

Monitoring and Control Solutions

BusWorks® Ethernet I/O Series Brochure

Modbus TCP/IP

Ethernet/IP

i2o® Peer-to-Peer



Industrial Ethernet Analog & Discrete I/O Modules



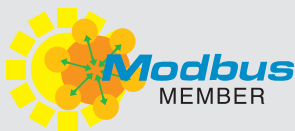
Depend on Acromag

Experience counts:

*especially when
you are selecting
an I/O partner.
And with 60+ years
of I/O experience,
Acromag can help
you to improve
reliability, increase
productivity and
reduce your costs.*



ISO9001
AS9100



Acromag: The I/O Leader

Acromag is a customer-driven manufacturer focused on developing embedded I/O products that provide the best long term value in the industry. Compare and you'll find that Acromag products offer an unmatched balance of price, performance, and features.

60+ Years of I/O Experience

Acromag has more than 60 years of measurement and control experience. Since 1957, we have delivered nearly a million units to thousands of customers around the globe for manufacturing, power, environmental, transportation, and military applications.

Top Quality and a 2-Year Warranty

We take every measure to guarantee you dependable operation and products that perform at or beyond their specifications. Our state-of-the-art manufacturing and military-grade components add an extra degree of ruggedness. Most products qualify for an extended 2-year warranty. And with ISO9000/AS9100 certified quality control, you get full confidence.

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Online Ordering

For your convenience, Acromag provides full product documentation and pricing information on our website. You can obtain quotes or even place your order directly on our website.

Fast Delivery from Stock

Most products can be shipped within 24 hours of receiving your order.

Special Services

We are happy to accommodate your special requirements and offer the following services:

- custom product development
- custom calibration
- source inspections, quality audits
- special shipping, documentation
- protective humiseal coating
- plastic and stainless steel tagging

Certification and Approvals

Many Acromag products carry globally recognized agency approvals and safety certifications.

- | | |
|-----------|--------------------------|
| • CE | • Ethernet conformance |
| • UL, cUL | • Modbus conformance |
| • ATEX | • Profibus certification |
| • CSA | • IECEx |



Ethernet I/O: BusWorks® Series

900EN Series Compact Ethernet I/O Modules



◆ Analog I/O Modules



◆ Discrete I/O Modules



◆ Combination I/O Modules



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Combination I/O Modules (analog and discrete I/O)

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**Economical
Commercial-Grade Units
Available on Many Models**

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Ethernet I/O: BusWorks® Series

900EN Series Compact Ethernet I/O Modules



BusWorks 900EN Series Ethernet I/O Modules

The 900EN series is a rugged, high-performance line of networked I/O modules. Modules feature universal input/output ranges and an intelligent microcontroller to provide extreme flexibility and powerful monitoring and control capabilities. Select from a variety of analog and discrete I/O models to meet your application requirements.

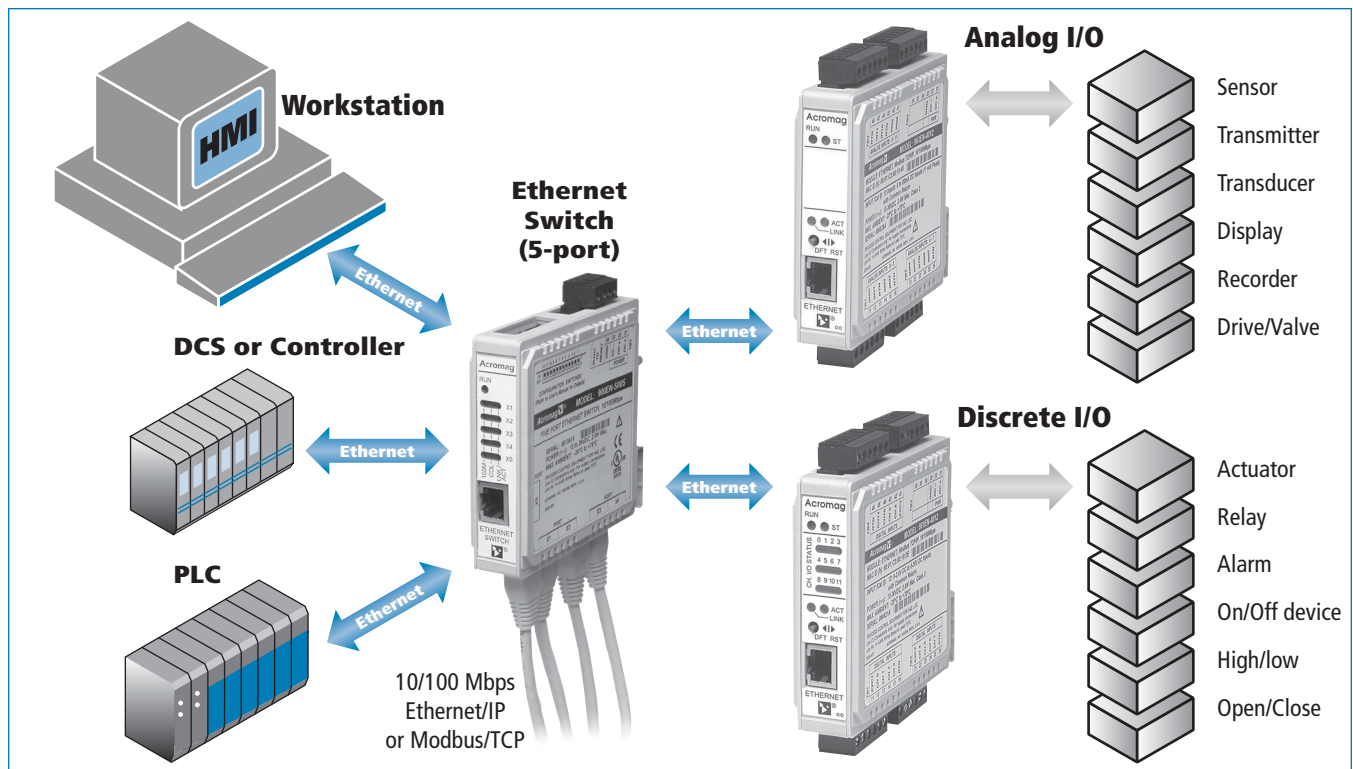
Each inch-wide module has a direct network interface, processes I/O signals on up to twelve channels, and handles power conversion. This space-saving approach is very cost-effective for systems that need to add I/O channels at an existing control site or network to new remote sites. By comparison, many "block I/O" devices would require a large, expensive processor block, an I/O rack, individual plug-in I/O terminal blocks, and a special system power supply.

The I/O modules are easily configured using your standard web browser. Each I/O module has embedded web pages to help you set up and control the unit. These web pages guide you through the steps to configure network settings, calibrate the module, and test operation.

Sophisticated watchdog timers increase system reliability. All I/O modules have a watchdog that monitors the microcontroller for failed operations or a "lock-up" condition and automatically resets the unit. If host communication is lost and a configurable watchdog timer expires, all analog and discrete outputs go to a "fail-safe" condition.

Key Features & Benefits

- **Web Browser Configuration:**
Built-in web page enables configuration with a web browser over an Ethernet connection
- **EtherNet/IP™ or Modbus TCP/IP Protocol:**
Supports 10Base-T and 100Base-TX interface
- **Peer-to-peer Ethernet communication:**
i2o technology enables module-to-module communication without a controller (Page 14)
- **Direct Network Interface on Each Unit:**
Each I/O module has a built-in microcontroller for communication. No bus coupler required.
- **Up to 10 Sockets per Module:**
Multiple masters can talk to one module
- **Automatic Data Flow Control:**
10/100Mbps and half/full duplex negotiation
- **Fully Isolated:**
I/O, network, and power circuits isolated from each other for safety and noise immunity
- **Wide Ambient Temperature Range:**
Provides reliable operation from -40 to 70°C





Ethernet I/O: BusWorks® Series

900EN Series Compact Ethernet I/O Modules



Discrete I/O Modules

These modules monitor discrete levels of various devices and/or provide on/off control capabilities depending on the model selected. Each module has up to twelve channels to save space and minimize costs. Models are available with input- or output-only, or bidirectional I/O configurations

Inputs

- Active-low inputs, 0 to 35V DC

Outputs

- Sinking outputs, 0 to 35V DC, up to 500mA

Functions

- Monitor discrete state or level
- Control on/off, high/low, open/close switching
- Activate audible or visual alarms
- Count / totalize

Analog Input Modules

These units monitor a wide variety of industrial machinery and equipment. They accept direct sensor inputs or DC process control signals from transducers, transmitters, and other instruments.

Inputs

- DC current
- DC voltage
- DC millivolts
- microBlox™ uB module inputs (more than 100 signal types)
- Thermocouple
- RTD/resistance
- AC current

Functions

- Measure process variables
- Monitor machinery and industrial devices
- Acquire data from non-networked instruments
- Integrate / totalize

Analog Output Modules

Analog output modules are ideal for controlling a wide variety of devices. The host defines the output of voltage or current signals to control speed, flow, temperature, frequency, level, force, torque, intensity, and many other physical properties.

Outputs

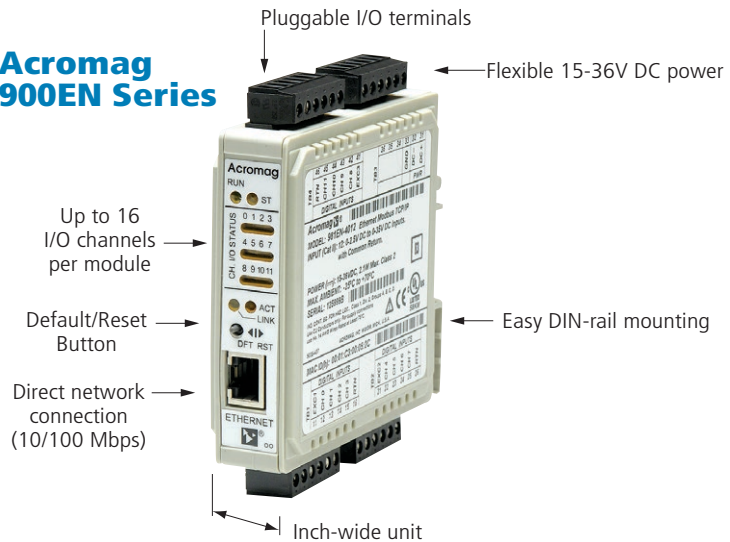
- DC voltage
- DC current

Functions

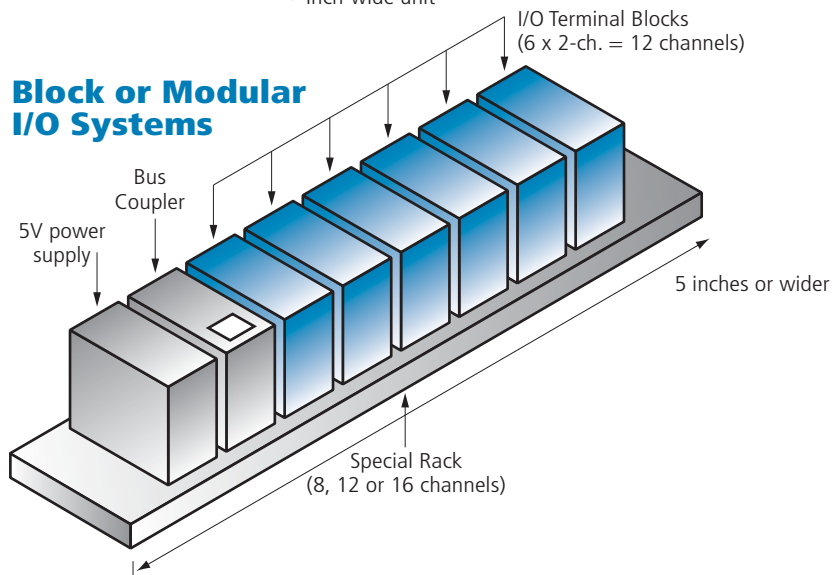
- Write data to local displays or recorders
- Control drives, valves, and positioners

A Simple Alternative to "Block I/O"

Acromag 900EN Series



Block or Modular I/O Systems



Acromag 900EN Series I/O

Stand-alone I/O modules are very easy to use.

- Configures with standard web browser
- Direct connection to network
- Up to 16 channels on one module
- 1-inch wide for 16 channels
- Flexible 15-36V DC power requirement
- Pluggable terminal blocks on top and bottom

Block or Modular I/O Systems

Block I/O systems are harder to implement.

- Installation of configuration software required
- Expensive bus coupler required
- Plug-in I/O modules or terminal blocks required
- Five inches wide or more for twelve channels
- Special 5V power supply may be required
- Fixed wiring terminals on front of unit



Ethernet I/O: BusWorks® Series

Easy Peer-to-Peer Modbus TCP/IP Communication with Acromag i2o®

i2o® Input-to-output Communication

Acromag's i2o technology provides the easiest way to link your inputs to your outputs without a PLC, PC or master CPU.

With i2o, many BusWorks 900EN I/O modules have the ability to operate like a long-distance transmitter. You can convert your sensor inputs at Point A to process control signals at Point B. Or, monitor a discrete device at one site by reproducing the discrete level with a relay output at another location.

Use your existing Ethernet lines to save time and wiring expenses

You can connect the input modules to the output modules using your existing copper/fiber infrastructure or with a single new cable. Multiple I/O modules can be multiplexed through a switch or wireless radios.

No complicated controllers.

No software. No programming.

Acromag's Ethernet I/O modules have a built-in web page making it simple to configure using your standard web browser. Just click a few menu settings, enter the IP addresses, and you are done. Fast and easy.



BusWorks 900EN Series I/O Modules

Up to 12 channels per module and reliable, failsafe communication

Monitor up to a dozen devices with a single pair of I/O modules. Discrete I/O modules have twelve channels that you can set up as inputs or as outputs in four-channel groups. This allows bi-directional communication between two modules. Analog input modules measure up to six current, voltage, thermocouple, or RTD sensor signals. This data is then transmitted to a six-channel analog output module providing DC current or voltage output signals.

Wire-saving Applications

Our i2o technology lets an input module speak directly to an output module. It is ideal for non-critical projects that don't need a PLC or PC master. Reproduce remote signals based on timed or event updates.

- Remote monitoring of process variables (temperature, pressure, level, flow) and discrete devices
- Remote data display, recording, alarms, or control
- Signal splitters
- Analyzer system monitoring
- Power and water utility monitoring
- Tank level, pump, and valve control
- Remote monitoring of motor loads and contactor status
- Remote control switching stations
- Environmental control systems
- Process shutdown, alarming, and annunciator systems
- RFID systems
- Modbus TCP/IP communication only

Peer-to-Peer Modbus TCP/IP Communication

Analog Inputs

4-20mA,
0-10V DC,
thermocouple,
RTD/resistance

Discrete Inputs

on/off,
high/low,
open/close,
momentary
push-buttons

Any Ethernet Media
Copper, fiber,
wireless, or Internet

Analog Outputs

proportional
4-20mA or
0-10V DC

Discrete Outputs

on/off,
high/low,
open/close



Input-to-Output
input channel writes
to the output channel

(uni-directional or bi-directional communication)



EtherStax I/O® also supports i2o



Ethernet I/O: BusWorks® Series

Acromag i2o® Technology for Peer-to-Peer Communication

900EN Series Modbus TCP/IP with i2o®

Analog Input Modules

[961EN-4006 / 962EN-4006](#)

6 differential current/voltage inputs

[965EN-4006](#)

6 thermocouple/mV inputs

[966EN-4006](#)

6 RTD/resistance inputs

[967EN / 968EN](#)

8 differential current/voltage inputs

Analog Output Modules

[972EN-4xxx](#)

4 or 6 current outputs

[973EN-4xxx](#)

4 or 6 voltage outputs

Discrete I/O Modules

[982EN-4012](#)

12 solid-state relay outputs

[983EN-4012](#)

12 solid-state input/outputs

Combination I/O Modules

[951EN-4012](#)

4 analog current inputs,

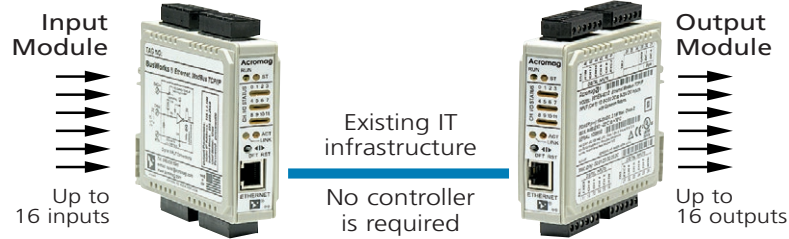
2 analog current outputs, 6 discrete I/O

[952EN-4012](#)

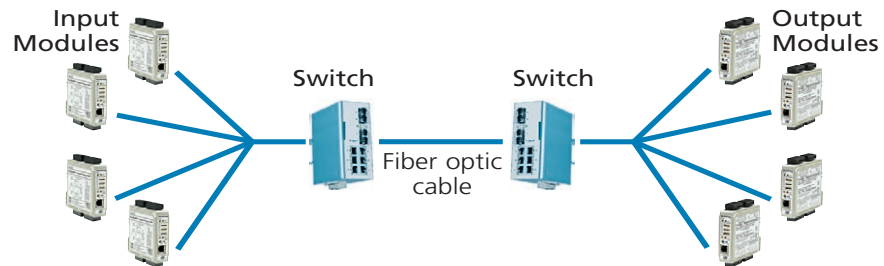
4 analog voltage inputs,

2 analog current outputs, 6 discrete I/O

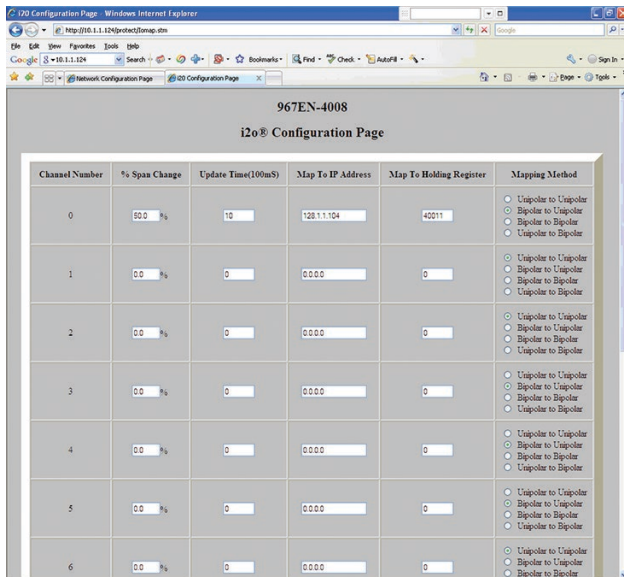
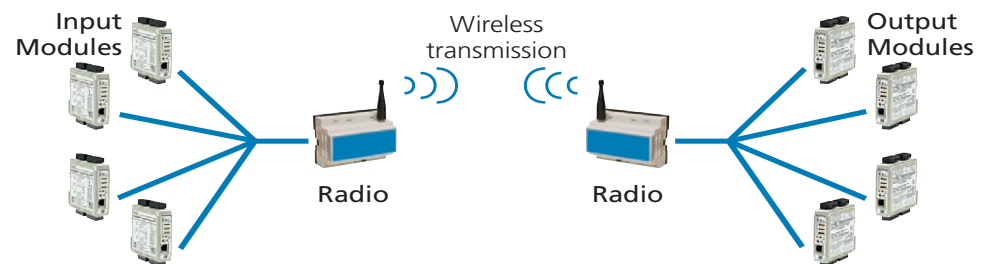
Installation #1: Copper Ethernet network



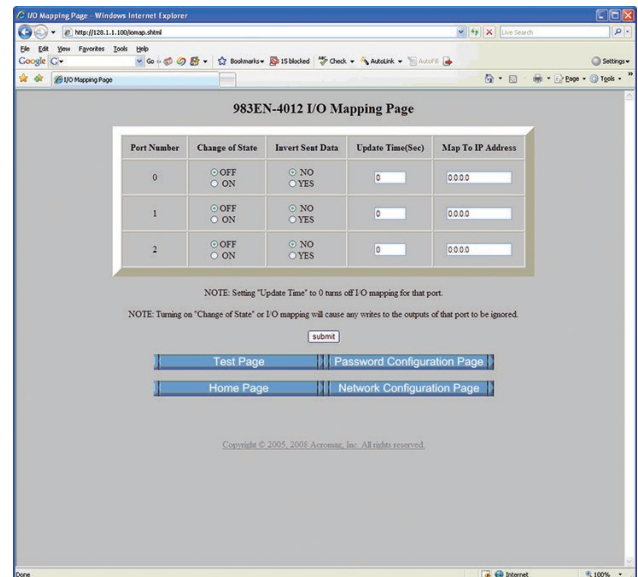
Installation #2: Fiber optic connection



Installation #3: Wireless connection (telemetry systems)



Analog input module configuration screen



Discrete I/O module configuration screen



Ethernet I/O: BusWorks® Series

Module Configuration

Easy to Configure

Industrial Ethernet networks offer several advantages. They are proven, fast (up to 100Mbps without fiber optic cable) and ideal for transmitting analog or discrete data. I/O devices are also easy to install and maintain. And with Ethernet networks already in place at many facilities, it is a simple task to bring your process data to any networked computer.

Acromag's 900EN I/O modules are easily installed and configured using any standard web browser. No special software is required because each module has a built-in web page for configuration purposes. The startup process is shown below.

Step 1:

Connect the Module

Connect the I/O module to your PC with an Ethernet cable. An RJ-45 plug is located right on the front of the I/O module. You can also use an Ethernet switch or switching hub to build a network of Ethernet modules. Acromag offers a 5-port Ethernet switch that includes automatic MDI/MDI-X crossover and accepts straight-through or crossover cable to keep it simple.

Step 2:

Configure the Module

You may use your own software to issue commands to this module or you may use a web browser to achieve basic functionality. Each I/O module has built-in web pages that allow you to setup and control the module via a standard web browser. Simply type the IP address assigned to your module in the browser's address window to access the module's home page. Here you can jump to several pages in order to set the desired network settings, password protection security, and operational functions. See Figure 2.

Step 3:

Test/control the I/O

After completing the network configuration parameters, you can use the test page to operate your module. The test page will allow you to read inputs, turn outputs on and off, configure the watchdog timer, and set watchdog time-out states. After confirming operation, you are ready to add the I/O module to your control system.

HOST PC CONNECTED DIRECTLY TO A MODULE

Note: This MDI-to-MDI connection requires the use of a crossover cable.

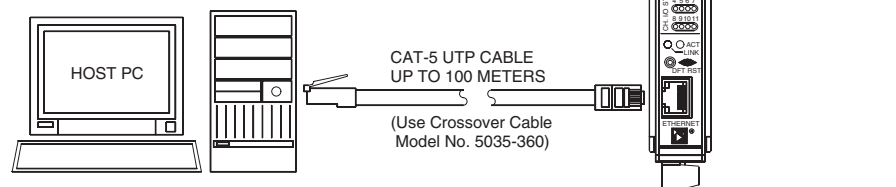


Figure 1: Plug the Ethernet cable from your computer into the I/O module's RJ-45 port to start configuration.

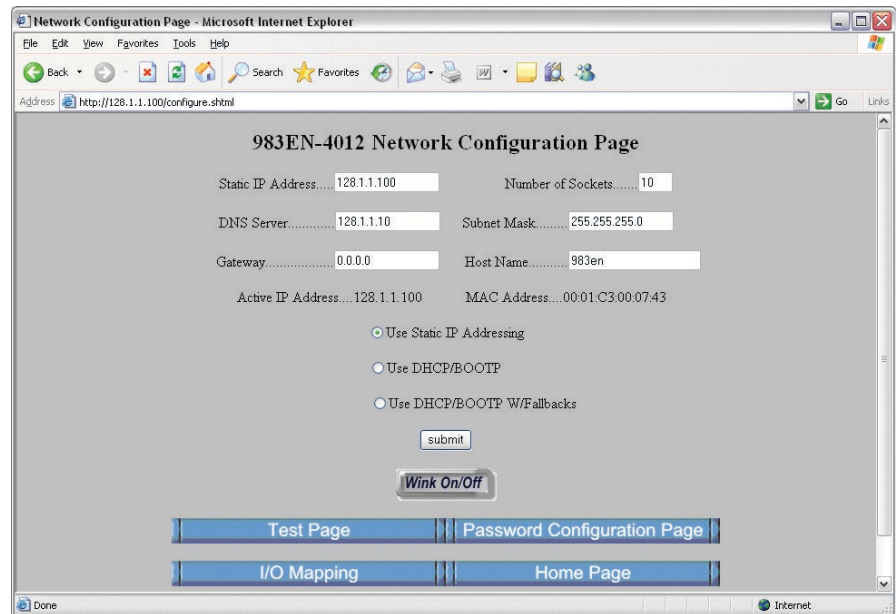


Figure 2: A web page is embedded into each module for easy configuration using a standard web browser.

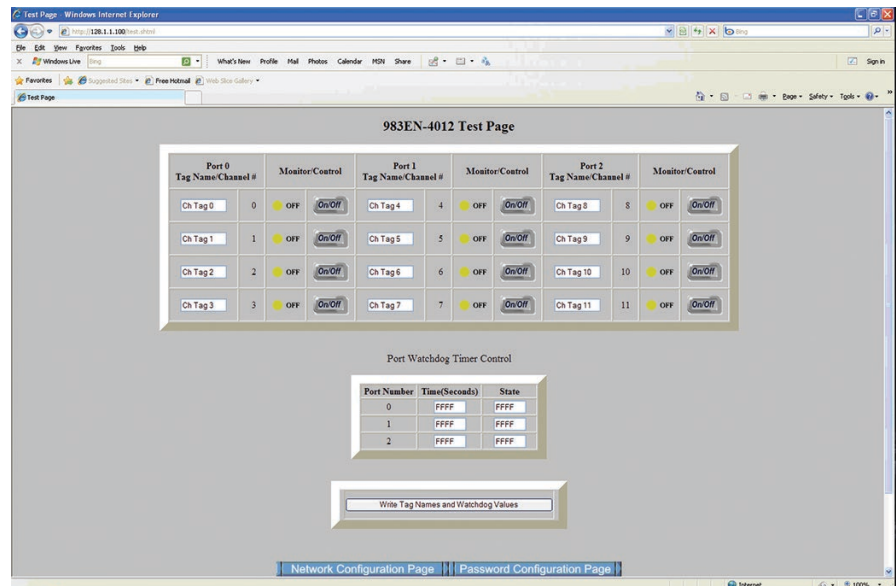


Figure 3: A test page is also accessible with your web browser to confirm proper operation of the I/O module.



Ethernet I/O: BusWorks® Series

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. 9xxEN I/O modules do NOT support auto-crossover. 900EN switch supports auto-crossover.

Protocol

EtherNet/IP or Modbus TCP/IP with web browser configuration. EtherNet/IP supports PCCC object for communication with legacy PLCs (e.g. SLC505).

IP Address

Default static IP address is 128.1.1.100

Port

Ethernet Modbus TCP/IP models (9xxEN-4xxx):

Up to 10 Modbus TCP/IP sockets supported.

EtherNet/IP models (9xxEN-6xxx):

Up to 10 EtherNet/IP sockets and
1 Modbus TCP/IP socket.

Data Rate

Auto-sensed, 10Mbps or 100Mbps.

Duplex

Auto-negotiated, full or half-duplex.

Compliance

IEEE 802.3, 802.3u, 802.3x, Ethernet II.

Configuration

Web page for configuration and control is built-in with Ethernet access via a standard web browser.

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 also user-programmable. A default toggle switch sets the static IP address to the default factory address of 128.1.1.100 for initial configuration.

◆ 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)

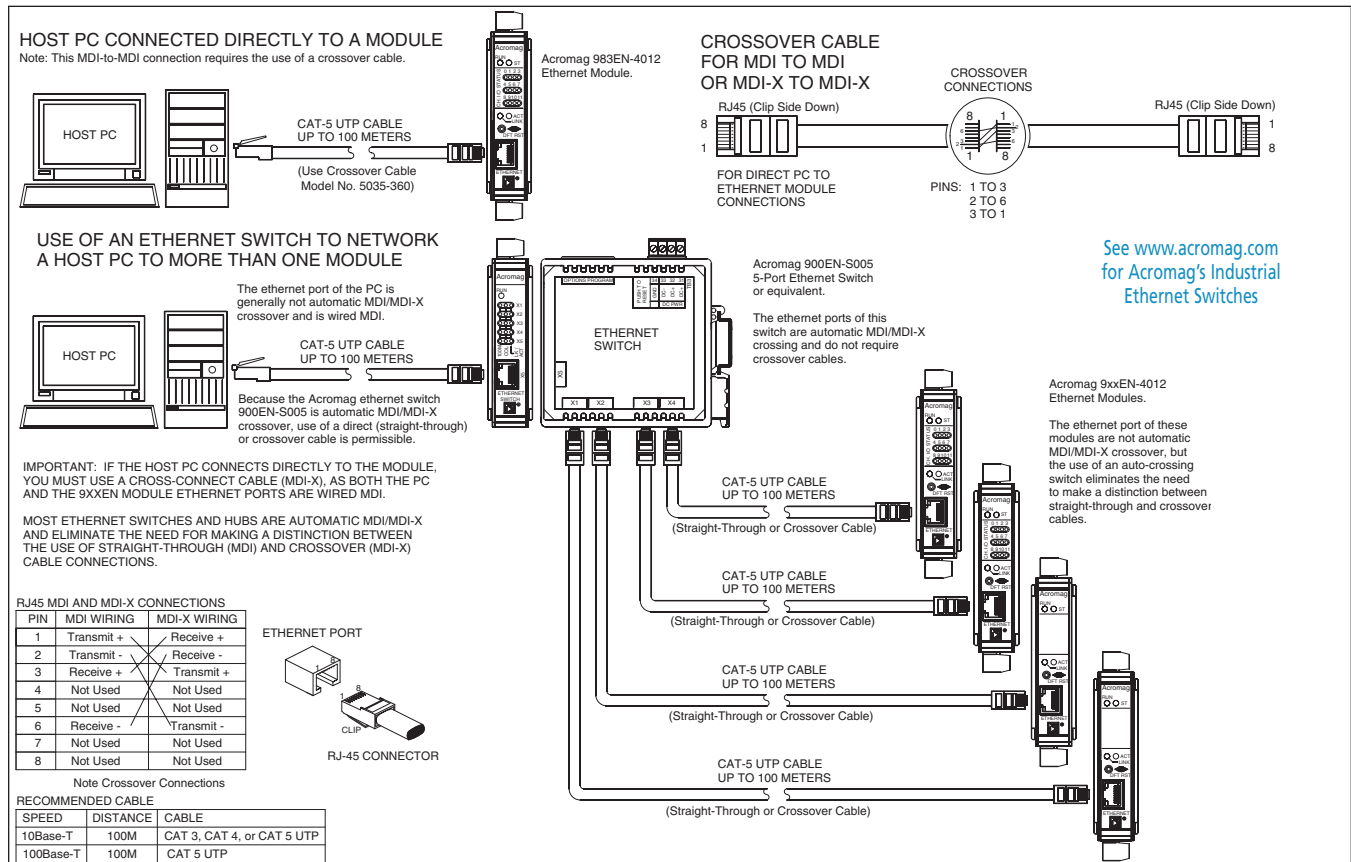
Per EN61000-4-6.

Surge Immunity

Per EN61000-4-5.

Radiated Frequency Emissions

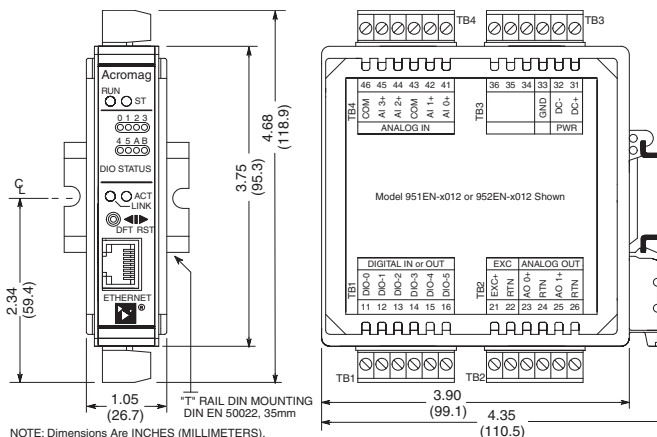
Per EN55022 Class B.





Ethernet I/O: BusWorks® Series

951EN, 952EN Ethernet Analog and Discrete I/O Modules



Standard model includes cage clamp terminal blocks. Optional terminals are available.

EtherNet/IP™
conformance tested

Modbus/TCP
conformance tested

4 Analog Inputs, 2 Analog Outputs, 6 Discrete I/O Channels ♦ Ethernet/IP, Modbus TCP/IP, i2o® Peer-to-peer

Description

Models

951EN: Combo module, analog current inputs

952EN: Combo module, analog voltage inputs

These modules provide an isolated Ethernet network interface for analog and discrete I/O signals. Multi-range analog inputs and outputs support a wide variety of industrial devices. High-resolution, low noise, A/D and D/A converters deliver high accuracy and reliability. 3-way isolation further improves system performance. The discrete I/O provide monitoring and control of on/off, high/low, or open/close industrial devices. Tandem I/O provides output level control and status verification in one unit.

The i2o® function lets inputs on one module write directly to outputs on another module.

Analog Input Ranges

DC Current (user-selectable ranges)
0 to 1mA, 0 to 11mA, 0 to 20mA, 4 to 20mA
0 to 20 amps AC (with optional AC sensor)

DC Voltage (user-selectable ranges)
±1V, ±5V, ±10V DC

Analog Output Ranges

DC Current (user-selectable ranges)
0 to 1mA, 0 to 20mA, or 4 to 20mA
(0 to 625 ohm loads, typical)

Discrete I/O Range

0 to 35V DC active-high inputs
Current sourcing (high-side switched) outputs

Network Communication

EtherNet/IP or Modbus TCP/IP 10/100 network

Power Requirement

15 to 36V DC supply (3.3 Watts) required

Approvals

CE/ATEX marked.
UL, cUL listed, Class I; Div. 2; Groups A, B, C, D.
EtherNet/IP, Modbus/TCP conformance tested.

Key Features & Benefits

- Configurable from standard web browser
- EtherNet/IP or Modbus TCP/IP communication with automatic 10/100Mbps negotiation
- i2o technology for peer-to-peer communication without a network controller
- Multi-function, multi-channel stand-alone module is very economical
- High-resolution 16-bit $\Sigma\Delta$ A/D and D/A converters ensure precise measurements
- 0-35V DC solid-state logic interface can monitor or control a wide variety of devices
- Discrete I/O channels are individually configurable as inputs or outputs in any combination
- Bi-directional discrete I/O facilitates read-back monitoring of the output state
- Built-in 5.6K ohm pull-down SIP resistors (socketed)
- Selectable failsafe modes (0%, off, last-state, or pre-defined) help prevent unsafe conditions
- Compact packaging with pluggable terminals saves space and simplifies wiring
- Wide operational temperature range permits installation in extreme environments

Acromag 
THE LEADER IN INDUSTRIAL I/O

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Ethernet I/O: BusWorks® Series

951EN, 952EN Ethernet Analog and Discrete I/O Modules



Performance Specifications

◆ Analog Input

Configuration

Four input channels. Input range is selectable as a 4-channel group.

Accuracy

Better than $\pm 0.05\%$ of span (0.1% for 0-1mA range), typical. Accuracy near or below 0mA or 0V is degraded if input COM shares AO/DIO RTNs.

Analog to Digital Converter (A/D)

16-bit $\Sigma\Delta$ converter

Resolution: 0.005% or 1 part in 20000

Noise Rejection

Normal Mode: Better than 40dB @ 60Hz

Common Mode: Better than 140dB @ 60Hz

Input Conversion Rate

Less than 50ms per channel

Input Impedance

DC current input (951EN): 49.9 ohms

DC voltage input (952EN): Greater than 110.5K ohms

◆ Analog Output

Configuration

Two output channels. Individually selectable ranges.

Accuracy

Better than $\pm 0.05\%$ of span (0.1% for 0-1mA range), typical.

Digital to Analog Converter (D/A)

16-bit converter

Current Output Compliance

12V minimum, 13V typical

Current Output Load Resistance Range

0 to 625 ohms, typical

◆ Discrete Input

Input Type

Six independent, active-high, buffered inputs with a common connection. Built-in 5.6K ohm pull-down resistors socketed for 3-channel groups.

Input Signal Voltage Range

0 to 35V DC, maximum

Input Impedance

100K ohms, typical

Input Signal Threshold

TTL compatible with 100mV of hysteresis, typical.

◆ Discrete Output

Output Type

Six independent, open-source, MOSFET switches.

Output Voltage and ON Resistance

Up to 35V DC max. (0 to 330mA/ch continuous).

0.15 ohms maximum ON resistance.

◆ Environmental

Ambient Temperature and Humidity

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 Information

NOTE: i2o function only on Modbus TCP/IP modules

◆ I/O Modules

951EN-4012

Combo module, current inputs, Ethernet Modbus TCP/IP interface, i2o communication

951EN-6012

Combo module, current inputs, EtherNet/IP interface

952EN-4012

Combo module, voltage inputs, Ethernet Modbus TCP/IP interface, i2o communication

952EN-6012

Combo module, voltage inputs, EtherNet/IP interface

◆ Accessories

Industrial Ethernet Switches

Hardware Accessories and Power Supplies

Software Support

i2o™ Input-to-Output Peer-to-Peer Communication



Acromag's i2o technology allows modules to talk directly to another module across any Ethernet media without a PLC, PC, or other controller in between. Input channels on one module can write to output channels on a remote module.

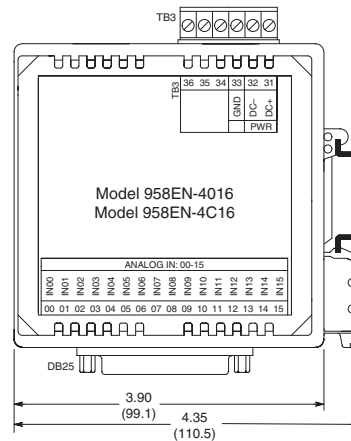
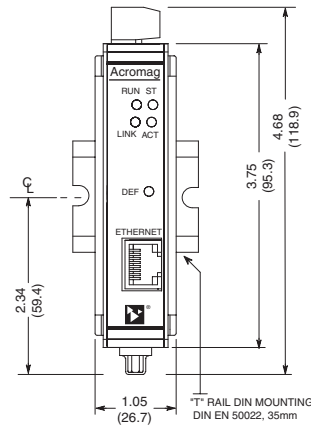
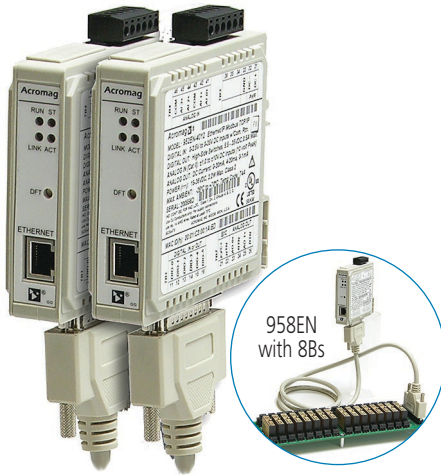


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Ethernet I/O: BusWorks® Series

958EN Ethernet 8B Interface Modules (Analog Input)



Standard model includes cage clamp terminal blocks.
Optional terminals are available.

16-channel Single-ended Voltage Input ♦ DB25 Port for 8B Modules ♦ Modbus TCP/IP communication

Description

Models

958EN-4016: Industrial-grade units

958EN-4C16: Commercial-grade units

These modules interface high-level analog input signals to an Ethernet control network. A high-performance design ensures reliable measurements and dependable operation.

The DB25 port provides a parallel connection to a rack of 8B analog input modules. The 8B modules provide an isolated front-end with signal conditioning of up to 16 sensor signals.

Industrial-grade models add a configurable integrator/totalizer plus superior accuracy and temperature performance compared to the economical commercial-grade version.

Input Ranges

±5V DC via DB25 port connection (default) or
±10V DC

Ethernet Communication

Modbus TCP/IP, 10/100Base-T(X)

Power Requirement

18 to 36V DC, 2.0W

Approvals

CE, UL/cUL (industrial-grade units only)
Zone 2, Class 1, Division 2, ABCD

Key Features & Benefits

- DB25 port provides an easy connection to a rack of 8B signal conditioning modules (4, 8, or 16 ch panels supported)
- High-resolution 16-bit A/D
- Fast scanning of all channels in 8mS
- 3-way isolation and surge suppression
- Configurable integration/totalization function with non-volatile memory
- Dual-format 16/32-bit data registers
- Scaling registers on all channels
- Configurable sample averaging
- Automatic calibration and self-test
- User-adjustable TCP Ports 1-99,999 for advanced network configuration
- Web browser configuration with copy utility for fast setup

Performance Specifications

Accuracy

958EN-4016: Less than 0.05% of range.
958EN-4C16: Less than 0.10% of range.

Input Impedance

4M ohms

Operating Temperature and Humidity Ranges

958EN-4016: -40 to 70°C (-40 to 158°F)

958EN-4C16: 0 to 55°C (32 to 131°F)

Relative humidity: 5 to 95%, non-condensing

Isolation

3-way isolation of I/O, power, network circuits.

Peak: 1500V AC, ANSI/ISA-82.01-1988.

Continuous: 250V AC, 354V DC.

Ordering Information

♦ I/O Modules

[Go to on-line ordering page >](#)

958EN-4016 {industrial-grade}

16-ch voltage input module with integrator

958EN-4C16 {commercial-grade*}

16-ch voltage input module

* CE approval only, no integrator function

♦ Accessories

Industrial Ethernet Switches

Hardware Accessories and Power Supplies

Software Support

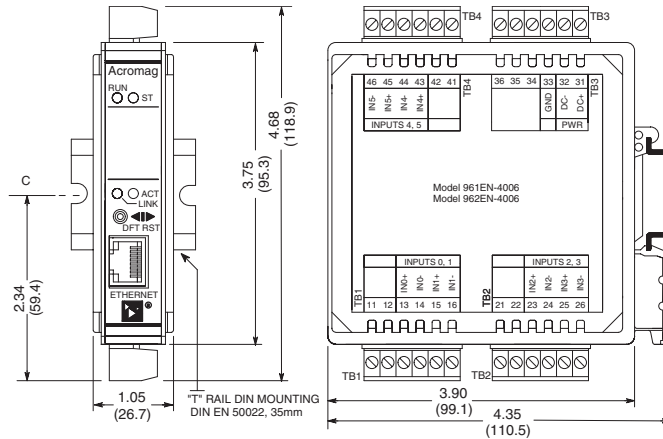


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Ethernet I/O: BusWorks® Series

961EN, 962EN Ethernet Analog Input Modules



Standard model includes cage clamp terminal blocks.
Optional terminals are available.

EtherNet/IP™
conformance tested

Modbus/TCP
conformance tested

6-channel Differential Analog Current or Voltage Input ♦ Ethernet/IP, Modbus TCP/IP, i2o® Peer-to-peer

Description

Models

961EN: 6 DC current input channels
962EN: 6 DC voltage input channels

These modules provide an isolated Ethernet network interface for six analog input channels. Differential inputs eliminate ground loops and thus the need for isolators in many applications. 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

Ranges are selectable for a 3-channel group.

DC Current:

0 to 1mA, 0 to 11mA, 0 to 20mA, 4 to 20mA
0 to 20 amps AC (with optional AC sensor)

DC Voltage:

±78mV to ±10V DC (eight range options)

Network Communication

EtherNet/IP or Modbus TCP/IP 10/100Mbps

Power Requirement

15 to 36V DC supply (2 Watts) required

Approvals

CE/ATEX marked.
UL, cUL listed, Class I; Div. 2; Groups A, B, C, D
EtherNet/IP, Modbus/TCP conformance tested.

Key Features & Benefits

Configurable from standard web browser

EtherNet/IP or Modbus TCP/IP communication
with auto 10/100Mbps data rate negotiation

i2o technology for peer-to-peer communication
without a network controller

6-input stand-alone module is very economical

Differential inputs eliminate ground loops

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

Wide operational temperature range permits
installation in extreme environments

Performance Specifications

♦ Input

Accuracy

Better than $\pm 0.05\%$ of span for nominal input ranges.

Analog to Digital Converter (A/D)

16-bit Σ - Δ converter. 0.005% (1/20000) resolution.

Noise Rejection

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

Input Filter Bandwidth

-3dB at 3Hz, typical.

Input Conversion Rate

80ms per channel.

Input Impedance

DC current input: 25 ohms
DC voltage input: Greater than 110.5K ohms.

♦ Environmental

Ambient Temperature and Humidity

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 Information

NOTE: i2o function only on Modbus TCP/IP modules

♦ I/O Modules

961EN-4006

Current input, 6-channel, Ethernet Modbus TCP/IP,
i2o communication

961EN-6006

Current input, 6-channel, EtherNet/IP

962EN-4006

Voltage input, 6-channel, Ethernet Modbus TCP/IP,
i2o communication

962EN-6006

Voltage input, 6-channel, EtherNet/IP

♦ Accessories

Industrial Ethernet Switches

Hardware Accessories and Power Supplies

Software Support

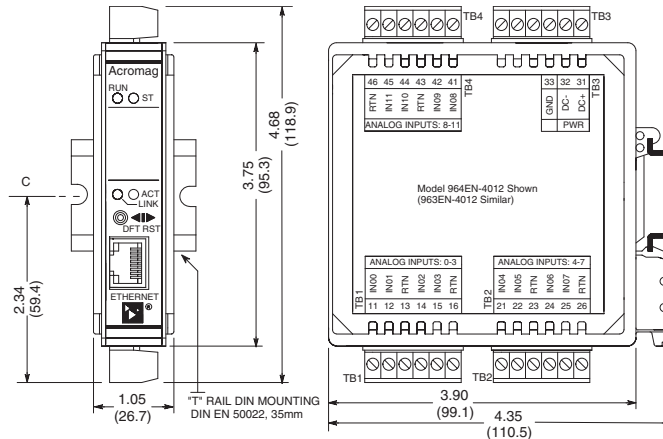
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Ethernet I/O: BusWorks® Series

963EN, 964EN Ethernet Analog Input Modules



Standard model includes cage clamp terminal blocks.
Optional terminals are available.

EtherNet/IP™
conformance tested

Modbus/TCP
conformance tested

12-channel Single-ended Analog Current or Voltage Input ♦ Ethernet/IP or Modbus TCP/IP Communication

Description

Models

963EN: 12 DC current input channels

964EN: 12 DC voltage input channels

These modules provide an isolated Ethernet network interface for twelve analog input channels. Compact design saves space and lowers system costs. 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

Ranges user-selectable on each terminal block for a group of four input channels (4-channel basis).

DC Current:

0 to 1mA, 0 to 11mA, 0 to 20mA, 4 to 20mA
0 to 20 amps AC (with optional AC sensor)

DC Voltage:

±1V, ±5V, or ±10V DC

Network Communication

EtherNet/IP or Modbus TCP/IP 10/100Mbps

Power Requirement

15 to 36V DC supply (2 Watts) required

Approvals

CE/ATEX marked.

UL, cUL listed, Class I; Div. 2; Groups A, B, C, D.

EtherNet/IP, Modbus/TCP conformance tested.

Key Features & Benefits

- Configurable from standard web browser
- EtherNet/IP or Modbus TCP/IP communication with auto 10/100Mbps data rate negotiation
- 12-input module has very low cost per channel
- Universal DC inputs support a wide variety of industrial sensors and signals
- High-resolution 16-bit Σ - Δ A/D converters ensure precise, high accuracy measurements
- Wide operational temperature range permits installation in extreme environments

Performance Specifications

♦ Input

Accuracy

Better than $\pm 0.05\%$ of span for nominal input ranges.

Analog to Digital Converter (A/D)

16-bit Σ - Δ converter. 0.005% (1/20000) resolution.

Noise Rejection

Normal Mode: Better than 40dB @ 60Hz.

Common Mode: Better than 140dB @ 60Hz.

Input Filter Bandwidth

-3dB at 3Hz, typical.

Input Conversion Rate

180mS per channel.

Input Impedance

DC Current Input: 49.9 ohms.

DC Voltage Input: Greater than 110.5K ohms.

♦ Environmental

Ambient Temperature and Humidity

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.

Inputs share a common.

Ordering Information

♦ I/O Modules

963EN-4012

Current input, 12-channel, Ethernet Modbus TCP/IP

963EN-6012

Current input, 12-channel, EtherNet/IP

964EN-4012

Voltage input, 12-channel, Ethernet Modbus TCP/IP

964EN-6012

Voltage input, 12-channel, EtherNet/IP

♦ Accessories

Industrial Ethernet Switches

Hardware Accessories and Power Supplies

Software Support

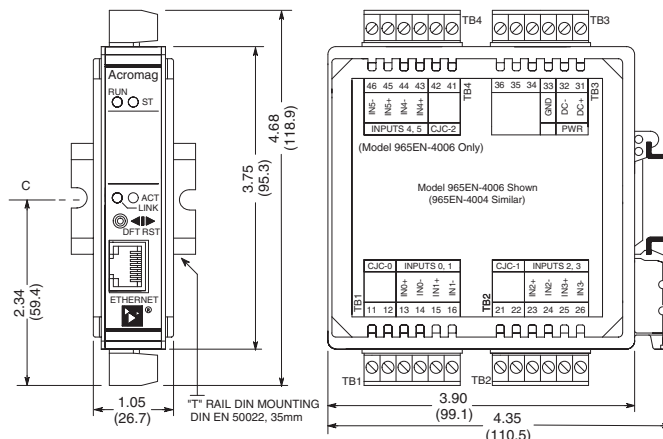
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Ethernet I/O: BusWorks® Series

965EN Ethernet Temperature Input Modules



Standard model includes cage clamp terminal blocks. Optional terminals are available.

EtherNet/IP™
conformance tested

Modbus/TCP
conformance tested

4 or 6-channel Thermocouple/milliVolt Input ♦ Ethernet/IP, Modbus TCP/IP, i2o® Peer-to-peer Messaging

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

Ranges are selectable for a 3-channel group.

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/IP or Modbus TCP/IP 10/100Mbps with automatic data rate negotiation

Power Requirement

15 to 36V DC supply (2 Watts) required

Approvals

CE/ATEX marked.

UL, cUL listed, Class I; Div. 2; Groups A, B, C, D.

EtherNet/IP, Modbus/TCP conformance tested.

Key Features & Benefits

- Configurable from standard web browser
- Universal inputs support a variety of sensors
- Thermocouple break detection (upscale or downscale) identifies sensor wiring failures
- High-resolution 16-bit Σ - Δ A/D converters ensure precise, high accuracy measurements
- Wide operational temperature range

Performance Specifications

♦ Input

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.

Noise Rejection

Normal Mode: Better than 40dB @ 60Hz.

Common Mode: Better than 140dB @ 60Hz.

Input Filter Bandwidth

-3dB at 3Hz, typical.

Input Conversion Rate

80mS per channel.

♦ Environmental

Ambient Temperature and Humidity

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 Information

NOTE: i2o function only available on 6-channel Modbus TCP/IP modules

♦ I/O Modules

965EN-4004

4-channel TC/mV input, Ethernet Modbus TCP/IP

965EN-6004

4-channel TC/mV input, EtherNet/IP

965EN-4006

6-channel TC/mV input, Ethernet Modbus TCP/IP, i2o

965EN-6006

6-channel TC/mV input, EtherNet/IP interface

♦ Accessories

Industrial Ethernet Switches

Hardware Accessories and Power Supplies

Software Support

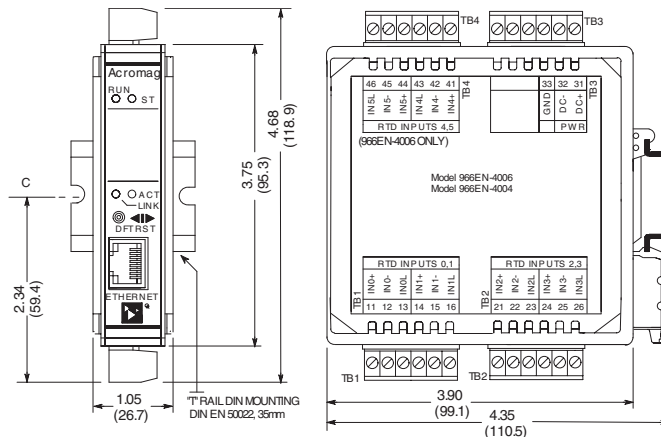
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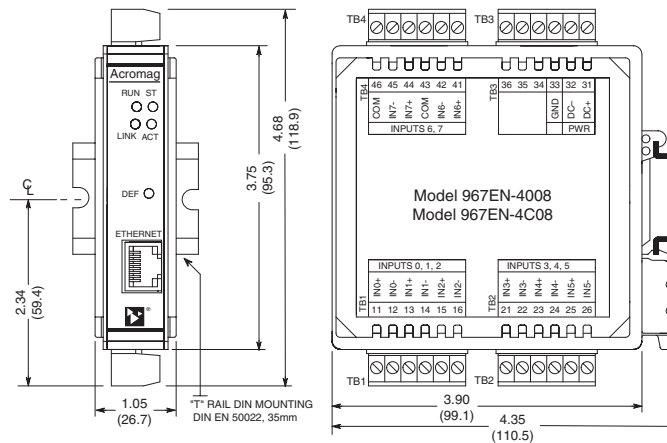
Ethernet I/O: BusWorks® Series

966EN Ethernet Temperature Input Modules



Ethernet I/O: BusWorks® Series

967EN Ethernet Analog Input Modules



Standard model includes cage clamp terminal blocks.
Optional terminals are available.

Modbus/TCP
conformance tested

8-channel Differential Current Input ♦ Modbus TCP/IP, i2o® Peer-to-peer Communication

Description

Models

967EN-4008: Industrial-grade units
967EN-4C08: Commercial-grade units

These modules interface high-level analog input signals to an Ethernet network. A high-performance design ensures reliable measurements and dependable operation.

Industrial-grade models add a configurable integrator/totalizer plus superior accuracy and temperature performance compared to the economical commercial-grade version.

Input Ranges

±20mA, 0-20mA, 4-20mA DC
(selectable on each channel)

Ethernet Communication

Modbus TCP/IP, 10/100Base-T(X),
i2o peer-to-peer

Power Requirement

18 to 36V DC, 2.4W

Approvals

CE, UL/cUL (industrial-grade units only)
Zone 2, Class 1, Division 2, ABCD

Key Features & Benefits

- High-resolution 16-bit A/D
- Fast scanning of all channels in 8mS
- 3-way isolation and surge suppression
- Peer-to-peer i2o communication with percent-of-span or timed-based updates
- Configurable integration/totalization function with non-volatile registers
- Dual-format 16/32-bit data registers
- Scaling registers on all channels
- Configurable sample averaging
- Automatic calibration and self-test
- User-adjustable TCP Ports 1-99,999 for advanced network configuration
- Web browser configuration with copy utility for fast setup

i2o® Peer-to-peer Messaging

With Acromag's i2o technology, you can map each input channel to any output channel on a 97xEN-400x output unit. Select updates based on time or on a percent of range change (100mS or 0.1% resolution).

Performance Specifications

Accuracy

967EN-4008: Less than 0.05% of range
967EN-4C08: Less than 0.10% of range

Input Impedance

200 ohms.

Operating Temperature and Humidity Ranges

967EN-4008: -40 to 70°C (-40 to 158°F)

967EN-4C08: 0 to 55°C (32 to 131°F)

Relative humidity: 5 to 95%, non-condensing

Isolation

3-way isolation of I/O, power, network circuits.

Peak: 1500V AC, ANSI/ISA-82.01-1988.

Continuous: 250V AC, 354V DC.

Ordering Information

♦ I/O Modules

967EN-4008 {industrial-grade}
8-ch current input module with integrator

967EN-4C08 {commercial-grade*}
8-ch current input module

* CE approval only, no integrator function

♦ Accessories

Industrial Ethernet Switches

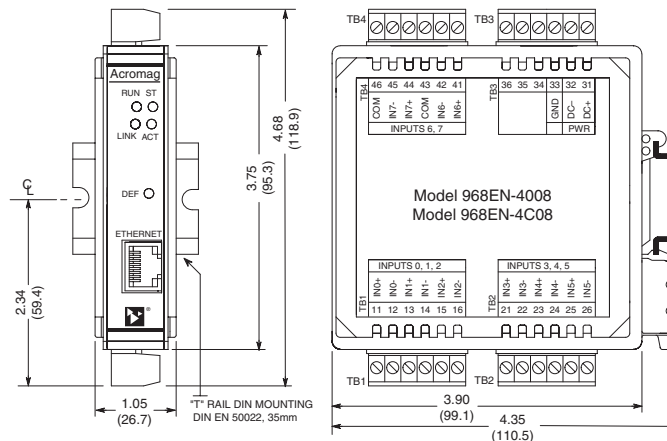
Hardware Accessories and Power Supplies

Software Support

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Ethernet I/O: BusWorks® Series

968EN Ethernet Analog Input Modules



Standard model includes cage clamp terminal blocks.
Optional terminals are available.

Modbus/TCP
conformance tested

8-channel Differential Analog Voltage Input ♦ Modbus TCP/IP, i2o® Peer-to-peer Communication

Description

Models

968EN-4008: Industrial-grade units

968EN-4C08: Commercial-grade units

These modules interface high-level analog input signals to an Ethernet network. A high-performance design ensures reliable measurements and dependable operation.

Industrial-grade models add a configurable integrator/totalizer plus superior accuracy and temperature performance compared to the economical commercial-grade version.

Input Ranges

±5V, ±10V DC (selectable on each channel)

Ethernet Communication

Modbus TCP/IP, 10/100Base-T(X),
i2o peer-to-peer

Power Requirement

18 to 36V DC, 2.4W

Approvals

CE, UL/cUL (industrial-grade units only)
Zone 2, Class 1, Division 2, ABCD

Key Features & Benefits

- High-resolution 16-bit A/D
- Fast scanning of all channels in 8mS
- 3-way isolation and surge suppression
- Peer-to-peer i2o communication with percent-of-span or timed-based updates
- Configurable integration/totalization function with non-volatile registers
- Dual-format 16/32-bit data registers
- Scaling registers on all channels
- Configurable sample averaging
- Automatic calibration and self-test
- User-adjustable TCP Ports 1-99,999 for advanced network configuration
- Web browser configuration with copy utility for fast setup

i2o® Peer-to-peer Messaging

With Acromag's i2o technology, you can map each input channel to any output channel on a 97xEN-400x output unit. Select updates based on time or on a percent of range change (100mS or 0.1% resolution).

Performance Specifications

Accuracy

968EN-4008: Less than 0.05% of range
968EN-4C08: Less than 0.10% of range

Input Impedance

4M ohms

Operating Temperature and Humidity Ranges

968EN-4008: -40 to 70°C (-40 to 158°F)

968EN-4C08: 0 to 55°C (32 to 131°F)

Relative humidity: 5 to 95%, non-condensing

Isolation

3-way isolation of I/O, power, network circuits.

Peak: 1500V AC, ANSI/ISA-82.01-1988

Continuous: 250V AC, 354V DC

Ordering Information

♦ I/O Modules

968EN-4008 {industrial-grade}
8-ch voltage input module with integrator

968EN-4C08 {commercial-grade*}
8-ch voltage input module

* CE approval only, no integrator function

♦ Accessories

Industrial Ethernet Switches

Hardware Accessories and Power Supplies

Software Support

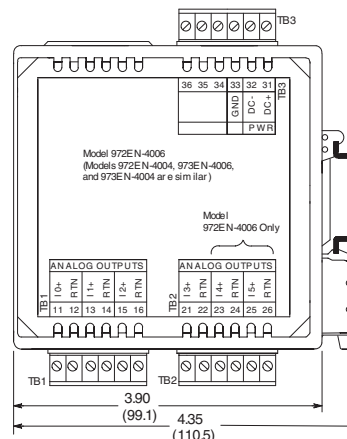
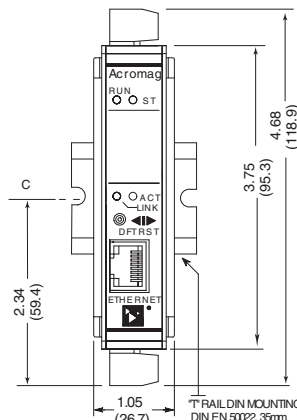
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Ethernet I/O: BusWorks® Series

972EN, 973EN Ethernet Analog Output Modules



Standard model includes cage clamp terminal blocks.
Optional terminals are available.

EtherNet/IP™
conformance tested

Modbus/TCP
conformance tested

4 or 6-channel DC Current or Voltage Output ♦ Ethernet/IP, Modbus TCP/IP, i2o® Peer-to-peer Messaging

Description

Models

972EN: DC current output channels

973EN: DC voltage output channels

These modules provide up to six channels of analog output. Multi-range outputs support a wide variety of industrial devices. They can drive displays and recorders, control drives, or send analog signals to other systems. High-resolution, low noise, D/A converters deliver high accuracy and reliability. 3-way isolation further improves system performance.

Output Ranges

Ranges selectable on channel to channel basis.

DC Current (user-selectable ranges)
0 to 1mA, 0 to 20mA, or 4 to 20mA

DC Voltage (user-selectable ranges)
0 to 1V, 0 to 5V, or 0 to 10V DC

Network Communication

EtherNet/IP or Modbus TCP/IP/100Mbps
with automatic data rate negotiation

Power Requirement

15 to 36V DC supply required
4.6 Watts (972EN) or 2.3 Watts (973EN)

Approvals

CE/ATEX marked.
UL, cUL listed, Class I; Div. 2; Groups A, B, C, D
EtherNet/IP, Modbus/TCP conformance tested

Key Features & Benefits

- Configurable from standard web browser
- 6-input stand-alone module has much lower start-up cost than multi-piece block I/O systems
- Universal DC outputs support a wide variety of signals and industrial devices
- Three selectable failsafe modes (0%, last-state, or pre-defined) help prevent unsafe conditions
- Wide operational temperature range permits installation in extreme environments

Performance Specifications

♦ Output

Accuracy

Better than $\pm 0.1\%$ of span, typical.
1.6% for 0 to 1mA range. 0.8% for 0 to 1V range.

Digital to Analog Converter (D/A)

12-bit converter

Current Output Compliance

12V minimum, 13V typical

Current Output Load Resistance Range

0 to 625 ohms, typical

Voltage Output Source Current

0 to 10mA DC, maximum

♦ Environmental

Ambient Temperature and Humidity

Operating:

972EN models: -25 to 60°C (-13 to 140°F)

973EN models: -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.
Outputs share a common.

Ordering Information

NOTE: i2o function only on Modbus TCP/IP modules

♦ I/O Modules

972EN-4004

4-ch. current output, Ethernet Modbus TCP/IP, i2o

972EN-6006

6-ch. current output, Ethernet Modbus TCP/IP, i2o

972EN-6004

4-channel current output, EtherNet/IP

972EN-6006

6-channel current output, EtherNet/IP

973EN-4004

4-ch. voltage output, Ethernet Modbus TCP/IP, i2o

973EN-4006

6-ch. voltage output, Ethernet Modbus/TCP, i2o

973EN-6004

4-channel voltage output, EtherNet/IP

973EN-6006

6-channel voltage output, EtherNet/IP

♦ Accessories

Industrial Ethernet Switches

Hardware Accessories and Power Supplies

Software Support

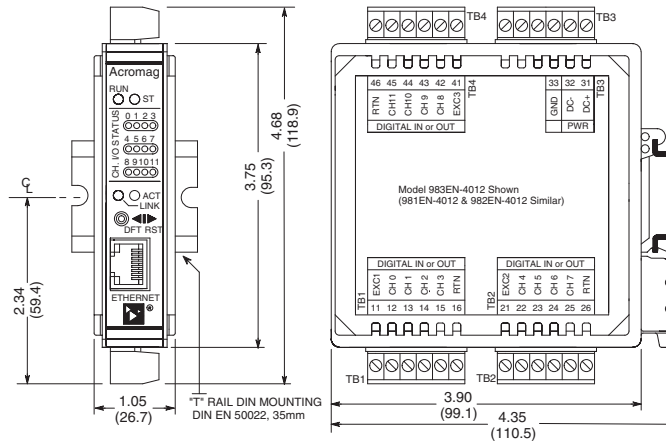
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Ethernet I/O: BusWorks® Series

981EN, 982EN, 983EN Ethernet Discrete I/O Modules



Standard model includes cage clamp terminal blocks. Optional terminals are available.

EtherNet/IP™
conformance tested
Modbus/TCP
conformance tested

12-channel Discrete Input and/or Output ♦ Ethernet/IP, Modbus TCP/IP, i2o® Peer-to-peer Messaging

Description

Models

981EN: 12 input channels
982EN: 12 output channels
983EN: 12 input/output channels

These modules provide an isolated Ethernet network interface for twelve discrete input and/or output channels. The outputs provide direct on/off, high/low, or open/close control of industrial devices. The inputs sense the status of motors, pumps, valves and other equipment. The 983EN model with tandem I/O provides output level control and status verification in one unit.

Input Range

0 to 35V DC

Output Range

0 to 35V DC

Network Communication

EtherNet/IP or Modbus TCP/IP 10/100Mbps with automatic data rate negotiation

Power Requirement

15 to 36V DC supply (2 Watts) required

Approvals

CE/ATEX marked.
UL, cUL listed, Class I; Div. 2; Groups A, B, C, D.
EtherNet/IP, Modbus/TCP conformance tested.

Key Features & Benefits

- Configurable from standard web browser
- 12-channel stand-alone module has far lower start-up cost than multi-piece block I/O systems
- 0-35V DC solid-state logic interface can monitor or control a wide variety of devices
- Bidirectional I/O models facilitate loopback monitoring of the output state
- Socketed SIP resistors provide input and output 5.6K ohm pull-ups to the excitation supply
- Three selectable failsafe modes (off, last-state, or pre-defined) help prevent unsafe conditions

Performance Specifications

♦ Input (981 & 983 models)

Input Type

Twelve active-low, buffered inputs, with a common connection. Built-in 5.6K ohm pullups to excitation terminal socketed for 4-channel groups.

Input Signal Voltage Range
0 to 35V DC, maximum.

Input Impedance
100K ohms, typical.

Input Signal Threshold
TTL compatible with 100mV of hysteresis, typical.

♦ Output (982 & 983 models)

Output Type

12 independent, open-drain, MOSFET switches.

Output Voltage and ON Resistance
0 to 35V DC max. (0 to 500mA/channel continuous).
0.28 ohms maximum ON resistance.

♦ Environmental

Ambient Temperature and Humidity
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 Information

NOTE: i2o function only on Modbus TCP/IP modules. 981EN does not have the i2o feature.

♦ I/O Modules

981EN-4012

Discrete input, Ethernet Modbus TCP/IP

981EN-6012

Discrete input, EtherNet/IP

982EN-4012

Discrete output, Ethernet Modbus TCP/IP, i2o

982EN-6012

Discrete output, EtherNet/IP

983EN-4012

Discrete input/output, Ethernet Modbus TCP/IP, i2o

983EN-6012

Discrete input/output, EtherNet/IP

♦ Accessories

Industrial Ethernet Switches.

Hardware Accessories and Power Supplies

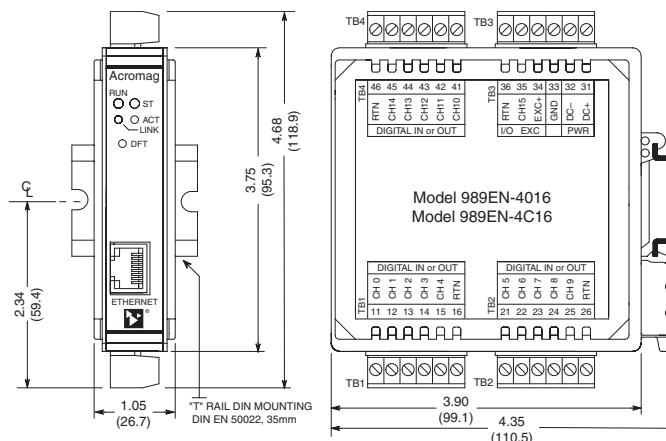
Software Support

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Ethernet I/O: BusWorks® Series

989EN Ethernet Discrete I/O Modules with Counter/Timers



Standard model includes cage clamp terminal blocks.
Optional terminals are available.

Modbus/TCP
conformance tested

16-channel Discrete I/O ♦ 8 Counter/timers ♦ Modbus TCP/IP Communication

Description

Models

989EN-4016: Industrial-grade version

989EN-4C16: Commercial-grade (no counters)

These modules provide an isolated Ethernet interface for any input/output mix of up to 16 discrete signals. Inputs sense the status of dry contacts, switches, power supplies, and DC logic. Industrial-grade units have eight 32-bit counters with timers, alarms, and non-volatile memory for metering, totalizing, and low-frequency periodic measurement. The outputs control solid-state switching of lamps, horns, and other devices.

Input/Output Ranges

Input: 0-28V DC, 31V DC maximum

Output: 0-28V DC, 0.5A/ch max, 2A total

Counter/Timers

(Industrial-grade units)

8 up/down counters, 32-bit, 150Hz max

8 timers, 16-bit, 1mS resolution

Ethernet Communication

Modbus TCP/IP, 10/100Base-T(X)

Power Requirement

18 to 36V DC (1.33 W)

Approvals (industrial-grade only)

CE, UL/cUL

Zone 2, Class 1, Division 2, ABCD

Key Features & Benefits

- 16 solid-state discrete I/O channels (any mix of inputs/outputs)
- 3-way isolation and surge suppression
- Web browser configuration
- Automatic MDI/MDI-X negotiation
- Inputs accept 2- or 3-wire sensors and active logic switches (dry contacts, proximity, namur, 5-28V DC logic)
- Inputs detect level and change of state
- 8 configurable counter/timers
 - 32-bit up/down pulse/event counters (with non-volatile memory)
 - 16-bit periodic timers for "last pulse"
 - Momentary/latch alarms (each counter)
- Programmable debounce (0-65 seconds with 1mS resolution)
- Programmable power-up conditions
- Over-temperature, over-current, and over-voltage output protection
- Ability to "read-back" output states
- Watchdog timer output configurable for failsafe or hold-last-value operation
- Self-test and auto-copy functions

Performance Specifications

♦ Environmental

Operating Temperature Range

989EN-4016: -40 to 65°C (-40 to 149°F)

989EN-4C16: 0 to 55°C (32 to 131°F)

Storage Temperature Range

989EN-4016: -40 to 85°C (-40 to 185°F)

989EN-4C16: 0 to 70°C (32 to 158°F)

Relative Humidity

5 to 95%, non-condensing

Isolation

3-way isolation of I/O, power, network circuits.

Peak: 1500V AC, ANSI/ISA-82.01-1988

Continuous: 250V AC, 354V DC

Ordering Information

♦ I/O Modules

989EN-4016

16 I/O channels with pulse counter/timers

989EN-4C16

Commercial-grade, 16 I/O, no counter/timers

♦ Accessories

[Industrial Ethernet Switches](#)

[Hardware Accessories and Power Supplies](#)

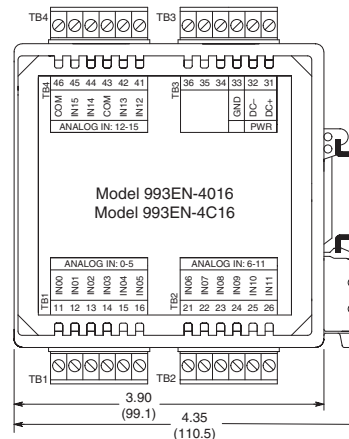
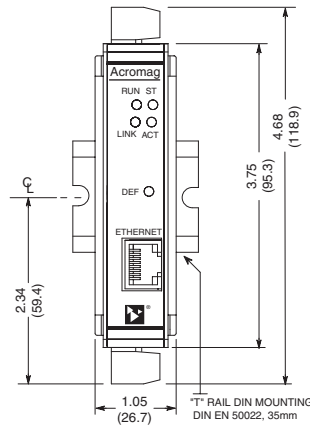
[Software Support](#)

Acromag 
THE LEADER IN INDUSTRIAL I/O

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Ethernet I/O: BusWorks® Series

993EN Ethernet Analog Input Modules



Standard model includes cage clamp terminal blocks.
Optional terminals are available.

Modbus/TCP
conformance tested

16-channel Single-ended Analog Current Input ♦ Modbus TCP/IP Communication

Description

Models

993EN-4016: Industrial-grade units

993EN-4C16: Commercial-grade units

These modules interface high-level analog input signals to an Ethernet control network. A high-performance design ensures reliable measurements and dependable operation.

Industrial-grade models add a configurable integrator/totalizer plus superior accuracy and temperature performance compared to the economical commercial-grade version.

Input Ranges

±20mA, 0-20mA, 4-20mA DC
(selectable on each channel)

Ethernet Communication

Modbus TCP/IP, 10/100Base-T(X)

Power Requirement

18 to 36V DC, 2.0W

Approvals

CE, UL/cUL (industrial-grade units only)
Zone 2, Class 1, Division 2, ABCD

Key Features & Benefits

- High-resolution 16-bit A/D
- Fast scanning of all channels in 8mS
- 3-way isolation and surge suppression
- Configurable integration/totalization function with non-volatile registers
- Dual-format 16/32-bit data registers
- Scaling registers on all channels
- Configurable sample averaging
- Automatic calibration and self-test
- User-adjustable TCP Ports 1-99,999 for advanced network configuration
- Web browser configuration with copy utility for fast setup

Performance Specifications

Accuracy

993EN-4016: Less than 0.05% of range
993EN-4C16: Less than 0.10% of range

Input Impedance

200 ohms

Operating Temperature and Humidity Ranges

993EN-4016: -40 to 70°C (-40 to 158°F)

993EN-4C16: 0 to 55°C (32 to 131°F)

Relative humidity: 5 to 95%, non-condensing

Isolation

3-way isolation of I/O, power, network circuits.

Peak: 1500V AC, ANSI/ISA-82.01-1988

Continuous: 250V AC, 354V DC

Ordering Information

♦ I/O Modules

993EN-4016 {industrial-grade}

16-ch current input module with integrator

993EN-4C16 {commercial-grade*}

16-ch current input module

* CE approval only, no integrator function

♦ Accessories

Industrial Ethernet Switches

Hardware Accessories and Power Supplies

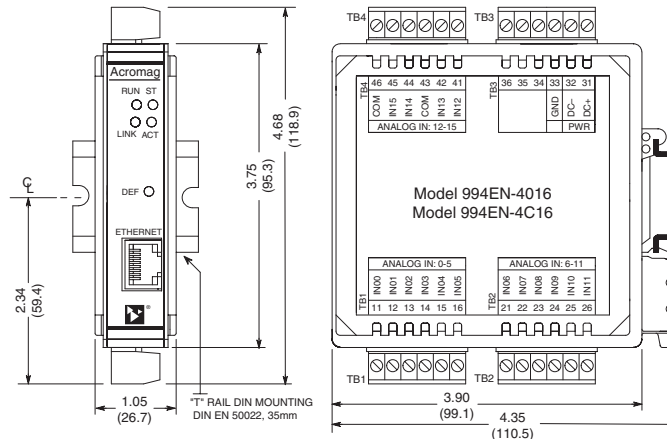
Software Support

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Ethernet I/O: BusWorks® Series

994EN Ethernet Analog Input Modules



Standard model includes cage clamp terminal blocks.
Optional terminals are available.

Modbus/TCP
conformance tested

16-channel Single-ended Analog Voltage Input ♦ Modbus TCP/IP Communication

Description

Models

994EN-4016: Industrial-grade units

994EN-4C16: Commercial-grade units

These modules interface high-level analog input signals to an Ethernet control network. A high-performance design ensures reliable measurements and dependable operation.

Industrial-grade models add a configurable integrator/totalizer plus superior accuracy and temperature performance compared to the economical commercial-grade version.

Input Ranges

±5V, ±10V DC
(selectable on each channel)

Ethernet Communication

Modbus TCP/IP, 10/100Base-T(X)

Power Requirement

18 to 36V DC, 2.0W

Approvals

CE, UL/cUL (industrial-grade units only)
Zone 2, Class 1, Division 2, ABCD

Key Features & Benefits

- High-resolution 16-bit A/D
- Fast scanning of all channels in 8mS
- 3-way isolation and surge suppression
- Configurable integration/totalization function with non-volatile registers
- Dual-format 16/32-bit data registers
- Scaling registers on all channels
- Configurable sample averaging
- Automatic calibration and self-test
- User-adjustable TCP Ports 1-99,999 for advanced network configuration
- Web browser configuration with copy utility for fast setup

Performance Specifications

Accuracy

994EN-4016: Less than 0.05% of range
994EN-4C16: Less than 0.10% of range

Input Impedance

4M ohms

Operating Temperature and Humidity Ranges

994EN-4016: -40 to 70°C (-40 to 158°F)
994EN-4C16: 0 to 55°C (32 to 131°F)
Relative humidity: 5 to 95%, non-condensing.

Isolation

3-way isolation of I/O, power, network circuits.
Peak: 1500V AC, ANSI/ISA-82.01-1988
Continuous: 250V AC, 354V DC

Ordering Information

♦ I/O Modules

994EN-4016 {industrial-grade}
16-ch voltage input module with integrator

994EN-4C16 {commercial-grade*}
16-ch voltage input module

* CE approval only, no integrator function

♦ Accessories

Industrial Ethernet Switches

Hardware Accessories and Power Supplies

Software Support

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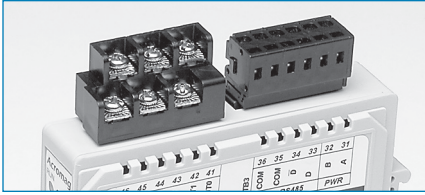
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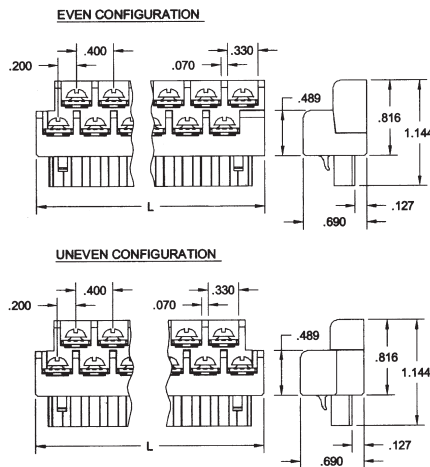
Ethernet I/O: BusWorks® Series

Accessories

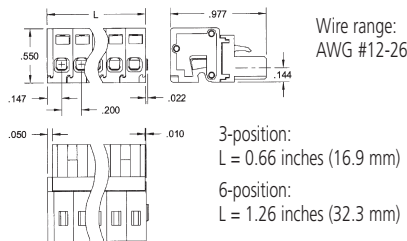
◆ Terminal Blocks



Barrier Strip Terminal Blocks*



Spring Clamp Terminal Blocks*



Ordering Information

* I/O modules ship with cage clamp terminal blocks. Terminal block kits are for replacement purposes. See I/O module information for compatibility

Barrier Strip

[TBK-B01](#)

Terminal block kit, two 6-position pieces

[TBK-B02](#)

Terminal block kit, four 6-position pieces

[TBK-B03](#)

Terminal block kit, one 3-position and three 6-position pieces

Spring Clamp

[TBK-S01](#)

Terminal block kit, two 6-position pieces

[TBK-S02](#)

Terminal block kit, four 6-position pieces

[TBK-S03](#)

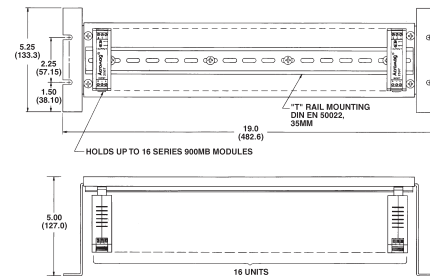
Terminal block kit, one 3-position and three 6-position pieces

◆ Mounting Hardware



Din-Rail Mounting

For your convenience, Acromag offers several mounting accessories to simplify your system installation. Our 19" rack-mount kit provides a clean solution for mounting your I/O modules and a power supply. Or you can buy precut DIN rail strips for mounting on any flat surface.



Ordering Information

[20RM-16-DIN](#)

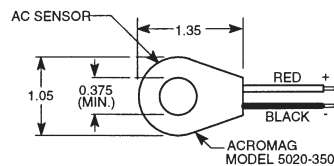
19" rack-mount kit with DIN rail.

[DIN RAIL 3.0](#)

[DIN RAIL 16.7](#)

DIN rail strip, Type T, 3 inches (75mm) or 16.7 inches (425mm)

◆ AC Current Sensor



This external sensor measures a 0-20A AC signal and provides a DC mA output for an Ethernet input module. It enables remote mounting of the I/O module for safe monitoring of the AC signal.

Ordering Information

[5020-350](#)

AC current sensor

◆ Power Supplies



Universal Slimline Power Supplies

Input Power Requirement
85 to 264V AC or 105 to 370V DC

Output
5V DC, 12V DC, or 24V DC
10W to 240W

Ordering Information

[PS5R-VB24](#)

Power supply, 15W, 0.65A at 24V DC

[PS5R-VD24](#)

Power supply, 60W, 2.5A at 24V DC

Visit www.acromag.com for additional models and more information.

◆ Cables and Adapters



Ordering Information

[5035-355](#)

Ethernet straight cable, CAT5, 3 feet long, shielded

[5035-360](#)

Ethernet crossover cable, CAT5E, 5 feet long, shielded

[4001-096](#)

USB Ethernet adapter

[4001-110](#)

Ribbon cable, 5 feet, DB25 male to 26-pin female IDC connector, interfaces 3B/5B input modules to 958EN

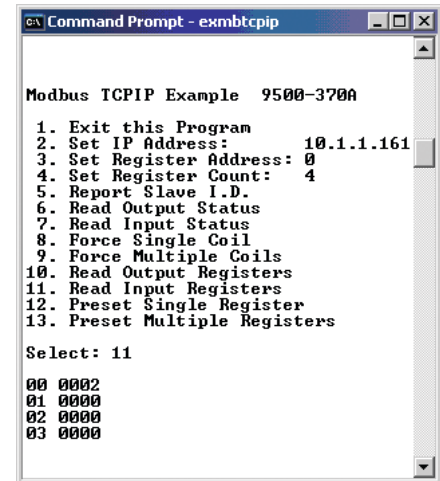
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Ethernet I/O: BusWorks® Series



ESW-MBLIB Ethernet Modbus C Library Software



Universal support for five operating systems ♦ C source code provided ♦ Demo program included

Description

Acromag's Modbus C Library software greatly simplifies development of programs to interface with Acromag's BusWorks® and EtherStax® Ethernet I/O products. The library also supports any standard Ethernet Modbus slave device that communicates via Modbus TCP/IP or UDP/IP protocol.

This utility is ideal for developers that are unfamiliar with Modbus protocol or the framing of TCP/IP or UDP/IP messages.

The C library makes programming easy and portable by simply linking user code with the provided function calls (below). Most function calls require passing only a few parameters such as the IP address, Modbus register address, and register count.

Codes	Functions
01 (01H)	Read Coil (Output) Status
02 (02H)	Read Input Status
03 (03H)	Read Holding Registers
04 (04H)	Read Input Registers
05 (05H)	Force Single Coil (Output)
06 (06H)	Preset Single Register
15 (0FH)	Force Multiple Coils (Outputs)
16 (10H)	Preset Multiple Registers
17 (11H)	Report Slave ID

Example Program

The included example program is menu-driven to help users build Modbus TCP/IP and UDP/IP commands. Menu selections let users configure, read, and write Ethernet I/O slave devices such as Acromag's Busworks and EtherStax products.

Users may also leverage this demonstration application into a tool for configuration or test by supplying commands and/or data values in the form of a text file. The program will execute each command in the text file as if it had been typed from the console terminal.

Key Features & Benefits

- Library of function routines simplify communication with I/O modules
- Works with 32 Bit and 64 Bit operating systems
- Function calls provided for a variety of operating systems
- C source code supplied
- Demonstration program included
- Saves development time
- Ideal for use with Acromag's BusWorks and EtherStax I/O modules
- Compatible with any standard Modbus TCP/IP or UDP/IP device



Microsoft
Visual C



Linux

VxWorks®

QNX®

microware® OS-9

Ordering Information

[Go to on-line ordering page >](#)

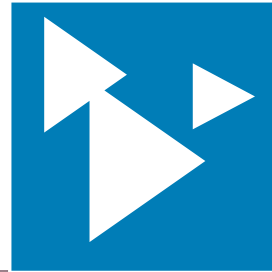
ESW-MBLIB
Ethernet Modbus C Library Software (CD-ROM)

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