

## **EtherTRAK<sup>™</sup>** **Industrial Ethernet** **Switches and Fiber** **Converter**



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#### Applicable standards and certifications:

ISO  
9001

Total Quality



Hazardous Locations



Standard Locations



European Directives



Marine & Offshore



US Emissions

This manual applies to the following products:

ET-GT-3ES-2SC or -2ST or -3SC

ET-GT-5ES-1 or -2SC or -2ST or -3SC or -4SC or -4ST or -5SC

ET-GT-9ES-1 or -2SC or -2ST or -3SC



# Section 1

## Overview

# General Information

This manual will help you install and maintain the EtherTRAK Industrial Ethernet Switches and Fiber Converter. These products are extremely easy to install and operate because little or no user configuration is required. Once the Ethernet connections are made and the unit is powered up it will immediately begin to operate.

**Note:** The Fiber Converter incorporates the same Layer 2 Ethernet switch technology as all the other ET-GT-#ES products. Throughout this manual, any mention of Ethernet Switches also applies to the Fiber Converter unless specifically noted otherwise.

## Operation

Unlike an Ethernet hub that broadcasts all messages out all ports, the EtherTRAK 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.

The EtherTRAK Industrial Ethernet Switches support both 10BaseT (10 Mbps) and 100BaseTx (100 Mbps) on their RJ45 ports. Each of these ports will independently auto-sense the speed, allowing you to interface to regular or fast Ethernet devices. Some models also have a 100BaseFX (100 Mbps) fiber optic port.

Refer to Section 6 for more information on Industrial Ethernet Switch operation and features.

## Performance Specifications

These general specifications apply to the EtherTRAK Industrial Ethernet Switches. Refer to Section 7 for complete technical specifications.

Ports (models vary)	10/100BaseT(x) (Shielded RJ45), 100BaseFX (SC or ST connectors)
Required Voltage	10 - 30 VDC (see Section 7 for power consumption for each model)
Ethernet Standards	IEEE 802.3 (10BaseT), 802.3u (100BaseTX), 802.3x (Full Duplex)
Ethernet Protocols	All standard IEEE 802.3 protocols supported
Speed Per Port	RJ45: 10 or 100 Mbps (half duplex), 20 or 200 Mbps (full duplex) Fiber: 100 Mbps (half duplex), 200 Mbps (full duplex)
Ethernet Isolation	1200 Volts RMS (for 1 minute)
Operating Temp.	-40 to 85 °C
Humidity	5 to 95% (non-condensing)
Screw Terminals	ET-GT-#ES-1: 14 AWG max. (tighten to 3.48 in-lbs. max.) ET-GT-#ES-#SC, -#ST: 12 AWG max. (tighten to 5.3 in-lbs. max.)

## Standards and Safety

The EtherTRAK Industrial Ethernet Switch meets the following standards:

**Electrical safety** - UL 508, CSA C22/14; EN61010-1 (IEC1010)

**EMI emissions** - FCC part 15, ICES 003, EN55022; Class B

**EMC immunity** - EN61326-1 (EN61000-4--2, 3, 4, and 6)

**Hazardous locations** - UL 1604, CSA C22.2/213 (Class 1, Div. 2), Groups A, B, C, D; Cenelec EN50021 (Zone 2)

**Install the EtherTRAK Industrial Ethernet Switch in accordance with local and national electrical codes.**

**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.**



## Section 2

## LED Indicators

### Overview

The EtherTRAK Industrial Ethernet Switches have communication LEDs for each port and a power LED. Refer to the pictures below for the typical location of these LEDs. The exact location of these LEDs may vary between the different models.



ET-GT-3ES-2SC, -2ST, or -3SC



ET-GT-5ES-1



ET-GT-9ES-1



ET-GT-5ES-4SC, -4ST, or -5SC



ET-GT-5ES-2SC, -2ST, or -3SC



ET-GT-9ES-2SC, -2ST, or -3SC

### Power LED

This LED will be on solid when proper power has been applied to the unit.

### ACT / LNK LEDs

The activity (ACT) and link (LNK) indication is combined into one LED (labeled "ACT/LNK" or "A") on the EtherTRAK Industrial Ethernet Switches. There is one of these LEDs per port.

**OFF** – This would indicate that there is not a proper Ethernet connection (Link) between the port and another Ethernet device. Make sure the proper cable type is in use and that it has been plugged securely into the ports at both ends. See section 5 for proper Ethernet cabling.

**ON Solid (not flashing)** – This would indicate that there is a proper Ethernet connection (Link) between the port and another Ethernet device, but no communications activity is detected.

**Flashing** - This would indicate that there is a proper Ethernet connection (Link) between the port and another Ethernet device, and that there is communications activity.

### 10 / 100 LEDs

This LED indicates what speed of communications is detected on the port. There is one of these LEDs per RJ45 port and it is labeled "S". (The fiber optic port does not have one of these LEDs because its speed is fixed at 100 Mbps.) (Mbps = Megabits per Second)

**OFF** – A 10 Mbps (10BaseT) connection is detected.

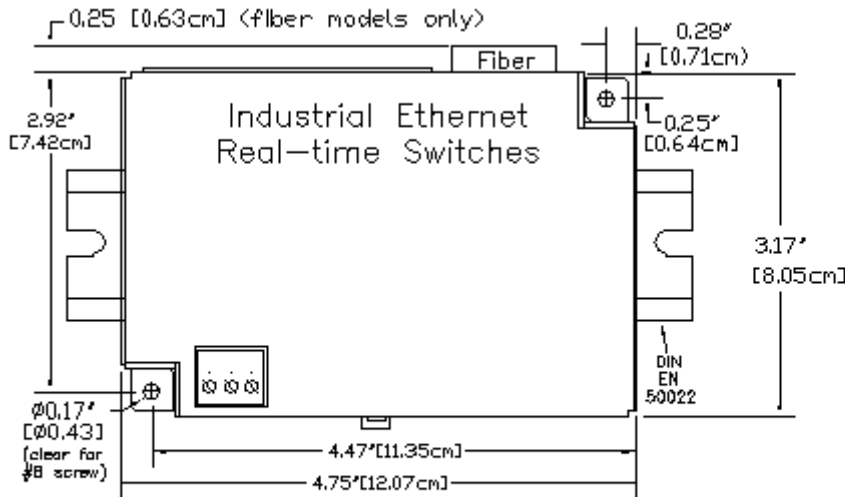
**ON** – A 100 Mbps (100BaseTx) connection is detected.

# Section 3

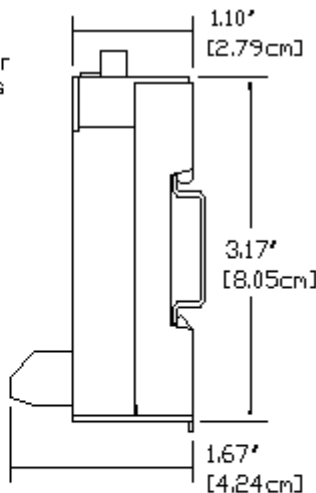
## Overview

# Installation

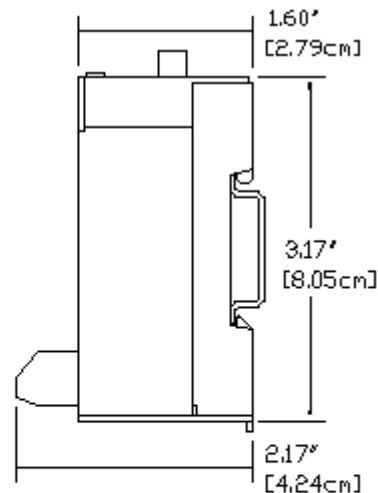
All EtherTRAK Industrial Ethernet Switches share the same footprint and can be snapped onto a standard DIN rail (EN50022) or screwed directly to a flat panel. Refer to the mechanical drawing below. **Note:** The Ethernet connections for the ET-GT-5ES-1 come out the face of the unit. The Ethernet connections for all other models come out the top. Make sure to allow enough room to route your Ethernet cables.



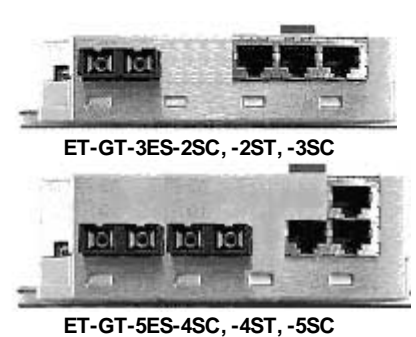
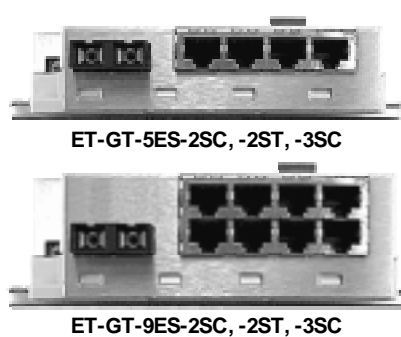
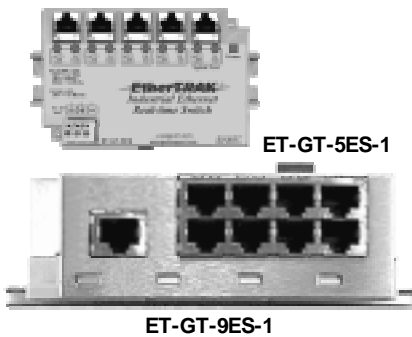
Note: All RJ45 and/or fiber optic connectors are on the top side of all switch models except for the ET-GT-5ES-1, which has RJ45 connectors on its front side.



End view for:  
 ET-GT-3ES-2SC  
 ET-GT-5ES-1  
 ET-GT-5ES-2SC



End view for:  
 ET-GT-5ES-4SC  
 ET-GT-5ES-5SC  
 ET-GT-9ES-1  
 ET-GT-9ES-2SC



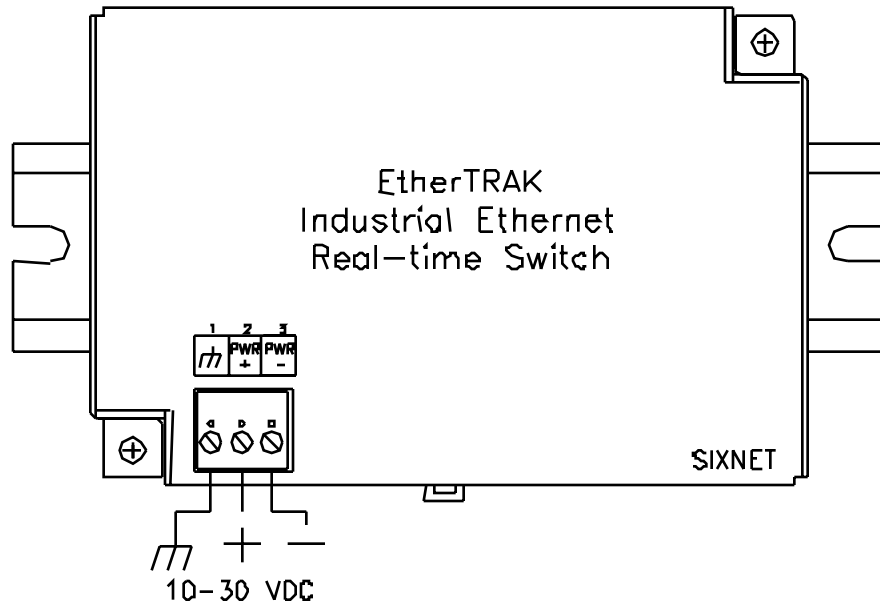
### Ethernet Port Locations

## Section 4

## Power Wiring

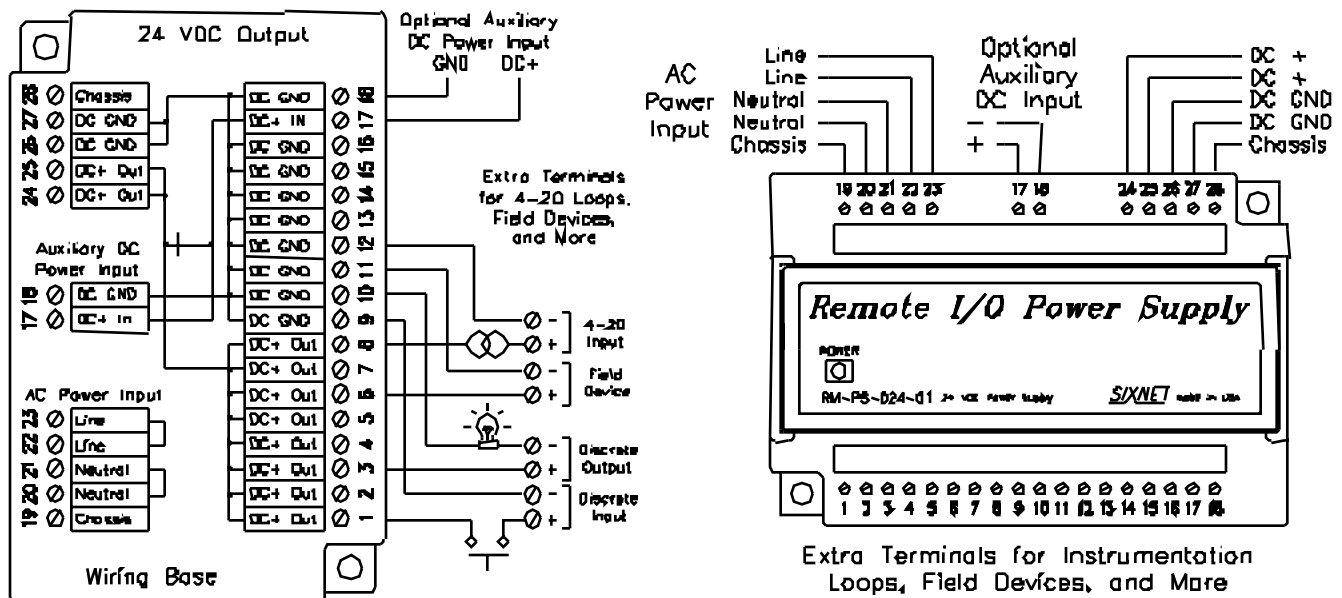
### Overview

EtherTRAK Industrial Ethernet Switches can be powered from the same DC source that is used to power your I/O devices. 10 to 30 VDC needs to be applied to terminals 2 and 3. Refer to the wiring diagram below. Terminal 1 should be tied to panel or chassis ground.



### RM-PS-024-01N (optional)

The RM-PS-024-01 can be used to power your EtherTRAK Industrial Ethernet Switches, instrumentation loops, and other devices. It operates on 85-264 VAC (47-63 Hz) or 120-370 VDC and outputs 24 VDC at up to 1 Amp. Refer to its data sheet for details. Refer to the figure below for the power connections.



### Screw Torque

The screw terminals should be tightened as follows:

For the ET-GT-#ES-1: tighten screw terminals to a maximum 3.48 in-lbs (0.4 Nm).

For the ET-GT-#ES-#SC, #ST: tighten screw terminals to a maximum 5.3 in-lbs (0.6 Nm).

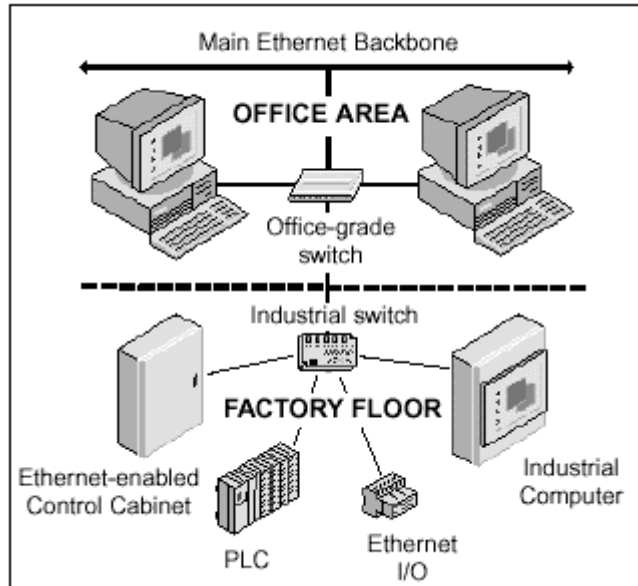
For the RM-PS-024-01F: tighten screw terminals to a maximum 3.48 in-lbs (0.4 Nm).

# Section 5

# Ethernet Wiring

## Overview

The EtherTRAK Industrial Ethernet Switches provides connections to Ethernet devices on the factory floor. Typically the uplink port or fiber port is used to connect to another Ethernet switch or hub that is connected to the main Ethernet backbone. The other Ethernet ports are then connected to Ethernet devices such as PLCs, Ethernet I/O, or industrial computers. Electrical isolation is provided on the Ethernet ports for increased reliability. **Please follow normal Ethernet wiring practices when installing the EtherTRAK Industrial Ethernet Switch and Fiber Converter.**



**Typical EtherTRAK Industrial Ethernet Switch Installation**

**Refer to the SIXNET On-line Catalog for More Usage Ideas**

## RJ45 Wiring Guidelines

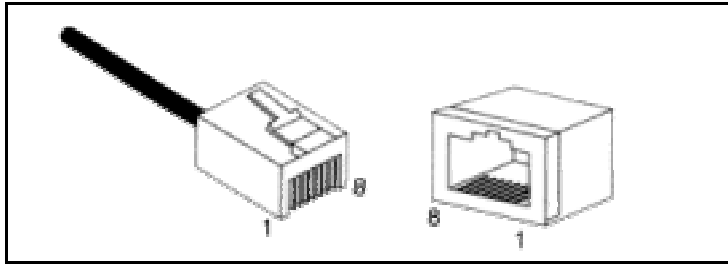
Use data-quality (not voice-quality) twisted pair cable rated category 5 with standard RJ45 connectors. For best performance use shielded cable. Please note that these cables are available as straight-thru or cross-over configurations. The following is a guide for when to use each type:

STANDARD (MDI-X) Port connected to	Cable Type to Use	UPLINK (MDI) Port connected to	Cable Type to Use
PC card	Straight-thru	PC card	Cross-over
Ethernet I/O	Straight-thru	Ethernet I/O	Cross-over
PLC	Straight-thru	PLC	Cross-over
Other Ethernet enabled devices	Straight-thru	Other Ethernet enabled devices	Cross-over
* Uplink port on another switch or hub	* Straight-thru (see note)	Standard port on another switch or hub	Straight-thru

**\* Note:** Some Ethernet switches and hubs have a settable switch on their Uplink port that will change how the port is internally wired. Make sure this switch is set in the "To Hub/Switch (MDI)" position as opposed to the "To PC (MDI-X)" position.

Straight-thru Cable Wiring		Cross-over Cable Wiring	
Pin 1	Pin 1	Pin 1	Pin 3
Pin 2	Pin 2	Pin 2	Pin 6
Pin 3	Pin 3	Pin 3	Pin 1
Pin 6	Pin 6	Pin 6	Pin 2

**Note:** The ET-GT-5ES-4SC, -4ST, & -5SC have auto-crossover RJ45 ports so either cable configuration can be used. For all other models refer to the charts above.



**Ethernet Connector Pin Positions**

Pin #	Switch Standard (MDI-X) Port	Switch Uplink (MDI) Port	Ethernet Device Port
1	TX+	RX+	RX+
2	TX-	RX-	RX-
3	RX+	TX+	TX+
6	RX-	TX-	TX-

**Ethernet Connector Pin Assignments**

### Cable Distance

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

From	To	Maximum Distance
Switch	Switch or Hub	100 meters (328 feet)
Switch or Hub	PLC, Ethernet I/O, PC, etc.	100 meters (328 feet)

**Note:** Hubs and Switches are different devices. Hubs simply broadcast all messages out all ports. Switches intelligently route messages only out the appropriate port

### Ethernet Fiber Wiring Guidelines

The ET-GT-#ES-2SC, -2ST, -4SC, or -4ST has one or two pair of multimode ports that support a maximum segment length of 2 km each. The ET-GT-#ES-3SC or -5SC has one or two pair of singlemode SC ports that support a maximum segment length of 15 km.

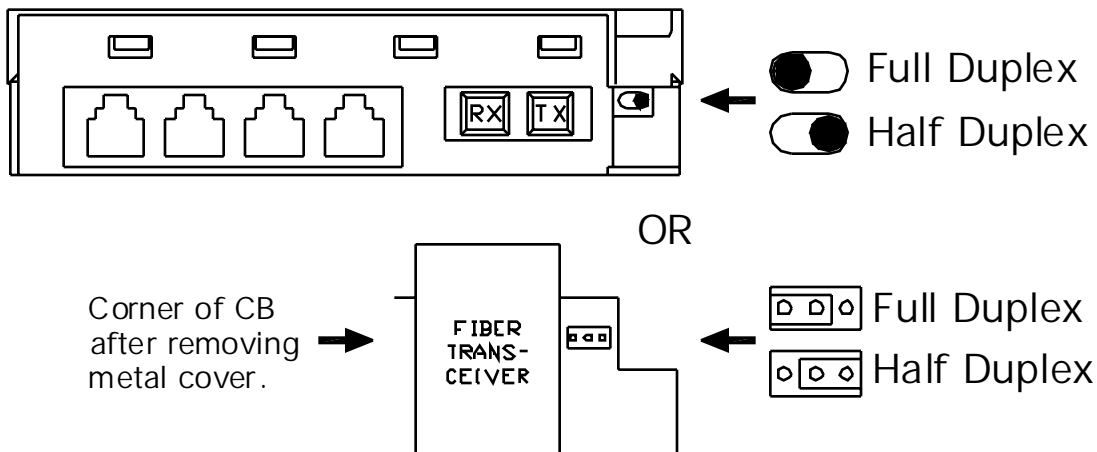
Each fiber optic port on the switch is comprised of a pair of SC or ST connectors, which are labeled with “RX” and “TX”. When making your fiber optic connections, make sure that the transmit (TX) port of the switch connects to the receive (RX) port of the other device, and the receive (RX) port of the switch connects to the transmit (TX) port of the other device.

The ACT/LNK LED will be ON solid when you have made a proper connection.

### Full or Half Duplex Operation

The RJ45 ports will auto-sense for Full or Half duplex operation. No user configuration is necessary. Each fiber optic port has a movable slide-switch or jumper that allows you to select the mode. The metal cover needs to be removed to access the movable jumper. See diagram.

**Note:** You must cycle power to the switch after changing the slide-switch position.



## Switching Features

Here's a brief explanation of the features found in the EtherTRAK Industrial Ethernet Switches documented by this manual.

### **10BaseT and 100BaseTx Autodetection**

Standard Ethernet (10BaseT) has a maximum speed of 10 Mbps (megabits per second). Fast Ethernet (100BaseTx) has a maximum speed of 100 Mbps. The RJ45 ports on the EtherTRAK Industrial Ethernet Switches automatically support both types.

### **100BaseFX (multimode and singlemode) fiber optic port**

The fiber optic port found on some models is classified as 100BaseFX and supports 100 Mbps operation only. Both multimode and singlemode models are available. Multimode allows for multiple wavelengths over a cable with a core diameter of typically 50 or 62.5 microns. The maximum distance for multimode is 2 km. Singlemode uses a single wavelength and cable core diameter of around 10 microns which allows for a maximum distance of 15 km or more.

### **1.0 Gbps (3ES) / 1.4 Gbps (5ES) / 2.0 Gbps (9ES) combined bandwidth**

With full duplex and 100BaseTX or 100BaseFX communications, each port can provide a full 200 Mbps of data throughput.

### **1K MAC addresses with automatic learning, aging and migration**

Each Ethernet device inserts its unique "MAC" address into each message it sends out. The port on the switch used for a given MAC address is automatically learned when a frame is received from that address. Once an address is learned, the switch will route messages to only the appropriate port, instead of broadcasting messages out all ports like a hub. A time stamp is also placed in memory when a new address is learned. This time stamp is used with the aging feature, which will remove unused MAC addresses from the table after 300 seconds. If a device moves, the associated port on the switch will be changed (migrated) as needed. Up to 1,024 MAC addresses can be stored and monitored at any time.

### **Auto-crossover**

The RJ45 ports of the ET-GT-5ES-4SC, -4ST, and -5SC will automatically detect the cable type (straight-thru vs. cross-wired) and re-configure themselves accordingly. Note: All other models do not support this feature and the appropriate cable type must be considered and used. See Sect. 5.

### **Auto-sensing speed and flow control**

The RJ45 ports of the EtherTRAK Industrial Ethernet Switches will auto-negotiate with the connected device to determine the optimal speed (10 Mbps vs. 100 Mbps) and flow control for each port.

### **Automatic power saving**

If there is no cable on a port, most of the circuitry for that port is disabled to save power.

### **Backoff operation**

The EtherTRAK Industrial Ethernet Switch will drop a packet after 16 collisions.

### **Back pressure for half-duplex**

The EtherTRAK Industrial Ethernet Switch will apply "back pressure" when necessary with half-duplex operation. This "back pressure" will reduce congestion on busy networks.

## **Broadcast storm protection**

Broadcasts and multicasts are limited to 25% (5ES) or 5% (9ES) of the available bandwidth. The 3ES models do not support this feature.

## **Buffering**

SRAM is used for buffering the messages. The 3ES has 64KB (16Kx32). The 5ES and 9ES have 128KB (32Kx32). The 3ES has 512 buffers (170 per port). The 5ES and 9ES have 1024 buffers (205 per port for the 5ES and 113 per port for 9ES). Each buffer is 128 bytes in all models.

## **Unmanaged operation**

The EtherTRAK Industrial Ethernet Switch requires no supervisory processor to operate properly.

## **Flow control**

The EtherTRAK Industrial Ethernet Switch automatically supports flow control frames on both the transmit and receive sides.

## **Forwarding**

The EtherTRAK Industrial Ethernet Switch supports store and forward mode. It will forward messages with known addresses out only the appropriate port. Messages with unknown addresses, broadcast messages, and multicast messages will get forwarded out all ports except the source port. The EtherTRAK Switch will not forward error packets, 802.3x pause frames, or “local” packets.

## **Full/Half duplex operation**

The RJ45 ports of the EtherTRAK Industrial Ethernet Switch automatically support (auto-sense) both full and half duplex flow control. The fiber optic port has a slide-switch, which allows you to select the desired operation.

## **Illegal frames**

Illegal frames as defined by IEEE 802.3 will be dropped. This includes short frames, long frames, and FCS error frames.

## **IEEE 802.3 compliant**

The EtherTRAK Industrial Ethernet Switch strictly abides to the IEEE 802.3 standard for 10BaseT, 100BaseTX, and 100BaseFX Ethernet communications.

## **Late collision**

If a packet experiences collisions after 512 bit times of transmission, the packet will be dropped.

## **Latency**

The typical latency of a message is 5 microseconds or faster. The latency is the time it takes a message to be routed internal to a switch from one port to another.

## **Plug and play**

This means that most functions or features of the EtherTRAK Industrial Ethernet Switch are automatic and that there are minimal or no optional parameters that need to be set. Just plug in your Ethernet cables, apply power, and the unit will immediately begin to operate.

## **Priority tagging**

802.1p priority is enabled on all ports of the 9ES. (The 5ES does not support this.) A 6KB buffer is reserved for priority traffic. Default high priority is a value greater than 4 in the priority field with low priority being 3 or less.

## **Protocol independent**

The EtherTRAK Industrial Ethernet Switch will work with all popular Ethernet protocols and networks such as TCP/IP, the Internet (IP), UDP, NetBEUI, and many more. It is compatible

with all protocols that run over standard Ethernet (IEEE 802.3). In fact, it will support packets of different protocols simultaneously.

## Section 7

## Technical Specifications

### Technical Specifications

Here are the technical specifications for the EtherTRAK Industrial Ethernet Switches covered by this manual.

<b>10/100BaseT(x) Ports:</b>	
10/100BaseT(x) ports	Shielded RJ45
Protocols supported	All standard IEEE 802.3
Ethernet compliancy	IEEE 802.3
Auto-crossover	Only on the models ET-GT-5ES-4SC, -4ST, and -5SC
Auto-sensing operation	Full and half duplex
Auto-negotiating	10BaseT and 100BaseTX
Flow control	Automatic
Ethernet isolation	1200 VRMS 1 minute
Plug and play	Yes
Cable requirements	Twisted pair (Cat. 5) (shielded recommended)
Max. cable distance	100 meters
<b>ET-GT-#ES-2SC, -2ST, -4SC or -4ST Fiber Port: (multimode)</b>	
100BaseFX ports	1 or 2
Fiber port mode	Multimode
Fiber port connector	Duplex SC or ST
Optimal fiber cable	50/125, 62.5/125 $\mu\text{m}$
Center wavelength	1300 nm
TX output power	-14 dBm to -22 dBm
RX input sensitivity	-31 dBm peak min.
Maximum distance	2 km on multimode fiber
Half and full duplex	Switch selectable
Ethernet compliance	100BaseFX
Eye safety	IEC 60825-1, Class 1; FDA 21 CFR 1040.10 and 1040.11
<b>ET-GT-#ES-3SC or -5SC Fiber Port: (singlemode)</b>	
100BaseFX ports	1 or 2
Fiber port mode	Singlemode
Fiber port connector	Duplex SC
Optimal fiber cable	9/125, 10/125 $\mu\text{m}$
Center wavelength	1300 nm
TX output power	-8 dBm to -15 dBm
RX input sensitivity	-31 dBm peak min.
Maximum distance	15 km on singlemode fiber
Half and full duplex	Switch selectable
Ethernet compliance	100BaseFX
Eye safety	IEC 60825-1, Class 1; FDA 21 CFR 1040.10 and 1040.11

<b>General:</b>	
Forwarding mode	Store and forward
Latency (typical)	5 usec (time to route a message from one port to another internal to switch)
Memory bandwidth	1.0 Gbps (3ES) or 1.4 Gbps (5ES) or 2.0 Gbps (9ES)
MAC addresses	1K
Address learning	Automatic
Address aging	Remove old address after 300s
Address migration	Automatic
Backoff operation	Drops after 16 collisions
Back pressure	Automatic for halfduplex
Broadcast storm protection	Limits to 25% (5ES) or 5% (9ES) of bandwidth; (3ES – none)
Buffer memory	64KB (16Kx32) (3ES) or 128KB (32Kx32) (5ES & 9ES)
Buffers (total)	512 (3ES) or 1024 (5ES and 9ES)
Buffers per port	170 (3ES), 205 (5ES) or 113 (9ES)
Buffer size	128 bytes per buffer (all models)
Illegal frames	Dropped per 802.3
Late collisions	Dropped after 512 bit times
<b>Environmental:</b>	
Required supply voltage	10 – 30 VDC
Power consumption (typical)	2W (all 3ES); 2W (5ES-1); 3W (5ES w/ 1 fiber); 4W (5ES w/ 2 fiber); 4W (9ES-1), 6W (9ES w/ 1 fiber)
Power saving	Automatic
Max. screw terminal torque and wire gauge	ET-GT-#ES-1: 3.48 in-lbs (0.4 Nm), 14 AWG ET-GT-#ES-#SC: 5.3 in-lbs (0.6 Nm), 12 AWG
Operating temp. range	-40 to 85 C
Storage temp. range	-40 to 85 C
Humidity	5 to 95 % (non-condensing)
Flammability	UL 94V-0 materials
Electrical safety	UL508, CSA C22/14; EN61010-1 (IEC1010), CE
EMI emissions	FCC part 15, ICES 003, EN55022; Class B; CE
EMC immunity	EN61326-1 (EN61000-4-2, 3, 4, and 6), CE
Surge withstand	IEEE-472 (ANSI C37.90)
Vibration	IEC68-2-6
Hazardous locations	UL1604, CSA C22.2/213 (Class 1, Div. 2), Cenelec EN50021 (Zone 2)
Dimensions	3.25" x 4.75"
Mounting	DIN rail or panel direct

## Section 8

## Service Information

### Service Information

We sincerely hope that you never experience a problem with any **SIXNET** product. If you do need service, call **SIXNET** at (518) 877-5173 and ask for Applications Engineering. A trained specialist will help you to quickly determine the source of the problem. Many problems are easily resolved with a single phone call. If it is necessary to return a unit to us, an RMA (Return Material Authorization) number will be given to you.

**SIXNET** tracks the flow of returned material with our RMA system to ensure speedy service. You must include this RMA number on the outside of the box so that your return can be processed immediately.

The applications engineer you are speaking with will fill out an RMA request for you. If the unit has a serial number, we will not need detailed financial information. Otherwise, be sure to have your original purchase order number and date purchased available.

We suggest that you give us a repair purchase order number in case the repair is not covered under our warranty. You will not be billed if the repair is covered under warranty.

Please supply us with as many details about the problem as you can. The information you supply will be written on the RMA form and supplied to the repair department before your unit arrives. This helps us to provide you with the best service, in the fastest manner. Normally, repairs are completed in two days. Sometimes difficult problems take a little longer to solve.

If you need a quicker turnaround, ship the unit to us by air freight. We give priority service to equipment that arrives by overnight delivery. Many repairs received by mid-morning (typical overnight delivery) can be finished the same day and returned immediately.

We apologize for any inconvenience that the need for repair may cause you. We hope that our rapid service meets your needs. If you have any suggestions to help us improve our service, please give us a call. We appreciate your ideas and will respond to them.

#### **For Your Convenience:**

Please fill in the following and keep this manual with your **SIXNET** system for future reference:

P.O. #: \_\_\_\_\_ Date Purchased: \_\_\_\_\_

Purchased From: \_\_\_\_\_

### Product Support

To obtain support for **SIXNET** products:

**On-line support:** [www.get2support.com](http://www.get2support.com)

**Order on-line:** [www.industrialmodem.com](http://www.industrialmodem.com)

**Latest product info:** [www.sixnetio.com](http://www.sixnetio.com)

**Phone:** +1 (518) 877-5173

**Fax:** +1 (518) 877-8346

**E-mail:** [support@sixnetio.com](mailto:support@sixnetio.com)

**Mailing address:** **SIXNET**, 331 Ushers Road, P.O. Box 767, Clifton Park, NY 12065