EISwitch

CTRLink®

A Line of Fixed-Port Industrial Ethernet 10/100 Mbps Switches

INSTALLATION GUIDE

INTRODUCTION

The EIS series—Ethernet Interconnect Switch in the CTRLink® family—provides a solution for those industrial applications requiring a larger network diameter and greater throughput. The EIS series becomes an essential element of the control strategy.

Classified as switching hubs, each device segments the Ethernet network into separate collision domains. The EIS8-100T offers eight ports of expansion via twisted-pair cabling. Four models offer fiber ports when greater distance or galvanic isolation is required: The EIS6-100T/FC and EIS6-100T/FT accommodate a fiber backbone via two fiber ports and offer four twisted-pair ports for local drops. The EIS5-100T/FC and EIS5-100T/FT provide one fiber port to terminate a fiber link and four local ports of twisted-pair. Each fiber model also has an "–FCS" transceiver option for single-mode fiber.

Each switch functions as a "bridge" between the various data links—creating a larger network diameter than can be achieved with repeating hubs. To optimize speed and throughput, some functions are *automatically negotiated*:

Each twisted-pair port automatically optimizes its data rate to 10 Mbps or 100 Mbps. The data rate of fiber ports is fixed at 100 Mbps.

Each port negotiates flow control—supporting the PAUSE function for full-duplex links, and using the backpressure scheme for half-duplex segments.

The switch learns the ports of devices by reading Ethernet frames and noting source addresses. It then creates and maintains a table of addresses and port assignments by which traffic is restricted to only those ports party to a data exchange. This allows other data to be *simultaneously* exchanged on other ports—with improved throughput. If a broadcast, multicast, or unicast transmission to an unknown destination arrives at a port, all other ports receive the transmission. As an option for reduced data latency, cut-through operation can be selected instead of store-and-forward operation.

The switch front-panel features one LED to warn of network loops and LEDs for link status, port activity, and data rate of each port. All units operate from low-voltage AC or DC power and are DIN-rail mountable.

CONTEMPORARY CONTROLS®

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INDUSTRIAL CONTROL EQUIPMENT FOR HAZARDOUS LOCATIONS
9BA2

SPECIFICATIONS

Electrical

INPUT	**DC**	**AC**
Voltage:	10–36 volt	8–24 Volts
Power:	6 W	6 VA
Frequency:	N/A	47–63 Hz

Environmental

Operating temperature: 0°C to +60°C
Storage temperature: –40°C to +85°C

Regulatory Compliance

CE Mark, CFR 47 Part 15 Class A,
UL 508 and UL 1604 Listed Device
(intended for use with Class 2 circuits)
UL 864 Recognized (only for models EIS8-100T and EIS6-100T/FT)

Functional

Compliance: ANSI/IEEE 802.3
Data Rate: 10 Mbps and 100 Mbps
Signaling: 10BASE-T, 100BASE-TX
100BASE-FX

LED Indicators

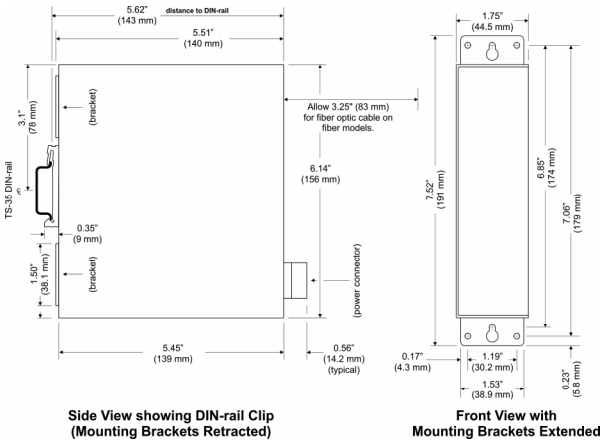
SWITCH	**EACH PORT**
Power—green	Link/Data—green
Loop Detect—red	Data Rate—yellow

Shipping Weight

2 lbs. (.9 kg)

Warning: This is a Class A product. In a domestic environment the product may cause radio interference in which case the user may be required to take adequate measures.

Mechanical

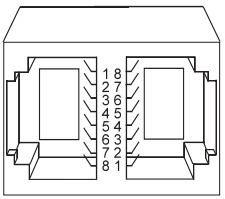


Side View showing DIN-rail Clip (Mounting Brackets Retracted)

Front View with Mounting Brackets Extended

100BASE-T MDI-X CONNECTOR PIN ASSIGNMENTS

RJ-45	**Usage**
1	TD+
2	TD–
3	RD+
4	Not Used
5	Not Used
6	RD–
7	Not Used
8	Not Used



Note : The MDI-X interface has internal crossover so that adapters attach to switches with straight-through cables, but switches connect to each other using crossover cables.

INSTALLATION

The EISwitch is intended to be panel-mounted in an industrial enclosure or wiring closet with two #8 pan-head screws (not provided). An optional DIN-rail mounting kit is also available. Refer to the mechanical specification for details.

Cabling Considerations

When attaching cables to the EISwitch, Table 1 should be considered.

Medium	Signaling and Data Rate	Minimum Required Cable	Maximum Segment Distance
Copper	10BASE-T 10 Mbps	Category 3 UTP	100 m (328 ft)
Copper	100BASE-TX 100 Mbps	Category 5 UTP	100 m (328 ft)
Fiber	100BASE-FX 100 Mbps	1300 nm, multimode 50/125 or 62.5 m	Full-Duplex : 2 km (6562 ft) Half-Duplex : 412 m (1352 ft)
Fiber	100BASE-FX 100 Mbps	1300 nm, single-mode	Full-Duplex : 15 km (49213 ft) Half-Duplex : 412 m (1352 ft)

Table 1 — Cabling Considerations

Observe in Table 1 that segment distance is very limited when using copper media—regardless of the data rate. Although 10BASE-T segments can successfully use Category 3, 4 or 5 cable, 100BASE-TX segments must use Category 5 cable.

A popular choice for improved distance is multimode fiber—which also gives good electromagnetic noise immunity and optimum protection from lightning strikes. Considerable distance can be achieved in full-duplex mode—and the greatest distance can be realized in full-duplex mode with single-mode fiber. Note that half-duplex operation yields a modest, fixed distance which does not vary with the type of fiber in use. This is because half-duplex mode is limited by the *collision domain*—irrespective of the length and type of fiber.

EIS switches offer three types of field connectors. Copper ports accept RJ-45 modular plugs. Two choices of fiber connectors are available: ST and SC.

Configuring Switches in Fiber Cable Networks

The EIS series includes two types of devices which accommodate different fiber backbone situations. One device provides connectivity from one link to another via dual fiber ports. The other device terminates the backbone with a single fiber port. Each type of device offers four RJ-45 ports for attaching local equipment. Figure 1 illustrates a fiber backbone using both kinds of devices. In this example, each EIS5-100T/FX device terminates the fiber backbone at either end of the network via its single fiber port. The pair of EIS6-100T/FX devices in the center provide continuity for the backbone. Local equipment can attach to any of the fiber switches via twisted-pair.

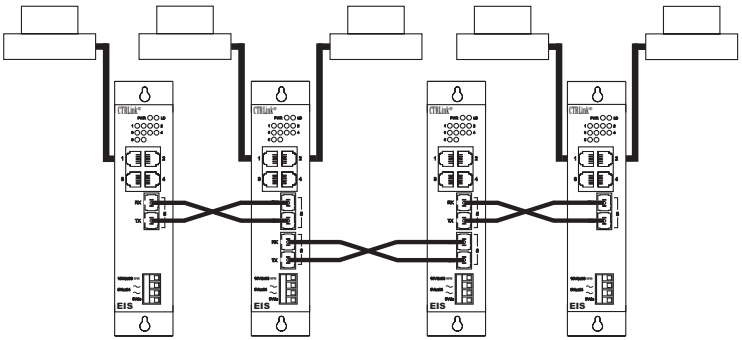


Figure 1 — Fiber Connections

UL1604 Considerations

- This equipment is suitable for use in Class I, Div. 2, Groups A, B, C, D, or Non-Hazardous Locations only.
- WARNING – Explosion Hazard – Substitution of Component May Impair Suitability for Class I, Div. 2.
- WARNING – Explosion Hazard – Do Not Disconnect Equipment Unless Power Has Been Switched Off Or The Area is Known to be Non-Hazardous.
- Operating Temperature Code (T-Code): T4A

Powering

The EISwitch requires low-voltage power—AC or DC—via a four-pin removable keyed connector. Consult the specifications for power requirements. The various power options are explained below.

NOTE: This device is intended for use with Class 2 circuits.

DC Powered

The EISwitch accepts a voltage range of 10-36 VDC and draws a current value commensurate with 5-watt power consumption. Power conductors should be sized accordingly. Ground is directly connected to zero volts and the equipment chassis is isolated from zero volts. The input connections are reverse-polarity protected.

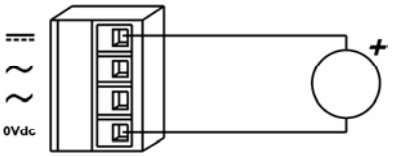


Figure 2 — DC Powered

Redundant DC Powered

Redundant diode-isolated DC power inputs are provided so the EISwitch can operate despite the loss of primary power. Both sources must provide 5 watts of power.

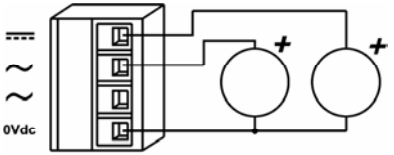


Figure 3 — Redundant DC Powered

AC Powered

The EISwitch can be powered by an AC voltage in the range of 8-24 V capable of delivering 5 VA of apparent power. Two auxiliary power supplies are available: The AI-XFMR is for use with 120 VAC. The AI-XFMR-E is for use with 230 VAC.

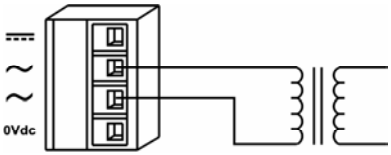


Figure 4 — AC Powered

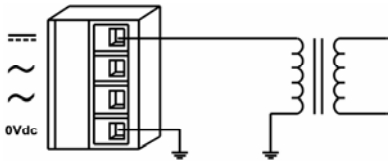


Figure 5 — AC Powered with Grounded Secondary

AC Powered with Battery Backup

The EISwitch can also operate in the AC mode with a backup battery providing power, if the AC source fails. The EISwitch does NOT charge the battery, so separate provisions are required for charging.

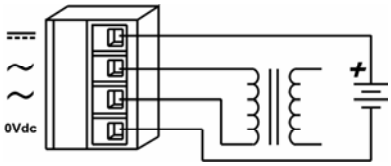


Figure 6 — AC Powered with Battery Backup

OPERATION

Switching

The EISwitch uses an 8K-address look-up table augmented with 128 entries of Content Addressable Memory. An address-hashing algorithm is used to update the table. Addresses are aged in 215-322 seconds. Runt packets (less than 64 bytes) are always discarded. In store-and-forward mode, oversize packets (greater than 1536 bytes) are discarded.

Data Storage

Data storage consists of 1K pages (256 bytes per page) of DRAM. Ethernet packets occupy a minimum of one page and a maximum of seven.

Data Forwarding

Two modes of data forwarding are available. In *Store-and-Forward* mode, an entire Ethernet packet must be received before forwarding occurs. In the *Cut-through* mode, data forwarding begins after 512 bytes are received (a packet shorter than 512 bytes is forwarded as soon as it is completed).

Flow Control

Each port automatically negotiates flow control for either half- or full-duplex operation. In full-duplex mode, the PAUSE function is supported. In half-duplex mode, the backpressure method is used. When flow control is disabled, the destination of an incoming packet is checked and if found to be congested, the packet is discarded to avoid blocking the packet stream. The flow control capabilities are set by jumpers as shown in Tables 2 and 3.

Loop Detection

Each EISwitch has a unique identifier (SID) stored in EEPROM. The Loop Detection function broadcasts the following 64-byte frame to test for circular messaging between switches.

FFFFFF	SID	0040	0000000. . .000	CRC

If the frame is returned—and a loop therefore indicated—the switch will activate the LED marked “LD”, thus indicating a loop and unreliable data transfer. To restore reliable switch operation, ALL port cables must be disconnected then reconnected in such a way that the loop no longer exists.

Broadcast Storm Control

Using a storm-control counter, each port will pass 64 continuous broadcast packets before dropping extra ones. The counter will reset every 800 ms or after receiving a packet whose Device ID is other than ff ff ff ff ff ff.

External LEDs

PWR (green)	*Power*—Glows when power is supplied to the EISwitch.
LD (red)	*Loop Detect*—Glows when a wiring loop exists as described in the section entitled *Loop Detection*.
LINK (green)	*Link*—Each port has one of these LEDs which glows to indicate that a valid Ethernet link has been established. The LED flashes when data transfer is occurring.
HS (yellow)	*Data Rate*—Each port has one of these LEDs which glows to indicate that data is transferring at 100 Mbps.

User Control

Figure 7 depicts the circuit board area (fiber version) containing the following:

- Jumpers (in their default settings) to control several functions
- LEDs to indicate the status of each channel (port)

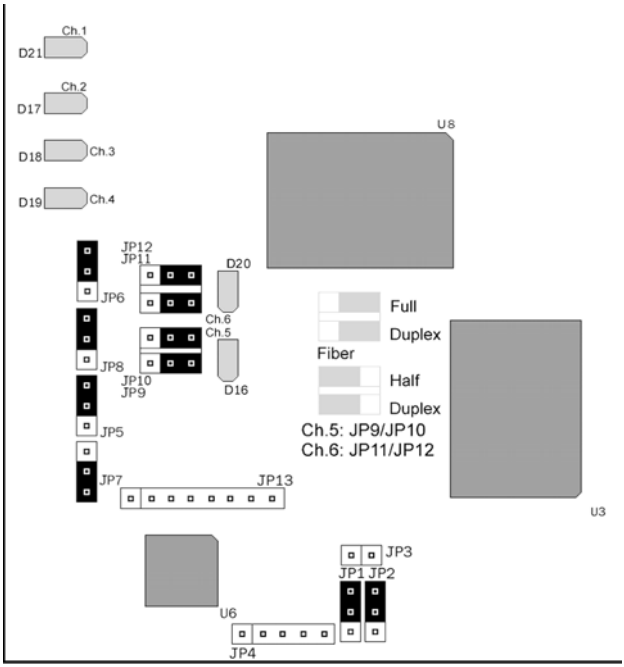


Figure 7 — Circuit Board User Area (Fiber Models)

Figure 7 illustrates all installed jumper headers, including five used **only** for factory testing. These are JP3, JP4, JP13 which have no jumpers installed—and JP1, JP2 which have jumpers that **must** be left in their default positions.

If viewed as shown in Figure 7, the user-adjustable jumpers may be set according to Tables 2 and 3—where default settings are indicated in italics.

JUMPER	FUNCTION	IF SET UP	IF SET DOWN
JP5	PAUSE	*Enabled*	Disabled
JP6	Backpressure	*Enabled*	Disabled
JP7	Data Forwarding	Cut-through	*Store-and-forward*
JP8	Broadcast Storm Control	*Enabled*	Disabled

Table 2 — Flow Control Jumper Options — All Models

JUMPER	FUNCTION	IF SET LEFT	IF SET RIGHT
JP9	Channel 5 Duplex Operation	Half-Duplex	*Full-Duplex*
JP10	Channel 5 Duplex Operation	Half-Duplex	*Full-Duplex*
JP11	Channel 6 Duplex Operation	Half-Duplex	*Full-Duplex*
JP12	Channel 6 Duplex Operation	Half-Duplex	*Full-Duplex*

Table 3 — Duplex Jumper Options for Fiber Models

Note: On fiber models, the settings of JP9 and JP10 must match (as must those of JP11 and JP12) or else data will be erratic.

Internal LEDs

The data flow of each 100BASE-TX port is auto-negotiated. When such a channel is in full-duplex mode, its associated LED will glow. In half-duplex mode, its LED will be off—but will flash during a data collision.

The data flow of each 100BASE-FX port is set by a jumper (see Table 3). In full-duplex mode, the channel LED will glow. In half-duplex mode, the LED will be off. On fiber switches, LEDs D16 and D20 should never flash.

Channel:	1	2	3	4	5	6
LED:	D21	D17	D18	D19	D16	D20
Signaling:	TX	TX	TX	TX	FX	FX
if OFF:	HD	HD	HD	HD	HD	HD
if ON:	FD	FD	FD	FD	FD	FD
if flashing:	C	C	C	C	—	—

Table 4 — Internal LEDs for Fiber Switches

Legend: HD = Half-Duplex FD = Full-Duplex C = Collision

Channel:	1	2	3	4	5	6	7	8
LED:	D20	D21	D22	D23	D24	D25	D26	D27
Signaling:	TX	TX	TX	TX	TX	TX	TX	TX
if OFF:	HD	HD	HD	HD	HD	HD	HD	HD
if ON:	FD	FD	FD	FD	FD	FD	FD	FD
if flashing:	C	C	C	C	C	C	C	C

Table 5 — Internal LEDs for Model EIS8-100T

Legend: HD = Half-Duplex FD = Full-Duplex C = Collision

NEED MORE HELP INSTALLING THIS PRODUCT?

More comprehensive information can be found on our web site at www.ccontrols.com. This includes our on-line technical manuals, downloadable software drivers and utility programs that can test the product. When contacting one of our offices, just ask for Technical Support.

Warranty

Contemporary Controls (CC) warrants its new product to the original purchaser for two years from the product shipping date. Product returned to CC for repair is warranted for one year from the date that the repaired product is shipped back to the purchaser or for the remainder of the original warranty period, whichever is longer.

If a CC product fails to operate in compliance with its specification during the warranty period, CC will, at its option, repair or replace the product at no charge. The customer is, however, responsible for shipping the product; CC assumes no responsibility for the product until it is received.

CC's limited warranty covers products only as delivered and does not cover repair of products that have been damaged by abuse, accident, disaster, misuse, or incorrect installation. User modification may void the warranty if the product is damaged by the modification, in which case this warranty does not cover repair or replacement.

This warranty in no way warrants suitability of the product for any specific application. IN NO EVENT WILL CC BE LIABLE FOR ANY DAMAGES INCLUDING LOST PROFITS, LOST SAVINGS, OR OTHER INCIDENTAL OR CONSEQUENTIAL DAMAGES ARISING OUT OF THE USE OR INABILITY TO USE THE PRODUCT EVEN IF CC HAS BEEN ADVISED OF THE POSSIBILITY OF SUCH DAMAGES, OR FOR ANY CLAIM BY ANY PARTY OTHER THAN THE PURCHASER.

THE ABOVE WARRANTY IS IN LIEU OF ANY AND ALL OTHER WARRANTIES, EXPRESSED OR IMPLIED OR STATUTORY, INCLUDING THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR PARTICULAR PURPOSE OR USE, TITLE AND NONINFRINGEMENT.

Returning Products for Repair

Before returning a product for repair, contact Customer Service. A representative will instruct you on our return procedure.

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DECLARATION OF CONFORMITY

Applied Council Directives:

Electromagnetic Compatibility Directive, 89/336/EEC Council Directive as amended by Council Directive 92/31/EEC & Council Directive 93/68/EEC
General Product Safety Directive 92/59/EEC

Standard to which Conformity is Declared

EN 55022:1995, Class A, Limits and Methods of Measurement of Radio Disturbance Characteristics of Information Technology Equipment

EN 55024:1998, Information Technology Equipment — Immunity Characteristics — Limits and Methods of Measurement

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UNITED KINGDOM

Type of Equipment: Industrial Ethernet switching hub

Models		
EIS5-100T/FC	EIS6-100T/FC	EIS8-100T
EIS5-100T/FCS	EIS6-100T/FCS	
EIS5-100T/FT	EIS6-100T/FC	

Regulatory Compliance Standards			
Standard	Test Method	Description	Test Levels
EN 55024	EN 61000-4-2	Electrostatic Discharge	6 kV Contact
EN 55024	EN 61000-4-3	Radiated Immunity	10 V/m 80 MHz to 1 GHz
EN 55024	EN 61000-4-4	Fast Transient Burst	1 kV Clamp & 2 kV Direct
EN 55024	EN 61000-4-5	Voltage Surge	1 kV L to L & 2 kV L to Earth
EN 55024	EN 61000-4-6	Conducted Immunity	10 Volts (rms)
EN 55024	EN 61000-4-11	Voltage Dips & Interruptions	1 to 5 Seconds @ 100% Dip 1 Line Cycle @ 100% Dip
EN 55022	CISPR 22	Radiated Emissions	Class A
EN 55022	CISPR 22	Conducted Emissions	Class B

Manufacturer's Declaration: I, the undersigned, hereby declare that the products specified above conform to the listed directives and standards.

George M. Thomas, President March 1, 2004