Acromag
THE LEADER IN INDUSTRIAL I/O

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

Tel: 877-214-6267 ■ info@acromag.com ■ www.acromag.com ■ 30765 Wixom Rd, Wixom, MI 48393 USA

Bulletin #8400-529L

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.*

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.

All trademarks are the property of their respective owners.

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

Ethernet I/O: BusWorks® Series

900EN Series Compact Ethernet I/O Modules

RoHS Compliant · Ex · cULus LISTED · CE · 24 HOUR STOCK ITEM · 2 YEAR WARRANTY

◆ Analog I/O Modules

◆ Discrete I/O Modules

◆ Combination I/O Modules

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Ethernet I/O: BusWorks® Series

900EN Series Compact Ethernet I/O Modules

RoHS Compliant | Ex | c UL us LISTED | CE | 24 HOUR STOCK ITEM | 2 YEAR WARRANTY

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.

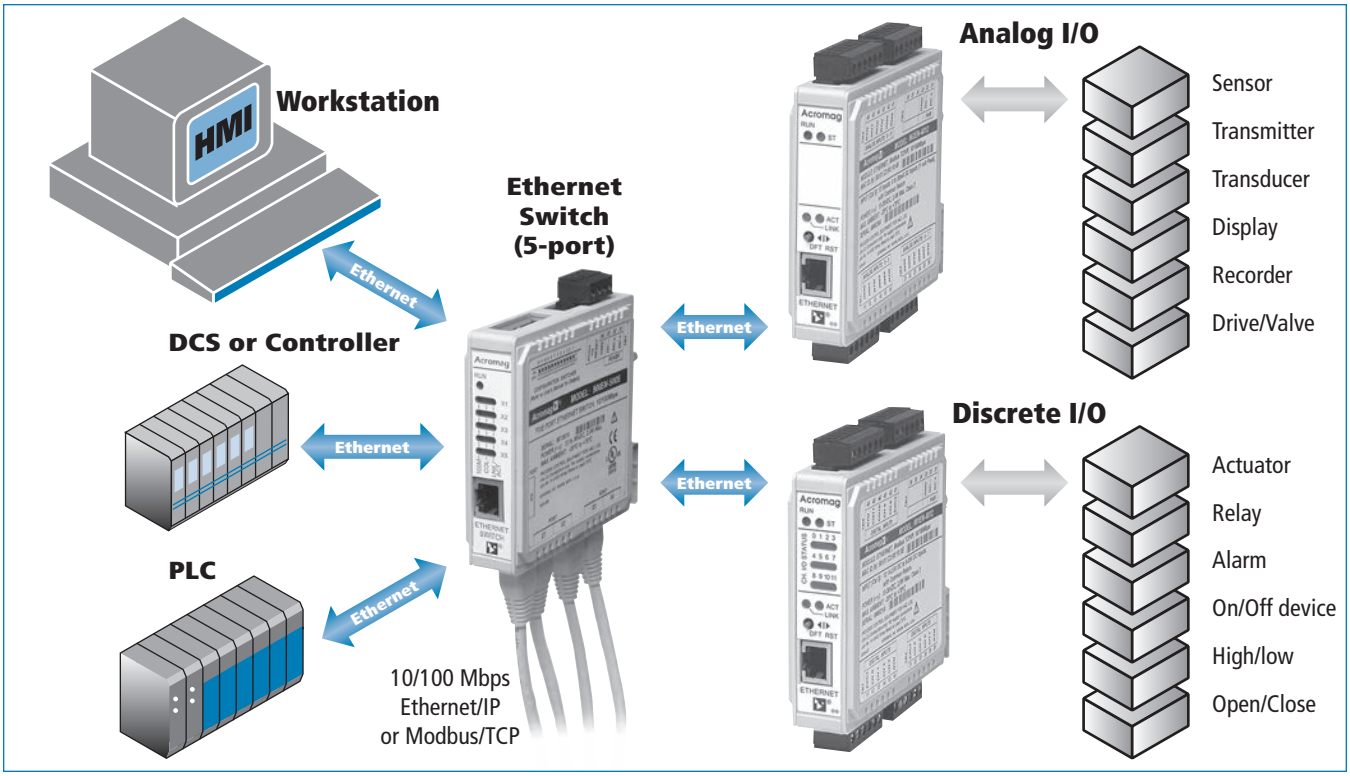
Each inch-wide module has a direct network interface, processes I/O signals on up to twelve channels, and handles power conversion. This space-saving approach is very cost-effective for systems that need to add I/O channels at an existing control site or network to new remote sites. By comparison, many "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

RoHS Compliant · Ex · cULus LISTED · CE · 24 HOUR STOCK ITEM · 2 YEAR WARRANTY

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

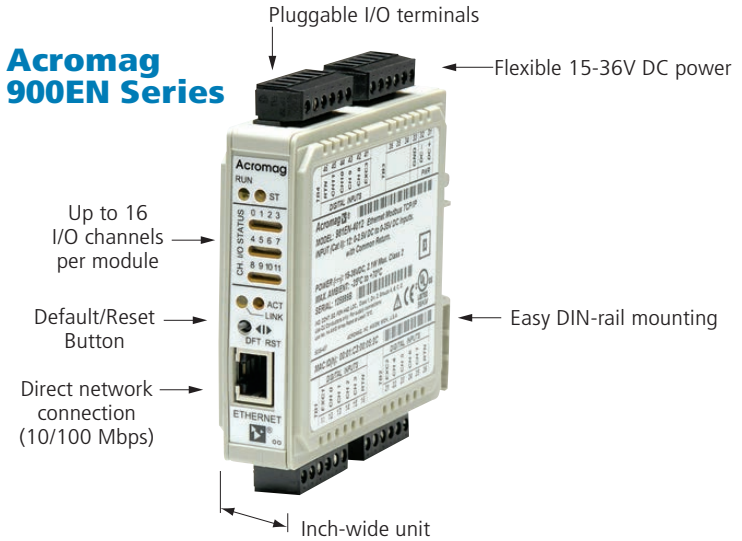
Analog Output Modules

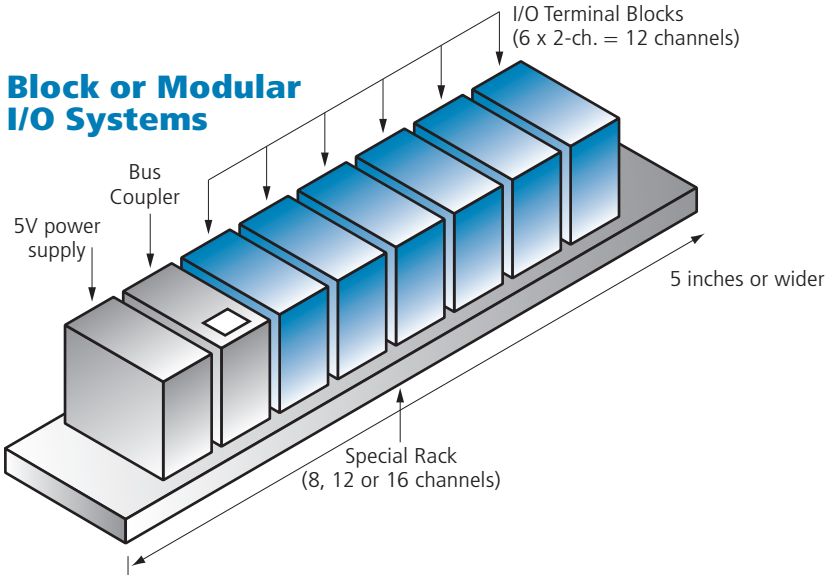
Analog output modules are ideal for controlling a wide variety of devices. The host defines the output of voltage or current signals to control speed, flow, temperature, frequency, level, force, torque, intensity, and many other physical properties.

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 I/O	Block or Modular I/O Systems
Stand-alone I/O modules are very easy to use.	*Block I/O systems are harder to implement.*
■ Configures with standard web browser	■ Installation of configuration software required
■ Direct connection to network	■ Expensive bus coupler required
■ Up to 16 channels on one module	■ Plug-in I/O modules or terminal blocks required
■ 1-inch wide for 16 channels	■ Five inches wide or more for twelve channels
■ Flexible 15-36V DC power requirement	■ Special 5V power supply may be required
■ Pluggable terminal blocks on top and bottom	■ 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

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

Analog Outputs
proportional 4-20mA or 0-10V DC

Discrete Outputs
on/off, high/low, open/close

(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

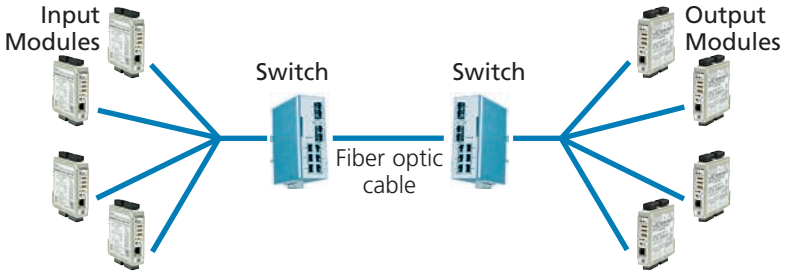
952EN-4012
4 analog voltage inputs,
2 analog current outputs, 6 discrete I/O

Installation #1: Copper Ethernet network

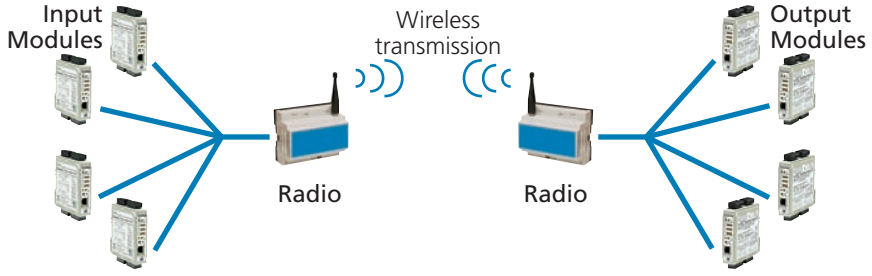
NOTE:
Buy 900EN modules in pairs.
For example:

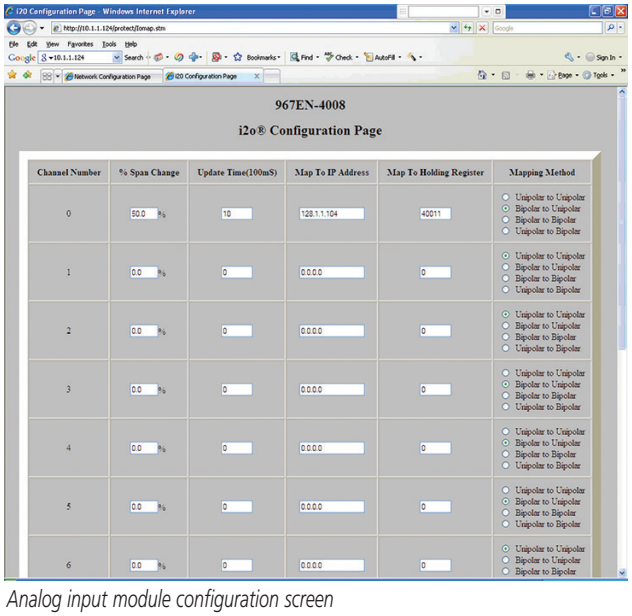
AI with AO
DIO with DO or DIO
Combo with Combo

Installation #2: Fiber optic connection

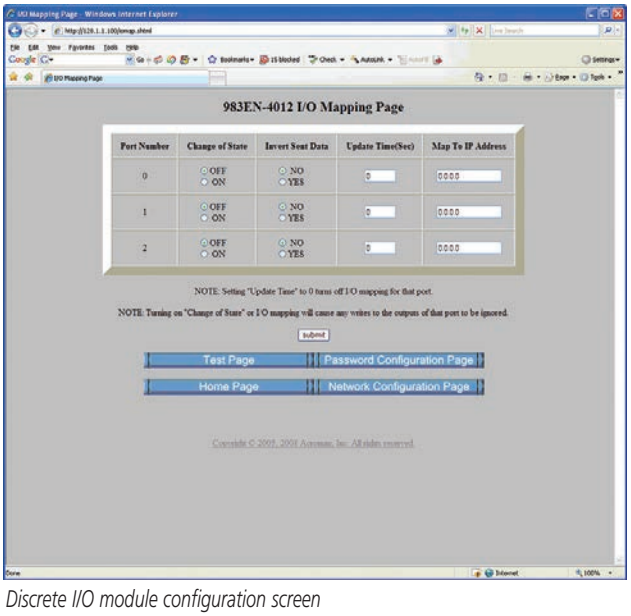


Installation #3: Wireless connection (telemetry systems)





Analog input module configuration screen



Discrete I/O module configuration screen

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.

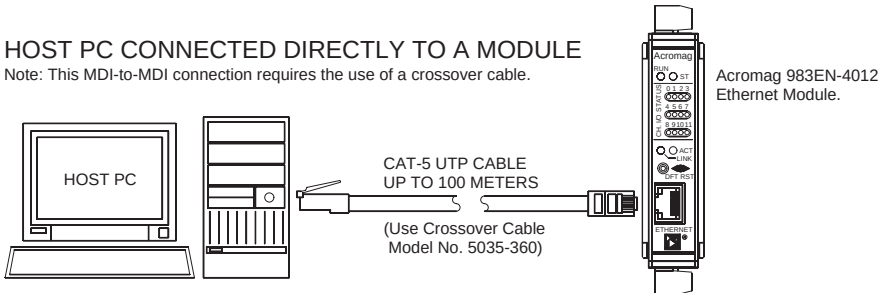


Figure 1: Plug the Ethernet cable from your computer into the I/O module's RJ-45 port to start configuration.

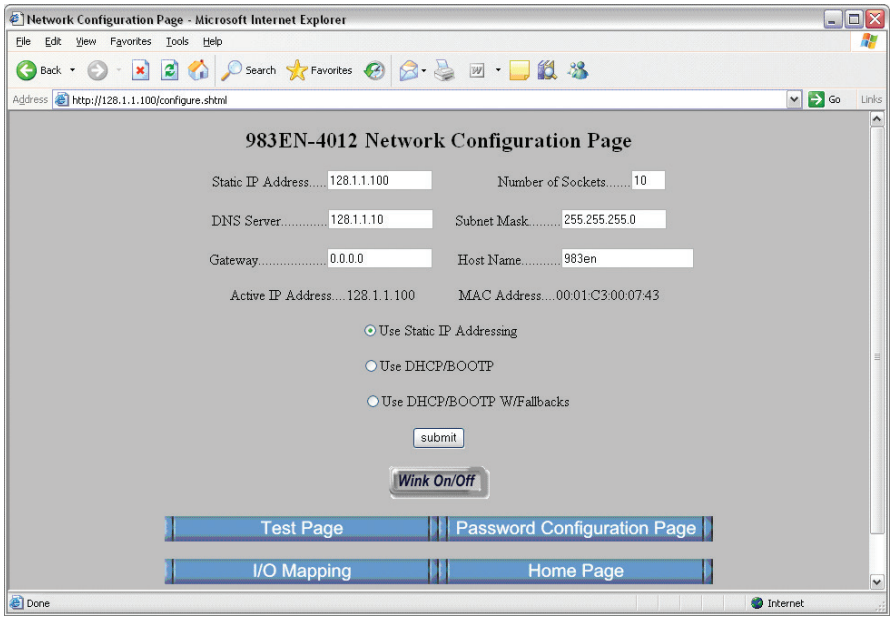


Figure 2: A web page is embedded into each module for easy configuration using a standard web browser.

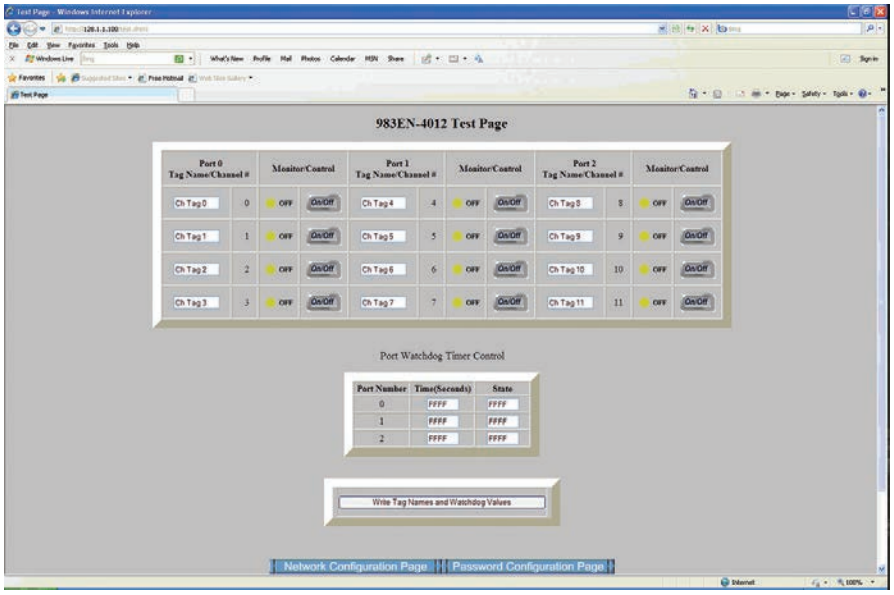


Figure 3: A test page is also accessible with your web browser to confirm proper operation of the I/O module.

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.

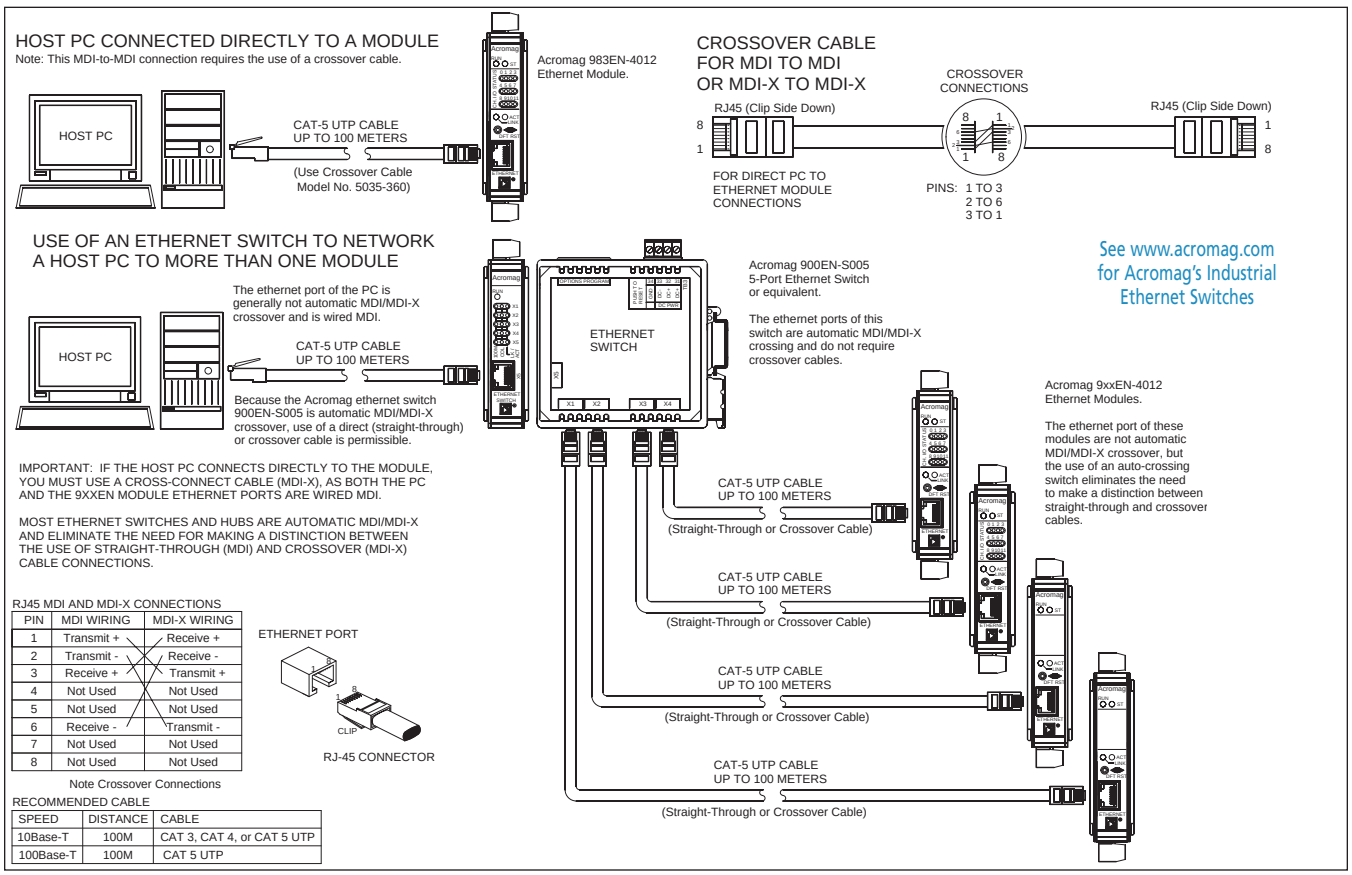
Radiated Field Immunity (RFI)
Per EN61000-4-3 and ENV50204.

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

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

Surge Immunity
Per EN61000-4-5.

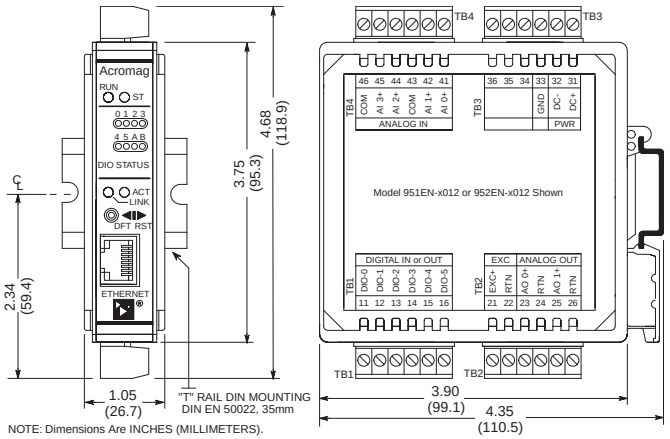
Radiated Frequency Emissions
Per EN55022 Class B.



Ethernet I/O: BusWorks® Series

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

RoHS Compliant | Ex | cULus LISTED | CE | 24 HOUR STOCK ITEM | 2 YEAR WARRANTY



NOTE: Dimensions Are INCHES (MILLIMETERS).

Standard model includes cage clamp terminal blocks. Optional terminals are available (see Page 26).

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 (see Page 6)
- Multi-function, multi-channel stand-alone module is very economical
- High-resolution 16-bit Σ-Δ 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

Performance Specifications

◆ General Specifications

See Page 9 for communication and other specs.

◆ Analog Input

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

Accuracy
Better than ±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 Σ-Δ 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 ±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
See Page 25.

Hardware Accessories and Power Supplies
See Page 26.

Software Support
See Page 27.

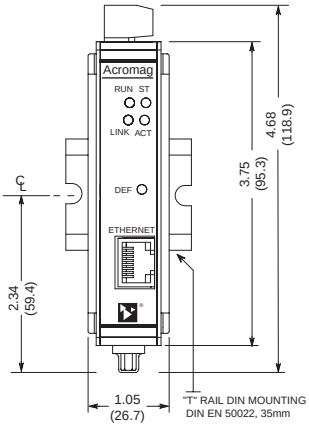
i2o™ Input-to-Output Peer-to-Peer Communication

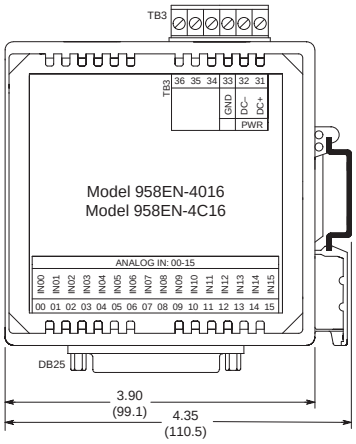
Acromag's i2o technology allows modules to talk directly to another module across any Ethernet media without a PLC, PC, or other controller in between. Input channels on one module can write to output channels on a remote module.

Ethernet I/O: BusWorks® Series

958EN Ethernet microBlox™ Interface Modules (Analog Input)

RoHS Compliant | Ex | cULus LISTED | CE | 24 HOUR STOCK ITEM | 2 YEAR WARRANTY





Standard model includes cage clamp terminal blocks. Optional terminals are available (see Page 26).

Modbus/TCP conformance tested

16-channel Single-ended Voltage Input ◆ DB25 Port for microBlox® Modules ◆ Modbus TCP/IP comm.

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 microBlox™ analog input modules. The microBlox™ 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 microBlox™ 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

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
See Page 25.

Hardware Accessories and Power Supplies
See Page 26.

Software Support
See Page 27.

Acromag® THE LEADER IN INDUSTRIAL I/O

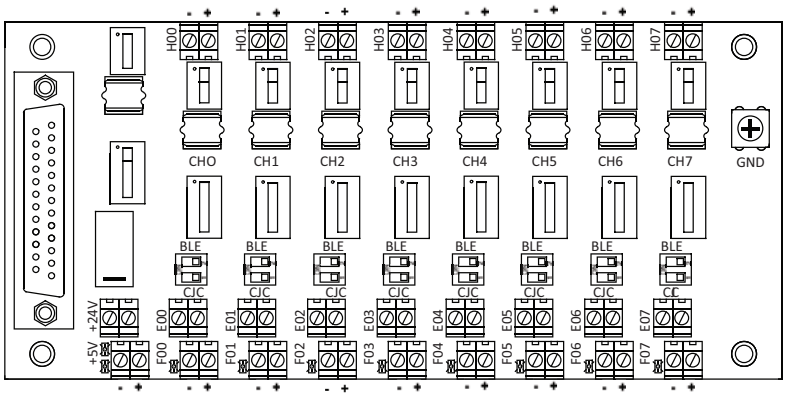
Tel: 248-295-0880 ■ sales@acromag.com ■ www.acromag.com ■ 30765 S Wixom Rd, Wixom, MI 48393 USA

Ethernet I/O: BusWorks® Series

microBlox™ Signal Conditioning Modules

RoHS Compliant · Ex · cULus LISTED · CE · 24 HOUR STOCK ITEM · 2 YEAR WARRANTY

Bluetooth®



High-density Isolation Amplifiers ◆ Parallel Interface Connects to 958EN Ethernet Analog Input Modules

Description

Acromag's microBlox™ uB Series I/O modules offer a compact, high-performance solution for interfacing sensors and field devices with data acquisition systems. uB signal conditioning modules are ideal to isolate, filter, convert and amplify a wide variety of signal types for test, measurement and control systems. Just plug uB modules into 4, 8, or 16-channel backpanels in any mix for a high-density analog I/O interface. Channel-to-channel isolation provides optimal noise and surge protection from ground loops, spikes, and high common mode voltages.

Key Features & Benefits

- Selection of 175 I/O modules with either a fixed-range or *Bluetooth*® wireless configuration option, as well as cost-saving commercial grade versions
- User-configurable I/O ranges with smartphone or tablet
- Input polling with trend charts in Android® or iOS® app
- Alarm output function with setpoint and deadband
- 1500Vac isolation field-to-host and channel-to-channel
- Up to 0.05% accuracy and 130db CMR
- Shock and vibration-resistant without screws

Applications

- Systems requiring high channel-to-channel isolation, noise rejection, surge suppression, and amplification
- Designed for front-end signal conditioning or embedded applications:
- DCS, PLC, controllers, data acquisition, remote I/O, recorders, etc.
- On-board embedded OEM applications
- Protects equipment, increases accuracy, and installs/expands easily
- Low-cost, high-density amplifier system

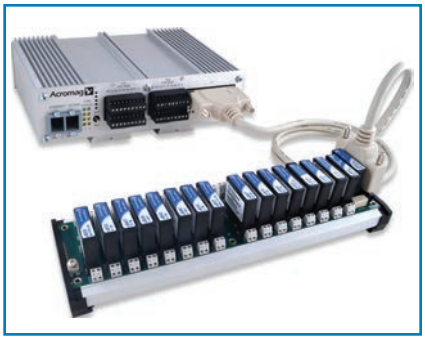
Ordering Information

◆ Input Modules

- milliVolt Field Input; 5Hz or 1kHz
- DC Voltage Input; 4Hz or 1kHz
- Narrow Band DC Current Field Input
- Platinum RTD Field Input; 2/3- or 4-wire
- Thermocouple Field Input; linearized or non-linearized
- 2-Wire Transmitter Field Input with Loop Excitation
- Frequency Input with Excitation Supply

◆ Accessories

- 4-, 8-, and 16-position analog I/O backpanels
- Power supplies



microBlox® also connect to EtherStax analog I/O modules (ES2151, ES2152, ES2153, ES2162, ES2172 models)

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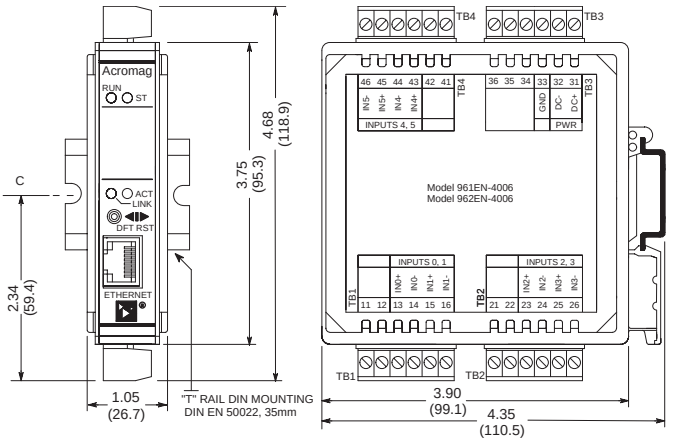
Ethernet I/O: BusWorks® Series

961EN, 962EN Ethernet Analog Input Modules

RoHS Compliant | Ex | cULus LISTED | CE | 24 HOUR STOCK ITEM | 2 YEAR WARRANTY



Standard model includes cage clamp terminal blocks. Optional terminals are available (see Page 26).

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 (see Page 6)
- 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 ±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
See Page 25.

Hardware Accessories and Power Supplies
See Page 26.

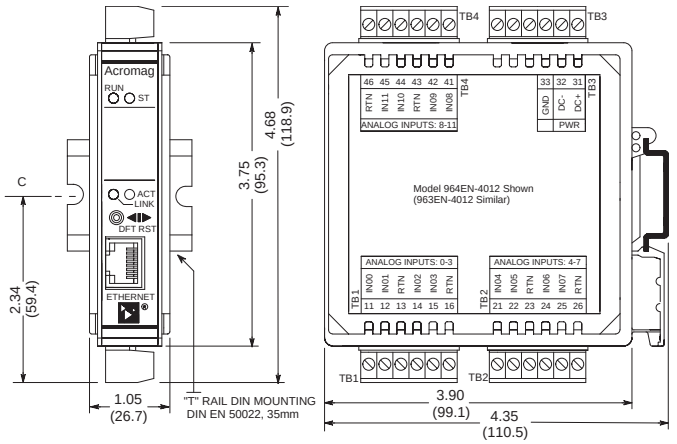
Software Support
See Page 27.

Acromag® THE LEADER IN INDUSTRIAL I/O

Ethernet I/O: BusWorks® Series

963EN, 964EN Ethernet Analog Input Modules

RoHS Compliant | Ex | c UL us LISTED | CE | 24 HOUR STOCK ITEM | 2 YEAR WARRANTY



Standard model includes cage clamp terminal blocks. Optional terminals are available (see Page 26).

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 ±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
See Page 25.

Hardware Accessories and Power Supplies
See Page 26.

Software Support
See Page 27.

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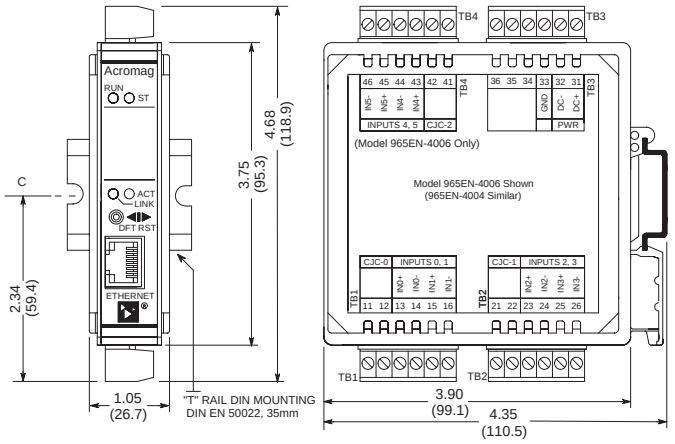
Ethernet I/O: BusWorks® Series

965EN Ethernet Temperature Input Modules

RoHS Compliant | Ex | cULus LISTED | CE | 24 HOUR STOCK ITEM | 2 YEAR WARRANTY



Standard model includes cage clamp terminal blocks. Optional terminals are available (see Page 26).

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

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.

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
See Page 25.

Hardware Accessories and Power Supplies
See Page 26.

Software Support
See Page 27.

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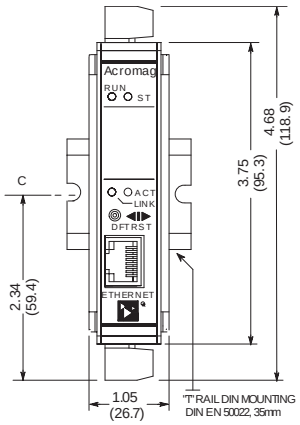
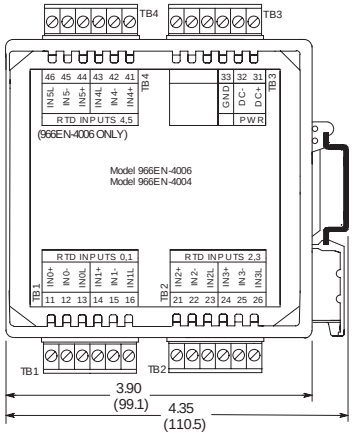
Ethernet I/O: BusWorks® Series

966EN Ethernet Temperature Input Modules

RoHS Compliant | Ex | cULus LISTED | CE | 24 HOUR STOCK ITEM | 2 YEAR WARRANTY





Standard model includes cage clamp terminal blocks. Optional terminals are available (see Page 26).

EtherNet/IP conformance tested

Modbus/TCP conformance tested

4 or 6-channel RTD/resistance 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. Multi-range inputs accept signals from a variety of sensors and devices. High-resolution, low noise, A/D converters deliver high accuracy and reliability. 3-way isolation further improves the system performance.

Input Ranges

Input ranges are selectable for a 3-channel group.

RTD

2-wire and 3-wire RTDs are supported.
Platinum 100 ohm (alpha = 1.3850 or 1.3911)
Nickel 120 ohm
Copper 10 ohm

Resistance
0 to 500 ohms

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
- 6-input stand-alone module has much lower start-up cost than multi-piece block I/O systems
- Versatile RTD or ohmic inputs support a wide variety of industrial sensors and devices
- RTD 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 permits installation in extreme environments

Performance Specifications

◆ Input

Accuracy

Input Type	Input Range	Accuracy (typical)
Pt 100 ohm	-200 to 850°C	±0.25°C
Ni 120 ohm	-80 to 320°C	±0.25°C
Cu 10 ohm	-200 to 260°C	±1.25°C
Resistance	0 to 500 ohms	±0.05 ohms

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

Noise Rejection
Normal Mode: Better than 40dB @ 60Hz
Common Mode: Better than 130dB @ 60Hz

Input Filter Bandwidth
-3dB at 3Hz, typical

Input Conversion Rate
80mS per channel

Excitation Current
1mA DC typical, all RTD types.

◆ 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

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

◆ I/O Modules

966EN-4004
4-channel RTD input, Ethernet Modbus TCP/IP

966EN-6004
4-channel RTD input, EtherNet/IP interface

966EN-4006
6-channel RTD input, Ethernet Modbus TCP/IP, i2o

966EN-6006
6-channel RTD input, EtherNet/IP interface

◆ Accessories

Industrial Ethernet Switches
See Page 25.

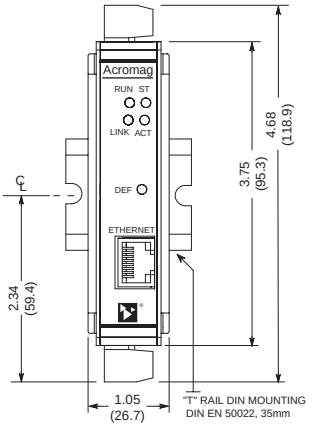
Hardware Accessories and Power Supplies
See Page 26.

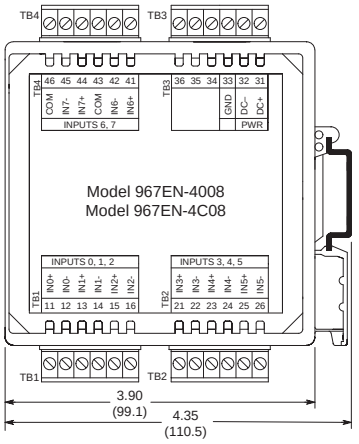
Software Support
See Page 27.

Acromag® THE LEADER IN INDUSTRIAL I/O

Ethernet I/O: BusWorks® Series

967EN Ethernet Analog Input Modules





Standard model includes cage clamp terminal blocks. Optional terminals are available (see Page 26).

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
See Page 25.

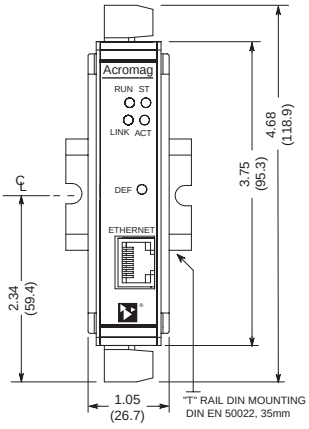
Hardware Accessories and Power Supplies
See Page 26.

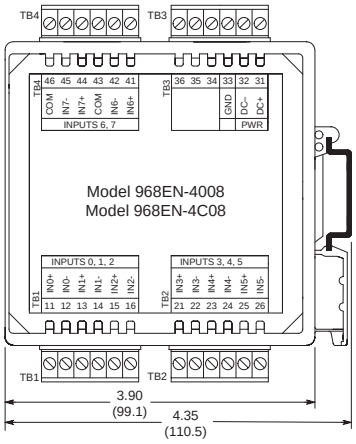
Software Support
See Page 27.

Acromag
THE LEADER IN INDUSTRIAL I/O

968EN Ethernet Analog Input Modules

RoHS Compliant | Ex | c UL us LISTED | CE | 24 HOUR STOCK ITEM | 2 YEAR WARRANTY





Standard model includes cage clamp terminal blocks. Optional terminals are available (see Page 26).

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
See Page 25.

Hardware Accessories and Power Supplies
See Page 26.

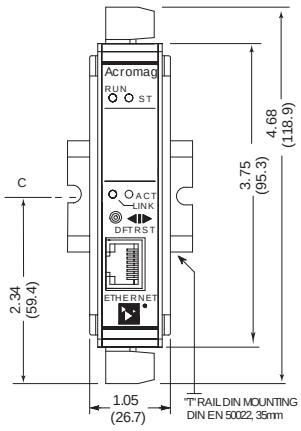
Software Support
See Page 27.

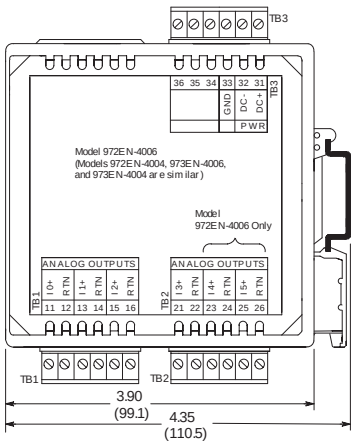
Acromag THE LEADER IN INDUSTRIAL I/O

Ethernet I/O: BusWorks® Series

972EN, 973EN Ethernet Analog Output Modules

RoHS Compliant | Ex | cULus LISTED | CE | 24 HOUR STOCK ITEM | 2 YEAR WARRANTY





Standard model includes cage clamp terminal blocks. Optional terminals are available (see Page 26).

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/IP10/100Mbps 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 ±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-4006](#)
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](#)
See Page 25.

[Hardware Accessories and Power Supplies](#)
See Page 26.

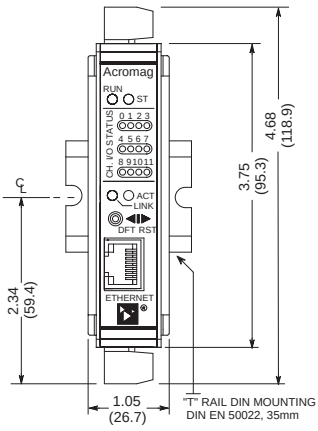
[Software Support](#)
See Page 27.

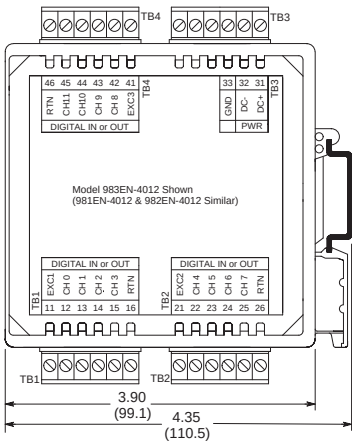
Acromag® THE LEADER IN INDUSTRIAL I/O

Ethernet I/O: BusWorks® Series

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

RoHS Compliant | Ex | cULus LISTED | CE | 24 HOUR STOCK ITEM | 2 YEAR WARRANTY





Standard model includes cage clamp terminal blocks. Optional terminals are available (see Page 26).

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 158F)
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. See Page 25.

Hardware Accessories and Power Supplies
See Page 26.

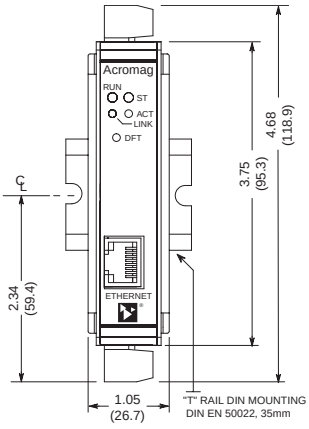
Software Support: See Page 27.

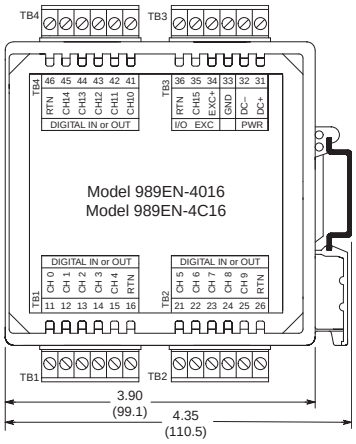
Acromag THE LEADER IN INDUSTRIAL I/O

Ethernet I/O: BusWorks® Series

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

RoHS Compliant | Ex | cULus LISTED | CE | 24 HOUR STOCK ITEM | 2 YEAR WARRANTY





Standard model includes cage clamp terminal blocks. Optional terminals are available (see Page 26).

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
See Page 25.

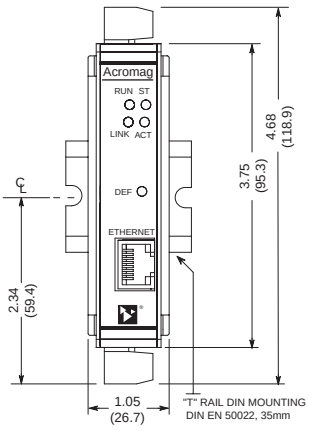
Hardware Accessories and Power Supplies
See Page 26.

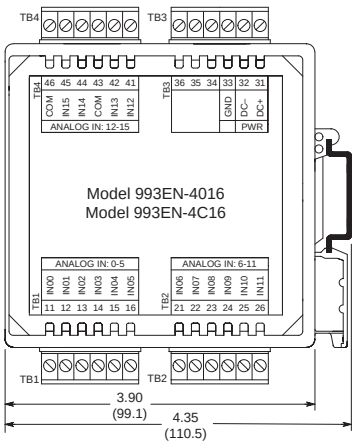
Software Support
See Page 27.

Acromag THE LEADER IN INDUSTRIAL I/O

Ethernet I/O: BusWorks® Series

993EN Ethernet Analog Input Modules





Standard model includes cage clamp terminal blocks. Optional terminals are available (see Page 26).

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
See Page 25.

Hardware Accessories and Power Supplies
See Page 26.

Software Support
See Page 27.

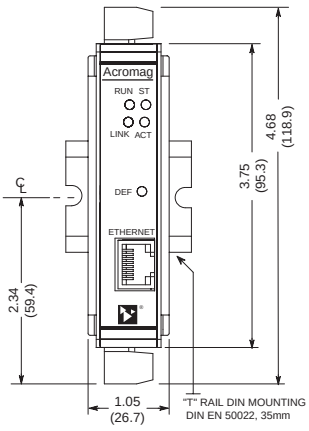
Acromag® THE LEADER IN INDUSTRIAL I/O

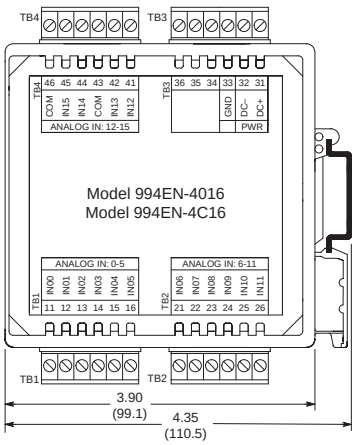
Tel: 248-295-0880 ■ sales@acromag.com ■ www.acromag.com ■ 30765 S Wixom Rd, Wixom, MI 48393 USA

Ethernet I/O: BusWorks® Series

994EN Ethernet Analog Input Modules

RoHS Compliant | Ex | cULus LISTED | CE | 24 HOUR STOCK ITEM | 2 YEAR WARRANTY





Standard model includes cage clamp terminal blocks. Optional terminals are available (see Page 26).

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
See Page 25.

Hardware Accessories and Power Supplies
See Page 26.

Software Support
See Page 27.

Acromag® THE LEADER IN INDUSTRIAL I/O

Tel: 248-295-0880 ■ sales@acromag.com ■ www.acromag.com ■ 30765 S Wixom Rd, Wixom, MI 48393 USA

900EN Series, IMC Series Industrial Ethernet Switches & Converters

◆ 900EN Series Switches

◆ IMC Series, Converters

900EN Ethernet Switches

Models

900EN-S005: 5-port, unmanaged

Acromag's Rugged 5-port industrial-grade Ethernet switches have internal intelligence for fast and easy network installation with auto data rate, flow control, and cross-over. No setup needed if used as a simple switch with Acromag I/O modules.

Ordering Information

◆ **Switches**

For more information please visit www.acromag.com.

900EN-S005
Ethernet switch, 5-port Copper

◆ **Accessories**

Hardware Accessories and Power Supplies

See Page 26.

IMC Series Converters

Models

IMC-100A-M-T: 10/100TX to 100FX, Multi-Mode
IMC-100A-S3-T: 10/100TX to 100FX, Single Mode

Acromag's IMC series industrial media converters convert between 10/100Base-TX and 100Base-FX cabling. They allow you to extend the cabling distance of your 100Base-FX network up to 30 kilometers.

Ordering Information

◆ **Converters**

For more information please visit www.acromag.com.

IMC-100A-M-T
10/100TX to 100FX Harden Media Converter, Multi-Mode 2KM, -40 to 80°C

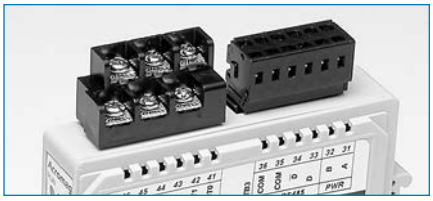
IMC-100A-S3-T
10/100TX to 100FX Harden Media Converter, Single Mode 30KM, -40 to 80°C

◆ **Accessories**

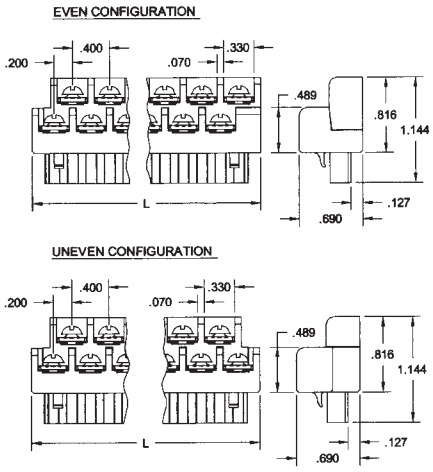
Hardware Accessories and Power Supplies
See Page 26.

Accessories

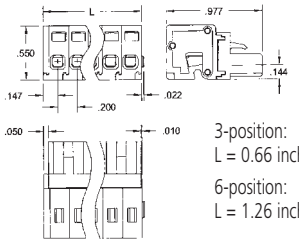
◆ Terminal Blocks



Barrier Strip Terminal Blocks*



Spring Clamp Terminal Blocks*



Wire range:
AWG #12-26

3-position:
L = 0.66 inches (16.9 mm)

6-position:
L = 1.26 inches (32.3 mm)

Ordering Information

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

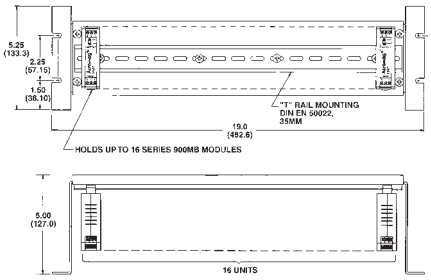
See I/O module information for compatibility

Barrier Strip	Spring Clamp
TBK-B01 Terminal block kit, two 6-position pieces	TBK-S01 Terminal block kit, two 6-position pieces
TBK-B02 Terminal block kit, four 6-position pieces	TBK-S02 Terminal block kit, four 6-position pieces
TBK-B03 Terminal block kit, one 3-position and three 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.

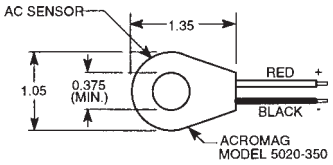


Ordering Information

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

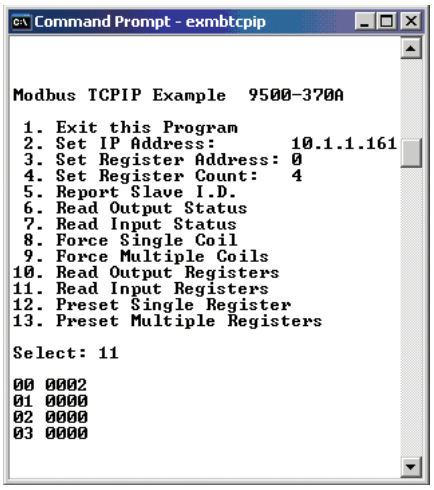
5035-360
Ethernet crossover cable, CAT5E, 5 feet long, shielded

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

Acromag®
THE LEADER IN INDUSTRIAL I/O

Software Support Application Development Tools



Integrate with HMI and SCADA Software ◆ Supports Five Operating Systems ◆ Demo Versions Available

Description

These software development tools help you quickly integrate Acromag Ethernet I/O with your application program.

OPC DA Server

This low-cost server is exclusively for use with Acromag Modbus TCP/IP Ethernet devices. The OPC Server connects Acromag's I/O modules to your HMI, SCADA or custom-built Visual Basic / C++ applications. Easy CSV import / export capability saves development time for faster deployment.

.NET / ActiveX Controls

These software controls provide a fast, easy way to communicate with any Modbus/TCP slave devices connected to your PC. Within minutes, your Visual Basic, Visual C, .NET, Excel, or other compatible applications will be talking Modbus protocol.

Function Libraries with C Source Code

Our C library of function routines speeds framing of Modbus messages. Examples help link your code with provided function calls to configure, read, and write to Acromag I/O modules. Ideal for Windows, Linux, VxWorks, and QNX OS.

Key Features & Benefits

- High-Speed OPC connectivity to all Acromag Modbus TCP/IP devices
- OPC DA Server supports all OPC-compliant HMI and SCADA applications
- ActiveX and .NET controls enable fast, easy communication with any Modbus TCP/IP or Modbus RTU slave device
- ActiveX and .NET controls support Visual Basic, Visual C++ and Excel applications
- Modbus C Libraries enable use with Linux, VxWorks, QNX, and other OS platforms
- Free evaluation versions

OPC®

Microsoft Visual C++ Visual Basic

Microsoft .NET activeX

Linux

VxWorks®

QNX®

microware® OS-9

Ordering Information

See table for model numbers. Software is provided on CD-ROMs except ACMBTCP-OPC which is download only. For more information, visit our website.

www.acromag.com/software

Ethernet Software Development Tools

Model	Description	Program Environment	Operating Systems
ACMBTCP-OPC	Modbus TCP/IP Master OPC DA Server	HMI, SCADA, Visual Basic, C++	Windows 7, Server
AMTN-CD	Modbus TCP/IP .NET Controls	Visual Basic, C++, C#	Windows 7
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