Ethernet Modbus/TCP

24HR
5YR

CE

Standard model includes cage clamp terminal blocks. Optional terminals are available (see ordering information).

965EN
Analog Input

4 or 6-Channel Input: Thermocouple or Millivolt Signals

■ Description

These modules provide an isolated Ethernet network interface for up to six input channels. Differential inputs eliminate ground noise and each terminal block includes a cold junction compensation (CJC) sensor for more precise temperature measurements. Multi-range inputs accept signals from a variety of sensors and devices. High-resolution, low noise, A/D converters deliver high accuracy and reliability.

Input Ranges
Thermocouple (user-selectable type)
Type J, K, T, R, S, E, B, or N

DC Millivolts (user-selectable range)
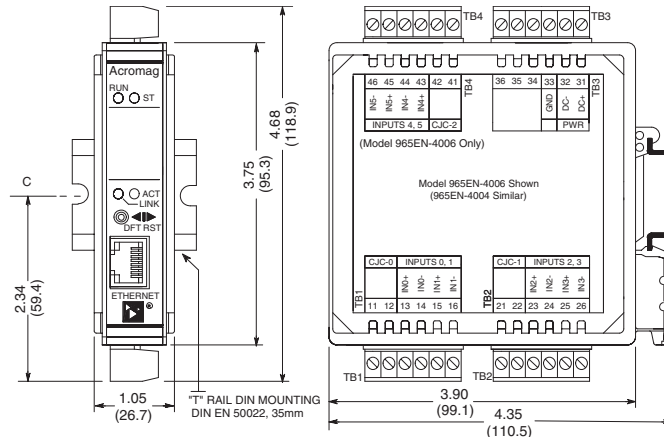±100mV or ±1V DC

Network Communication
Ethernet Modbus/TCP 10/100Mbps network

Power Requirement
15 to 36V DC supply required

Approvals
CE marked. UL, cUL listed (pending).
Class I; Division 2; Groups A, B, C, D (pending).

■ Special Features

■ Configurable from standard web browser

■ Modbus/TCP communication with automatic 10/100Mbps data rate negotiation

■ 6-input stand-alone module is very economical

■ Universal inputs support a variety of sensors

■ Built-in CJC sensor on each terminal block produces more precise temperature measurements

■ Thermocouple break detection (upscale or downscale) identifies sensor wiring failures

■ High-resolution 16-bit Σ–Δ A/D converters ensure precise, high accuracy measurements

■ Compact packaging with pluggable terminals

■ Wide operational temperature range

■ Performance

■ General Specifications
See Page 11 for communication and other specs.

■ Input
Configuration
Input ranges are selectable for a 3-channel group.

Accuracy

Input	Input Range	Accuracy (typical)
Type J	-210 to 760°C	±0.5°C
Type K	-200 to 1372°C	±0.5°C
Type T	-260 to 400°C	±0.5°C
Type R	-50 to 1768°C	±1.0°C
Type S	-50 to 1768°C	±1.0°C
Type E	-200 to 1000°C	±0.5°C
Type B	260 to 1820°C	±1.0°C
Type N	-230 to -170°C	±1.0°C
Type N	-170 to 1300°C	±0.5°C
Voltage	±100mV or ±1V DC	±0.1% of span

Cold Junction Compensation (CJC) Accuracy
±0.5°C.

Thermocouple Break Detection
Upscale or downscale selection applies to all channels.

Analog to Digital Converter (A/D)
16-bit Σ–Δ converter.

Noise Rejection
Normal Mode: Better than 40dB @ 60Hz.
Common Mode: Better than 140dB @ 60Hz.

Input Filter Bandwidth
-3dB at 3Hz, typical.

■ Environmental

Ambient Temperature
Operating: -25 to 70°C (-13 to 158°F).
Storage: -40 to 85°C (-40 to 185°F).

Relative Humidity
5 to 95%, non-condensing.

Isolation
1500V AC for 60 seconds or 250V AC continuous.
3-way isolation between I/O, network, and power.

■ Ordering Info

Models
965EN-4004
4-channel thermocouple/millivolt input module
965EN-4006
6-channel thermocouple/millivolt input module

Accessories (See Pages 12-14)
900EN-S005
Ethernet switch, 5-port

5035-355
Ethernet cable, CAT5, 3 feet long
5035-360
Ethernet crossover cable, CAT5E, 5 feet long, shielded

PS5R-D24
Power supply (24V DC, 2.1A).

General Operation and Performance Specifications

The following specifications are common to all 900EN Series I/O modules.

■ Communication

Connector
Shielded RJ-45 sockets, 8-pin, 10BaseT/100BaseTX.

Wiring
Wired MDI. Unit does NOT support auto-crossover.

Protocol
Modbus TCP/IP with web browser configuration.

IP Address
Default static IP address is 128.1.1.100.

Port
Up to 10 sockets supported.

Data Rate
Auto-sensed, 10Mbps or 100Mbps.

Duplex
Auto-negotiated, full or half-duplex.

Compliance
IEEE 802.3, 802.3u, 802.3x.

Modbus TCP/IP Protocol Support
Up to 10 sockets may be selected. Web page for configuration and control is built-in with Ethernet access via a standard web browser.

Rx/Tx Memory
8K bytes internal SRAM memory for receive and transmit buffers (FIFO).

Communication Distance
Distance between network devices is generally limited to 100 meters using recommended cable. Distances may be extended using hubs and switches.

Address
IP address is automatically acquired at startup. Unit may be configured to retrieve this address from the network server using BOOTP (Bootstrap Protocol), or via DHCP (Dynamic Configuration Protocol). A static IP address is user-programmable. A default toggle switch sets the static IP address to the default factory address of 128.1.1.100.

■ Environmental

Isolation
I/O channel, power, and network circuits are isolated from each other for common-mode voltages up to 250VAC, or 354V DC off DC power ground, on a continuous basis (will withstand 1500VAC dielectric strength test for one minute without breakdown). Complies with test requirements of ANSI/ISA-82.01-1988 for voltage rating specified.

■ Electromagnetic Compatibility (EMC)
Immunity per European Norm EN50082-1. Emissions per European Norm EN50081-1.

Electrostatic Discharge (ESD) Immunity
Per EN61000-4-2.

Radiated Field Immunity (RFI)
Per EN61000-4-3 and ENV50204.

Electrical Fast Transient Immunity (EFT)
Per EN61000-4-4.

Conducted RF Immunity (CRFI)
Per EN61000-4-6.

Surge Immunity
Per EN61000-4-5.

Radiated Frequency Emissions
Per EN55022 Class B.

HOST PC CONNECTED DIRECTLY TO A MODULE
Note: This MDI-to-MDI connection requires the use of a crossover cable.

HOST PC

CAT-5 UTP CABLE UP TO 100 METERS
(Use Crossover Cable Model No. 5035-360)

Acromag 983EN-4012 Ethernet Module.

CROSSOVER CABLE FOR MDI TO MDI OR MDI-X TO MDI-X

RJ45 (Clip Side Down)

CROSSOVER CONNECTIONS

FOR DIRECT PC TO ETHERNET MODULE CONNECTIONS

PINS: 1 TO 3
2 TO 6
3 TO 1

RJ45 (Clip Side Down)

USE OF AN ETHERNET SWITCH TO NETWORK A HOST PC TO MORE THAN ONE MODULE

The ethernet port of the PC is generally not automatic MDI/MDI-X crossover and is wired MDI.

HOST PC

CAT-5 UTP CABLE UP TO 100 METERS

Because the Acromag ethernet switch 900EN-S005 is automatic MDI/MDI-X crossover, use of a direct (straight-through) or crossover cable is permissible.

ETHERNET SWITCH

Acromag 900EN-S005 5-Port Ethernet Switch or equivalent.

The ethernet ports of this switch are automatic MDI/MDI-X crossing and do not require crossover cables.

Acromag 9xxEN-4012 Ethernet Modules.

The ethernet port of these modules are not automatic MDI/MDI-X crossover, but the use of an auto-crossing switch eliminates the need to make a distinction between straight-through and crossover cables.

IMPORTANT: IF THE HOST PC CONNECTS DIRECTLY TO THE MODULE, YOU MUST USE A CROSS-CONNECT CABLE (MDI-X), AS BOTH THE PC AND THE 9XXEN MODULE ETHERNET PORTS ARE WIRED MDI.

MOST ETHERNET SWITCHES AND HUBS ARE AUTOMATIC MDI/MDI-X AND ELIMINATE THE NEED FOR MAKING A DISTINCTION BETWEEN THE USE OF STRAIGHT-THROUGH (MDI) AND CROSSOVER (MDI-X) CABLE CONNECTIONS.

CAT-5 UTP CABLE UP TO 100 METERS
(Straight-Through or Crossover Cable)

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RJ45 MDI AND MDI-X CONNECTIONS

PIN	MDI WIRING	MDI-X WIRING
1	Transmit +	Receive +
2	Transmit -	Receive -
3	Receive +	Transmit +
4	Not Used	Not Used
5	Not Used	Not Used
6	Receive -	Transmit -
7	Not Used	Not Used
8	Not Used	Not Used

Note Crossover Connections

ETHERNET PORT

RJ-45 CONNECTOR
CLIP

RECOMMENDED CABLE

SPEED	DISTANCE	CABLE
10Base-T	100M	CAT 3, CAT 4, or CAT 5 UTP
100Base-T	100M	CAT 5 UTP