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 fibre ports when greater distance or galvanic isolation is required: The EIS6-100T/FC and EIS6-100T/FT accommodate a fibre backbone via two fibre ports and offer four twisted-pair ports for local drops. The EIS5-100T/FC and EIS5-100T/FT provide one fibre port to terminate a fibre link and four local ports of twisted-pair. Each fibre model also has an "–FCS" transceiver option for single-mode fibre.

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

Each twisted-pair port automatically optimises its data rate to 10 Mbps or 100 Mbps. The data rate of fibre 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

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CONTEMPORARY CONTROLS®

TRADEMARKS

TD000500-0IL 22 May 2014

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DISCLAIMER

Contemporary Control Systems, Inc. reserves the right to make changes in the specifications of the product described within this manual at any time without notice and without obligation of Contemporary Control Systems, Inc. to notify any person of such revision or change.

SPECIFICATIONS

Electrical

INPUT	DC	AC
Voltage:	10–36 V	8–24 V
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
Humidity, non-cond.: 10% to 95%

Functional

Compliance: ANSI/IEEE 802.3

LED Indicators

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

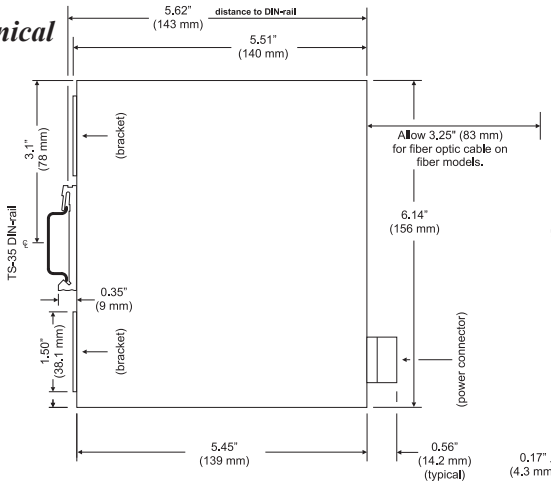
Regulatory Compliance

CFR 47, Part 15 Class A
UL 508 Listed Device
(intended for use *with Class 2 circuits only)*

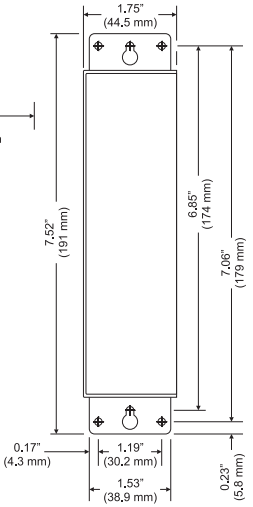
Shipping Weight 2 lbs. (.9 kg)

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)

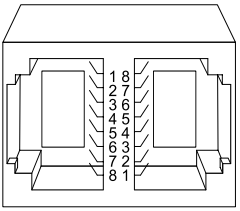


Front View with Mounting Brackets Extended

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)
Fibre	100BASE-FX 100 Mbps	1300 nm, multimode 50/125 or 62.5 µm	Full-Duplex : 2 km (6562 ft) Half-Duplex : 412 m (1352 ft)
Fibre	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 fibre — 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 fibre. Note that half-duplex operation yields a modest, fixed distance which does not vary with the type of fibre in use. This is because half-duplex mode is limited by the collision domain — irrespective of the length and type of fibre.

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

Configuring Switches in Fibre Cable Networks

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

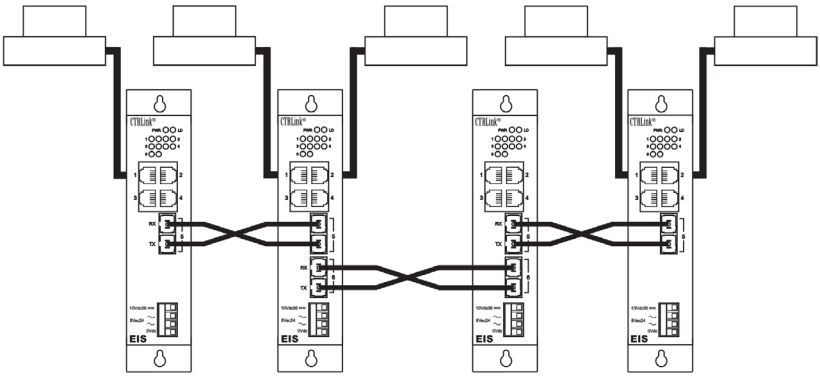


Figure 1 — Fibre Connections

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.

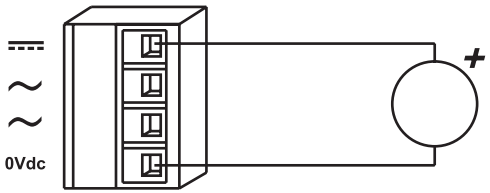


Figure 2 — DC Powered

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.

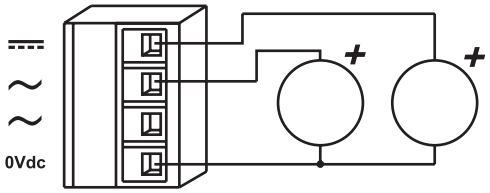


Figure 3 — Redundant DC Powered

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.

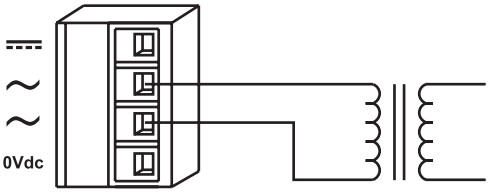


Figure 4 — AC Powered

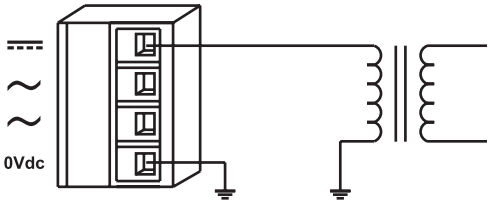


Figure 5 — AC Powered with Grounded Secondary

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.

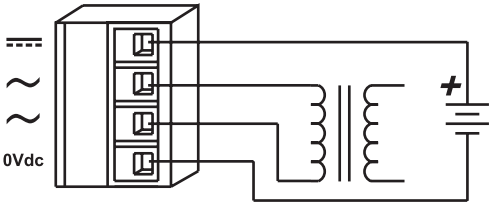


Figure 6 — AC Powered with Battery Backup

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 (fibre version) containing the following:

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

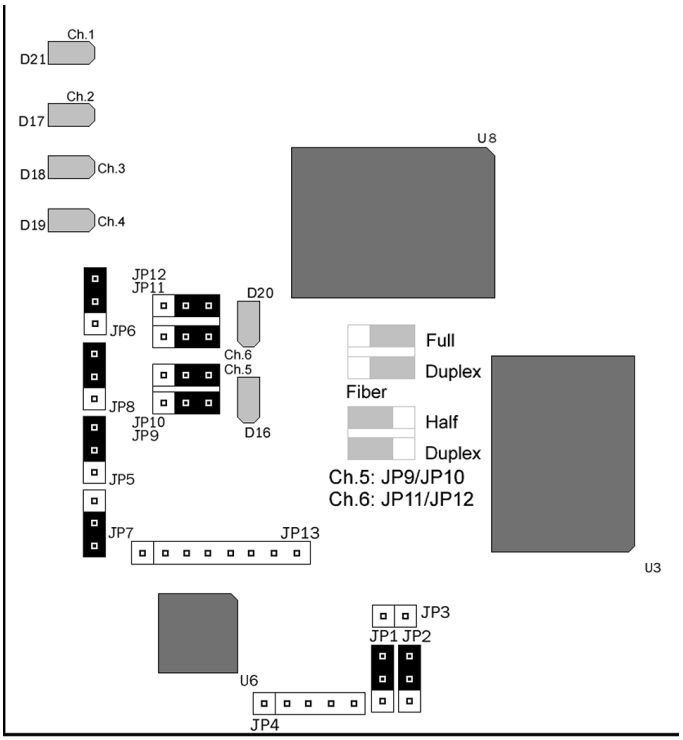


Figure 7 — Circuit Board User Area (Fibre Models)

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 Fibre Models

Note: On fibre 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 fibre 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 Fibre 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 WITH 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.

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May 2014