABLE FOR USE IN CLASS I, ZONE 2, GROUPS A, B, C, AND D OR NON- HAZARDOUS LOCATIONS ONLY.

B.) WARNING - EXPLOSION HAZARD - SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR CLASS I, ZONE 2.

C.) WARNING - EXPLOSION HAZARD - DO NOT DISCONNECT EQUIPMENT UNLESS POWER HAS BEEN SWITCHED OFF OR THE AREA IS KNOWN TO BE NON-HAZARDOUS.

Install the FL SWITCH SFN… on a clean DIN rail. To avoid contact resistance use only clean, corrosion-free rails that meet the EN 50022 standard. End clamps should be mounted on both sides of the module to stop the modules from slipping on the rail.

**NOTE:**

Connect the DIN rail to protective earth ground using a grounding terminal block. The modules are grounded when they are snapped onto the rail. Connect protective earth ground with low impedance. 1000 Mbps switches have a protective ground connecting screw on top.

## 5.1 Assembly

1. Place the module onto the DIN rail from above. The upper holding keyway must be hooked onto the top edge of the DIN rail.
2. Push the module from the front towards the mounting surface.
3. Once the module has been snapped on properly, check that it is fixed securely on the rail.

## 5.2 Removal

1. Insert a suitable tool (e.g., needle-nose pliers) into the arresting latch and pull it down.
2. Pull the module slightly away from the mounting surface.
3. Lift the module from the rail.

## 5.3 Power connection

The switch is designed for SELV and PELV operation at +24 V DC according to IEC 61140/EN 61140. Only SELV and PELV according to the defined standards may be used for supply purposes.

Snapping the switch onto a grounded DIN rail connects it to the ground potential. In an environment particularly prone to EMI, noise immunity can be increased by an additional low-impedance connection to functional earth ground.

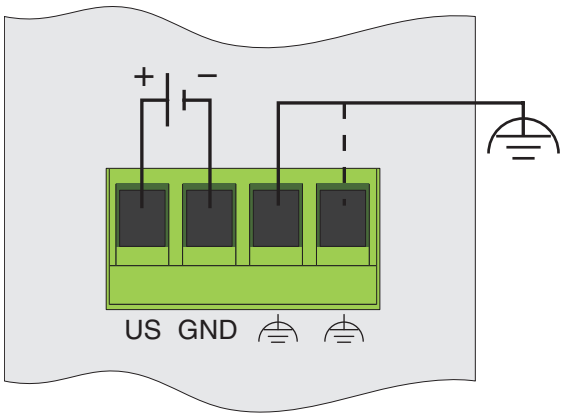



Figure 3 FL SWITCH SFN…TX… power connection

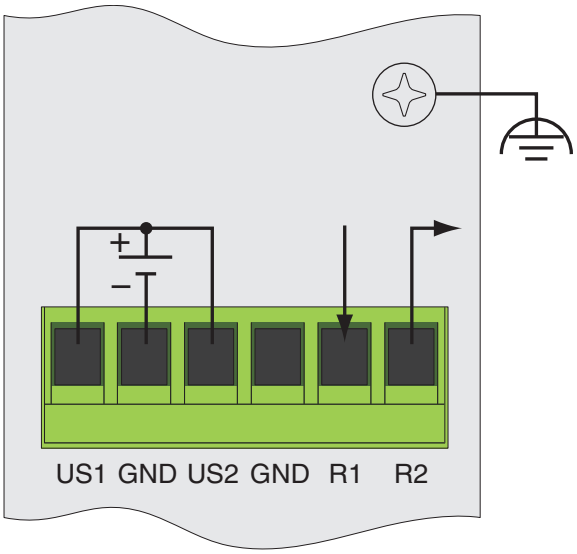



Figure 4 FL SWITCH SFN…GT… power connections for single power supply

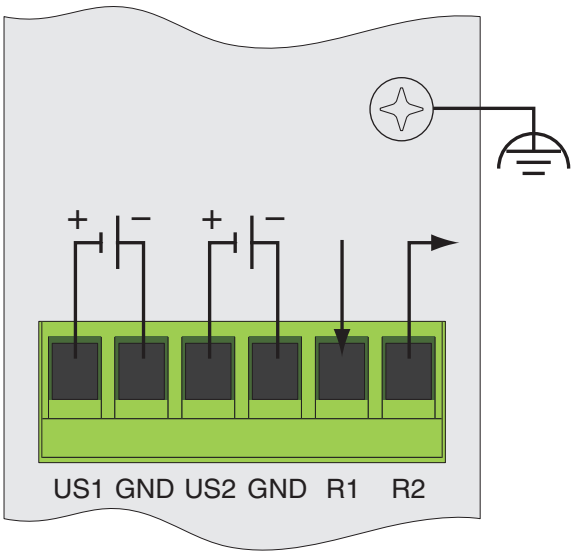



Figure 5 FL SWITCH SFN…GT… power connections for redundant power supply

Use power conductors between 0.2 - 2.5 mm² (24 - 12 AWG). Torque connection screws to 0.5 - 0.6 Nm (5 - 7 lb-in.).

### 5.4 Alarm contact

The FL SWITCH SFN… switch provides contacts (R1, R2) for remote alarms if a failure is detected.

– The contact closes if one or both power supplies fail.
– The contact opens if power is OK.

The maximum current, including inrush, is 100 A.

### 5.5 Ethernet interface

The FL SWITCH SFN… has five Ethernet ports on the front in RJ45 format to which only twisted-pair cables with an impedance of 100 Ω can be connected. The data transmission speed is 10/100 Mbps. In addition, every port has an auto crossing function: it is not necessary to make a distinction between 1:1 or crossover Ethernet cables.

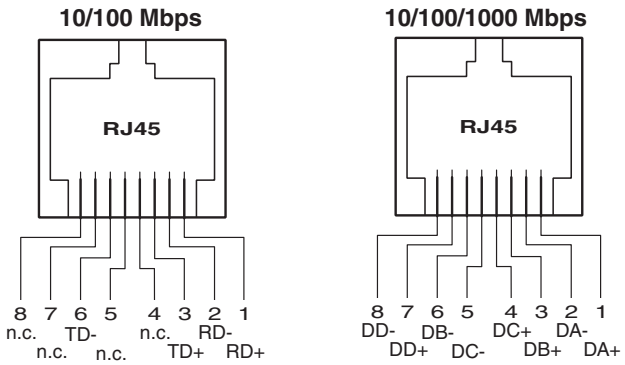



Figure 6 RJ45 pin assignment

### 5.6 Fiber optic connection

Two different types of fiber optic connection are available. The fiber optic connector(s) are located on the lower front face of the 8-port models or on the bottom face of the 5-port models.

The ST connectors are typically individual round connectors and use a 1/4-turn connection.

The SC connectors have a square interface and the “conductors” are typically locked together through the connector.

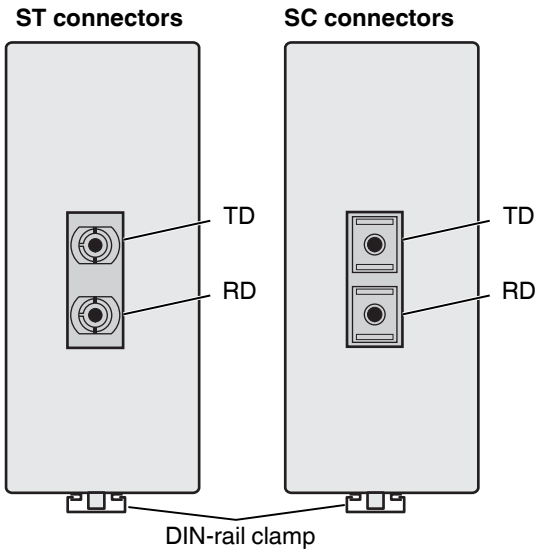



Figure 7 5-port fiber optic ports

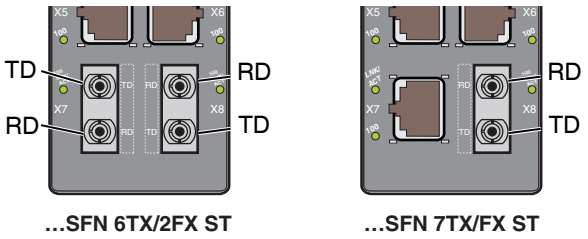



Figure 8 8-Port ST fiber optic ports

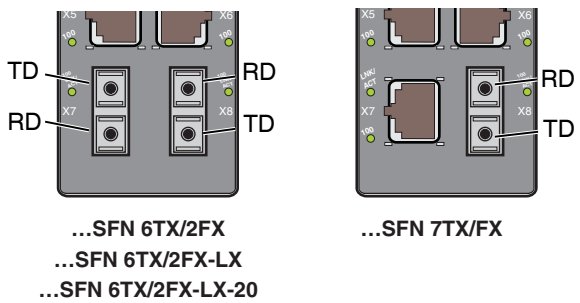



Figure 9 8-port SC fiber optic ports

### 5.7 Using the FL SEC PAC kit for port security

Layer 1 Port security for up to 4 ports is provided by purchasing the FL SEC PAC kit. The kit contains four red security frames, four gray port blocking security caps, unlocking key and instructions. The red security frame must first be attached to each port that is to be secured.

1. First orient the red security frame so that the cable locking tabs of both the frame and the switch are aligned.
2. Insert the four mounting feet of the security frame into the pre-punched holes around the switch port and push until the frame snaps into place with an audible click.

| | |
|---|---|
| | Once attached, the security frames are permanently mounted and cannot be removed. |

3. Inserted cables or gray port blocking security caps are now locked into place. Instructions for using the key to unlock the cables or security caps are included in the kit.

## 6 Switching characteristics

– **Store and forward**

All data telegrams received by the switch are saved and their validity checked. Invalid or faulty data packets (> 1522 bytes or CRC errors) and fragments (< 64 bytes) are rejected. Valid data telegrams are forwarded by the switch. The switch always forwards the data using the data transmission speed that is used in the destination network segment.

– **Multi-address function**

The switch independently learns the addresses for termination devices, which are connected via a port, by evaluating the source addresses in the data telegrams. Only packets with unknown addresses, with a source address of this port or with a multicast/broadcast address in the destination address field are forwarded via the corresponding port. The switch can store addresses in its address table with an aging time of 5 minutes (3 minutes for FL SWITCH SFN…GT… units). This is important when more than one termination device is connected to one or more ports. In this way, several independent subnetworks can be connected to one switch.

| | |
|---|---|
| | A restart deletes the entire address table. |

– **Quality of Service (QoS): IEEE 802.1P/Q**
  The FL SWITCH SFN… switches are capable of reading Ethernet packets that have already been assigned a priority level by a managed switch. In cases of heavy traffic, packets with a priority level between 4 and 7 are considered high priority and processed before packets with a priority level between 0 and 3. After prioritization the packets are forwarded without modification.

# 7 Dimensions

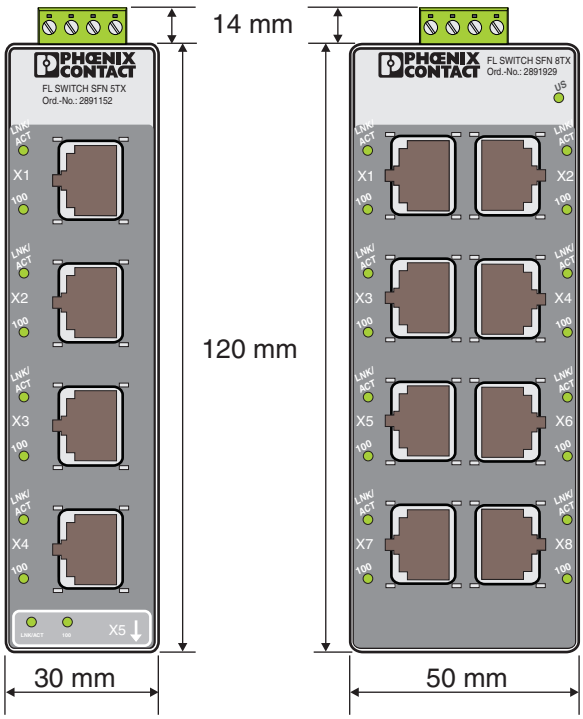



Figure 10 Housing dimensions

# 8 FL SWITCH SFN…GT… jumbo frame support

Certain revisions of the FL SWITCH SFN…GT… switches have the ability to support jumbo frames. Table 1 shows the minimum version code (V/C) and hardware code (H/C) that provides jumbo frame support:

Table 1 Jumbo frame support firmware

| Type code | Version code | Hardware code |
|---|---|---|
| FL SWITCH SFN 8GT | 02 | 12 |
| FL SWITCH SFN 7GT/SX | 03 | 13 |
| FL SWITCH SFN 6GT/2SX | 02 | 12 |
| FL SWITCH SFN 6GT/2LX | 02 | 12 |
| FL SWITCH SFN 6GT/2LX-20 | 01 | 11 |

A jumbo frame is an Ethernet packet (or frame) which has a size greater than the IEEE standard 1518 bytes. Jumbo frames are technically defined as 9000 bytes or less, but commercial use of the term has been applied to packet sizes over 9000 bytes. Jumbo frames are used to reduce network loading when transferring large data files. Fewer but larger packets, containing fewer overall overhead bytes, increase the overall network efficiency.

Version codes are displayed on the package label and hardware codes are displayed on the product label.

## 8.1 FL SWITCH SFN…GT… jumbo frame capability

FL SWITCH SFN…GT… switches support jumbo frames up to 9600 bytes per frame. In addition, the jumbo frames can be used with both 100 Mbps and 1000 Mbps communication. An FL SWITCH SFN…GT… switch has an Ethernet packet (frame) buffer memory capacity of 16 kB/ 500 kB per port (see “Differences compared to previous versions” on page 7 for information on which version you have). This memory capacity is especially important when data is fed through cascaded switches that make up a network backbone.

## 8.2 Jumbo frame performance factors

The switch’s frame buffer size, the size of the frames (bytes/ frame) and overall traffic loading of the network (bandwidth) impact the overall application performance. In the following sections, the loading per port is compared with the maximum frame size. At packet (frame) sizes over 3000 bytes, the switch will start sending pause frames to control the traffic flow (see vertical line on Figure 11 and Figure 12). As the size of the frame increases, the sending of pause frames increases. Figure 11 and Figure 12 indicate the maximum loading per port that can occur (for

each jumbo frame size) until the buffer is overloaded and packets start to be dropped.

Figure 11, Figure 12, and Figure 13 display traffic loading for 1000 Mbps (gigabit) data rates. For 100 Mbps data rates divide the y axis numbers by 10.

## 8.3 Application guidelines

The use of jumbo frames in industrial applications typically falls into two major application classes:

– Bidirectional data transfers: usually caused by larger data file exchanges between controllers or PC applications. These may use jumbo frames in both directions (read/write) between the industrial devices.
– Unidirectional data transfer: typically found in networks where security cameras or vision inspection equipment feed back to a centralized monitoring station. In these cases, the vast majority of the traffic flows in one direction, i.e., security images from a camera to the network, with only a few, normal size transmissions containing control commands going the opposite direction.

### Bidirectional data transfer guidelines

When using jumbo frames for bidirectional data transfers, the generation of pause frames starts at 3000-byte size frames. Traffic loadings of near 100% are possible with frame sizes up to 7000 bytes. Above 7000 bytes the percent traffic loading has to be reduced to prevent dropped packets.

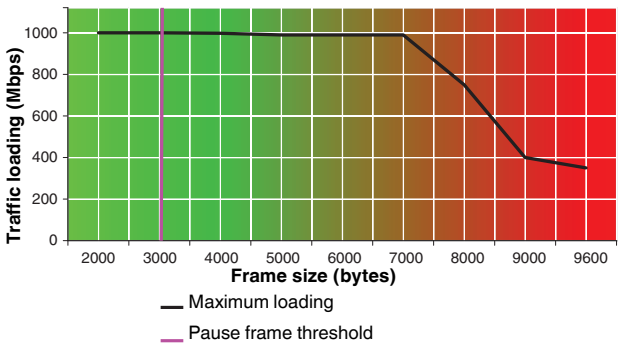



Figure 11 Maximum bidirectional traffic loading per port (FL SWITCH SFN 8GT)

### Unidirectional data transfer guidelines

In applications where the data flow is predominantly in one direction, such as cameras and vision systems, near 100% loading is possible using jumbo frames.

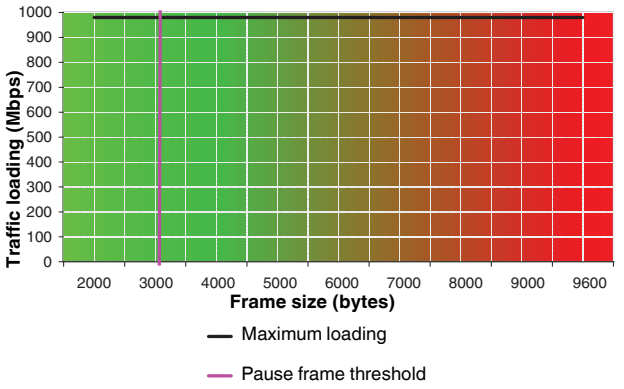



Figure 12 Maximum unidirectional traffic loading per port (FL SWITCH SFN 8GT)

When cascading devices in a trunk topology, up to 18 Mbps of the available bandwidth is required to support overhead and pause frame traffic for each link between cascaded switches.

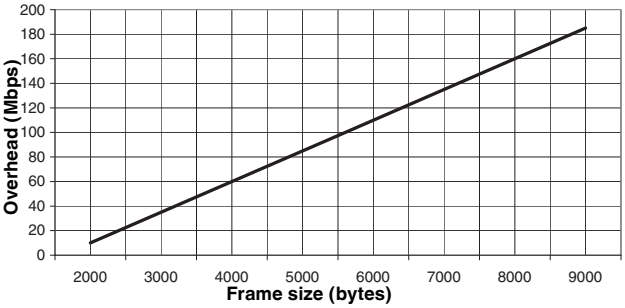



Figure 13 Overhead/cascaded switch vs. frame size

### 8.4 Calculating total network loading with cascaded (trunk topology) switches

Because of the buffer size considerations when using jumbo frames, network bandwidth loading should be planned in advance to prevent packet loss.

1. Determine the total application traffic load for the connected devices.

   Add all the traffic loads from each device that will be connected to the switch and transferred to the main trunk line. When using cameras or vision systems, the bandwidth usage per device can be high (see Table 1). Actual numbers may vary depending on the camera or device type used.

Table 1 Typical bandwidth load

| Typical camera settings | Color depth (bits/pixel) | Typical traffic load (Mbps) |
|---|---|---|
| 60 frames per second<br>750 x 640 pixels per frame | 8 | 182 |
| | 12 | 275 |
| | 16 | 366 |
| | 24 | 550 |
| | 32 | 732 |

2. Add all the application traffic from all connected switches and compare to the maximum network capacity.

   As the trunk traffic passes from switch to switch, add the total application device traffic from all the switches. The traffic load on the trunk ports cannot be greater than the total bandwidth available (1000 Mbps for gigabit and 100 Mbps for Fast Ethernet ports).

3. Determine the traffic load for bandwidth consumed by application overhead and pause frames (see Figure 13). After the first switch, add this amount for each additional switch segment.

   As an example, if a total of four switches are connected together, there will be a first switch then three additional switched segments. This means that three times the overhead value must be used.

4. Add all the application traffic (step 2.) with all the over head values (step 3.) and compare with the total available bandwidth.

**Example 1**

Assuming gigabit devices are used with 9000-byte jumbo frames and a total of three cascaded switches. Each switch has one 8 bit/pixel camera plus 10 Mbps of miscellaneous traffic from other ports.

Figure 14 depicts an example with three cameras connected to individual switches. Each camera is configured for an **8 bits per pixel** color depth, creating a load of **182 Mbps** per camera (see Table 1) with a total traffic load of **546 Mbps**. Frame size is configured to 9000 bytes creating an overhead of **180 Mbps** (see Figure 13) for each cascading switch for a total of **360 Mbps**.

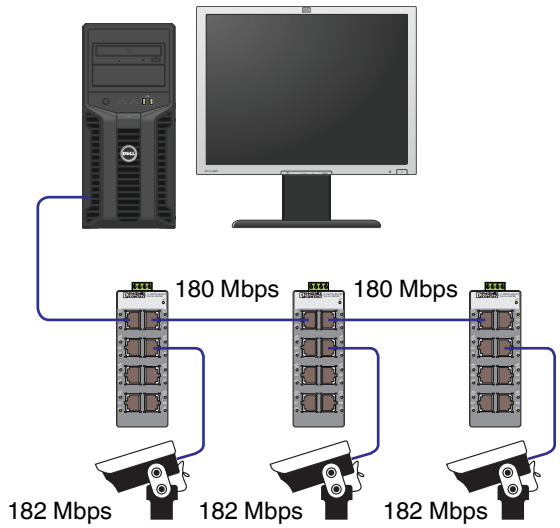



Figure 14 9000-byte frame size example

Adding the camera data and overhead together indicates a total traffic load of **906 Mbps**, leaving **94 Mbps** of the 1000 Mbps total unused.

**Example 2**

To take advantage of the bandwidth not used in example 1, assume one of the cameras is now required to operate at **12 bits per pixel**.

The increased camera color depth increases the traffic load to a total of **639 Mbps**. Combined with the **360 Mbps** overhead with a 9000-byte frame size, the total bandwidth is **999 Mbps**. While technically within the capability of a 1000 Mb switch, any additional traffic across the transmission line could result in frame loss.

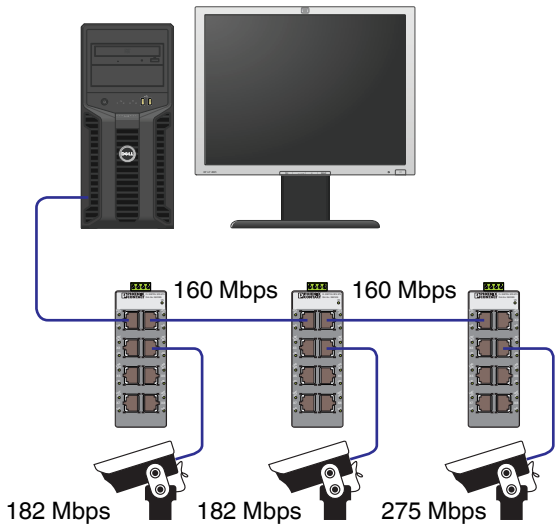



Figure 15 8000-byte frame size example

One possible solution is to change the frame size to 8000 bytes, reducing the overhead (see Figure 15). The reduced frame size results in a total overhead of **320 Mbps**. Combined with the camera traffic load, the resulting bandwidth requirement is **959 Mbps**, allowing some space for additional traffic.

**Artisan Technology Group** is an independent supplier of quality pre-owned equipment

## Gold-standard solutions

Extend the life of your critical industrial, commercial, and military systems with our superior service and support.

## We buy equipment

Planning to upgrade your current equipment? Have surplus equipment taking up shelf space? We'll give it a new home.

## Learn more!

Visit us at **artisantg.com** for more info on price quotes, drivers, technical specifications, manuals, and documentation.

Artisan Scientific Corporation dba Artisan Technology Group is not an affiliate, representative, or authorized distributor for any manufacturer listed herein.

We're here to make your life easier. How can we help you today?

(217) 352-9330 | sales@artisantg.com | artisantg.com

ARTISAN® TECHNOLOGY GROUP