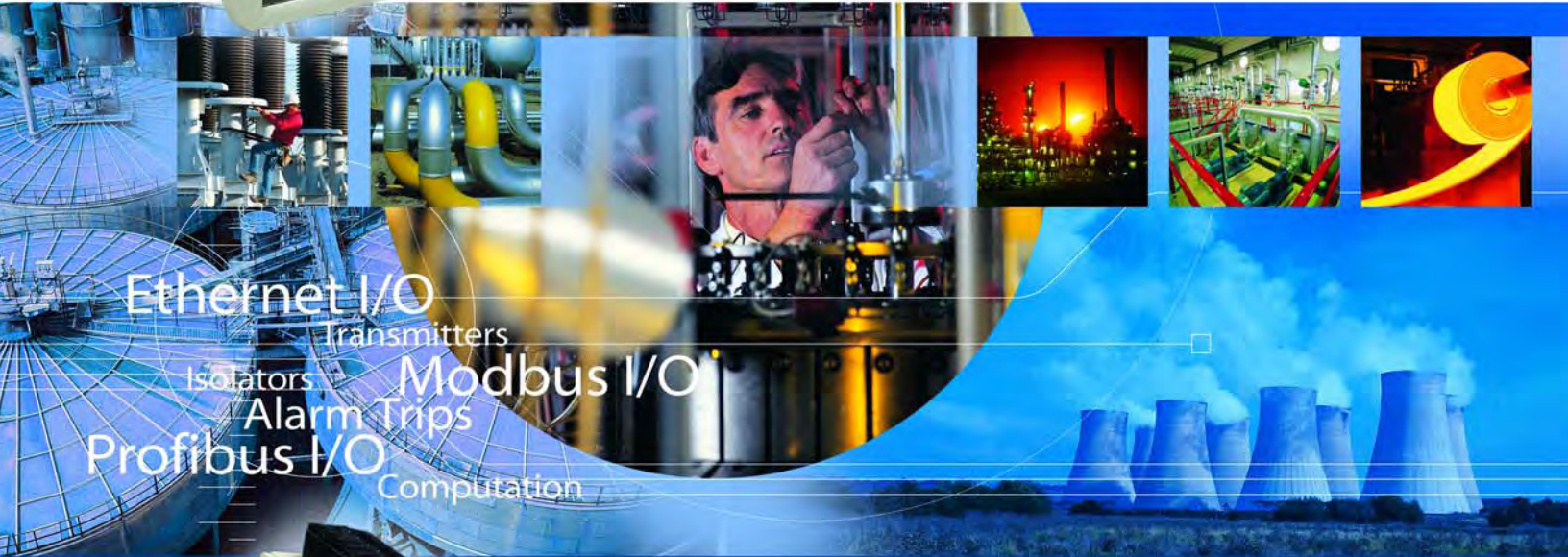


Answers @ Acromag



Ethernet I/O
Transmitters
Isolators
Alarm Trips
Modbus I/O
Profibus I/O
Computation



**Signal Conditioning
and
Distributed I/O Solutions**

Product Catalog

Acromag 
THE LEADER IN INDUSTRIAL I/O



Acromag, Inc.

Acromag is a customer-driven manufacturer that focuses on developing I/O products that provide the best value in their categories. Compare and you'll find that our units offer an unmatched balance of price, performance, and features.

Experience

Acromag is an international corporation that combines more than 45 years of process control experience with advanced computer design technologies learned developing high-performance VMEbus I/O boards for defense and aerospace industries. Since 1957, Acromag has delivered nearly a million units to thousands of customers for manufacturing, power generation, environmental, transportation, military, and scientific applications.

Quality

Acromag takes every safeguard to guarantee you dependable operation. State-of-the-art manufacturing techniques and extended burn-in cycles add an extra degree of ruggedness. Multi-level inspections and specialized testing further ensure you that all Acromag signal conditioners perform at or beyond rated specifications.

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Drawing on more than 45 years of experience in the industrial world, our qualified applications engineers are prepared to help customers in the design and development of complete solutions. For assistance call:

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Our sales staff is experienced in recommending products for a wide variety of applications ranging from simulators to machine control and countless other industrial processes.



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Additional Services

Skilled Acromag technicians provide quick repairs for any unit that becomes damaged during use. Equipment is restored to original specifications and promptly returned to the customer to avoid any unnecessary down-time.

All units are shipped with detailed documentation. The accompanying literature carefully outlines the specifications, installation, and use of the product.



EtherStax™ I/O

OVERVIEW

Rugged & Stackable Ethernet I/O



Front



Back



Stacked



Open-board model

EtherStax I/O blocks provide a ruggedized, high-density solution to interface many analog and discrete signals to your control system. A stackable aluminum housing maintains a small footprint and stands up to industrial environments. The Ethernet interface supports Modbus TCP/UDP/IP for reliable host data transfer or peer-to-peer communication. Web-based configuration simplifies setup with any web browser. For OEM systems, or those that require specialized housings, an open-board version without the enclosure is available. EtherStax are ideal for a broad range of measurement and control applications.

Rugged, Industrial-Grade Design

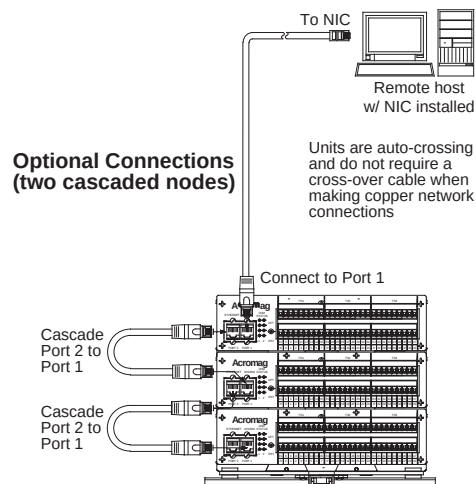
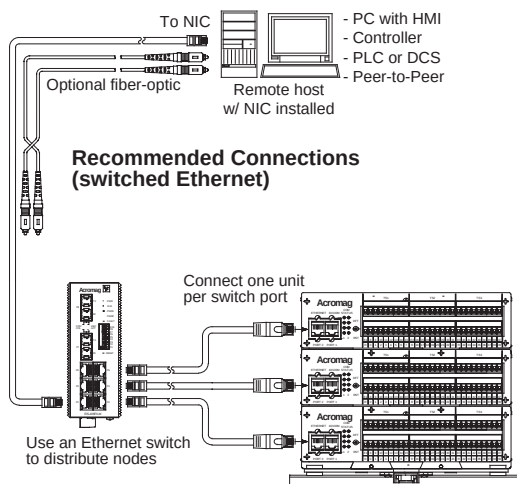
EtherStax are designed for high-reliability operation. Units feature 3-way isolation and surge protection. The I/O circuitry has over-temperature, over-voltage, and over-current protection. Redundant communication paths and DC power ensure dependable operation. If network communication is lost, outputs fail safely and a relay provides local alarming or shutdown functions.

Stackable, High-Density I/O

A variety of models offer a mix of analog and discrete I/O interfaces with up to 96 channels on a single unit. Monitor sensors, control devices, or add local alarms. The units interlock for secure stacking that consumes little space when mounted on a surface or DIN rail.

- **High-density industrial Ethernet I/O:**
Put hundreds of I/O channels in less panel space.
- **Stackable aluminum or open-board packaging:**
Choose industrial-strength or low-cost mounting.
- **Rugged, shock and vibration-resistant design:**
Mounts on machinery, DIN rail, wall, or flat surface.
- **Modbus TCP/UDP/IP or i2o peer-to-peer network:**
Reliable communication to host or between nodes.
- **Easy web configuration with copy function:**
Quickly set up units with any web browser.
- **Dual-port Ethernet hub or switch w/MDI/MDI-X:**
Get diagnostics, redundancy, and easy expansion.
- **Ready for STP, RSTP, other redundancy schemes:**
Supports dual-path communication via Cu and fiber.
- **Local failsafe SPST 5A fault relay:**
Provides alarm/shutdown if network or power fails.
- **Surge suppression and 1500Vrms isolation:**
Protects power, relay, I/O, and each Ethernet Port.
- **Redundant DC power w/internal diode coupling:**
For "bump-less" transfer to back-up power.
- **Extended operating temperature of -40 to 75°C**
- **Designed for CE and UL/cUL Class1 Div 2 ABCD**

Flexible network connections: Independently switched or daisy-chain cascaded nodes





Ethernet I/O Blocks

FEATURES

High-strength aluminum packaging
Dove-tailed grooves on top for stacking and interlocking units

Dual Ethernet ports
Two Cu or one Cu / one fiber

Locking Ethernet connection
RJ45 clip frame provides secure media connections resistant to shock and vibration when used with compatible cables.

Front View

High-density industrial I/O
Up to 96 channels per unit with pluggable terminal blocks.

Default/Reset toggle switch
Restore communication to factory configuration or reset the unit.

Port status LEDs
Indicate switch/hub mode, link, activity, 10/100Mbps, port faults

7.25" Depth
2.444" Height

8.226" Width

Rear View

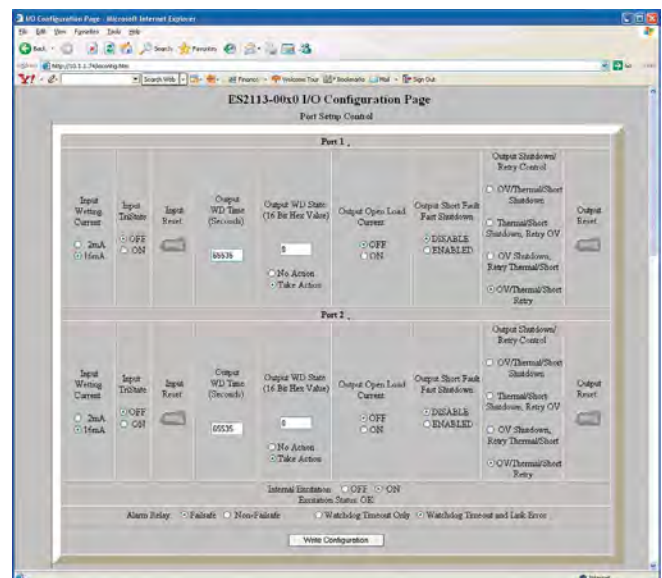
Status LEDs
Power, I/O, relay status

Fault relay
Local 5A Form A relay

Redundant DC Power
Pluggable terminals

Earth ground terminal
One on each side

Network and I/O Configuration Screens



Ethernet I/O Blocks

APPLICATIONS

Ideal for remote I/O or control rooms

With a variety of I/O configurations and flexible signal ranges, EtherStax serves many industries.

End-user Industries:

- Power gen & distribution
- Water & wastewater
- Oil & gas refining
- Food, dairy, beverage
- Chemical & petrochem
- Metals processing
- Pharmaceutical
- Military & Aerospace

System Integrators:

- SCADA applications
- Building & energy mgmt
- Factory automation
- Specialty machinery

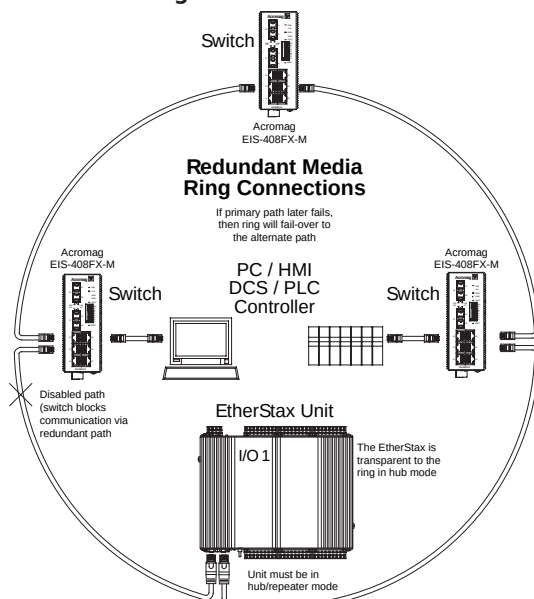
OEM Machinery:

- Engine & turbine controls
- Packaging equipment
- Semiconductor fab
- Switch gear equipment
- Boilers & furnaces
- Material handling

Distributed I/O for Batch Processing

EtherStax I/O interfaces sensors, actuators, displays and other instruments to a PLC, DCS, or PC over your Ethernet network. Analog inputs monitor temperature, level, flow, pressure, voltage, current, and myriad process variables. Analog outputs control drives, pumps, valves, motors, and heaters, or write to displays and recorders. Discrete inputs detect open/close and change-of-state while discrete outputs perform on/off control.

Redundant Ring Connections



SCADA and Remote I/O

In addition to all the functions already mentioned, EtherStax are ideal for supervisory control and data acquisition at remote sites. Units tolerate -40 to 75°C allowing outdoor mounting. Flexible, redundant power supports battery operation. Multi-media capability enables use of copper, fiber-optic, or wireless Ethernet networks to eliminate the high cost of leased lines.

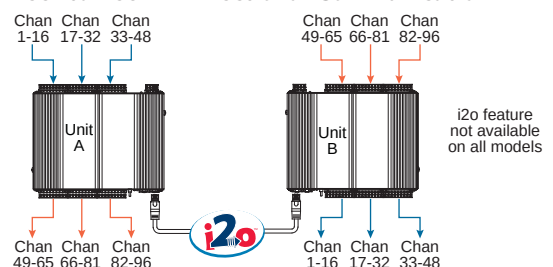
Discrete Manufacturing

EtherStax models with high-density discrete I/O provide a cost-efficient solution for automated operations such as machining, assembly, and packaging. These compact units can mount on machinery without worry of electrical noise, high voltage surges, or vibration affecting performance. EtherStax have a high level of immunity and resistance to transient signals from solenoids, motors, and magnetic fields.

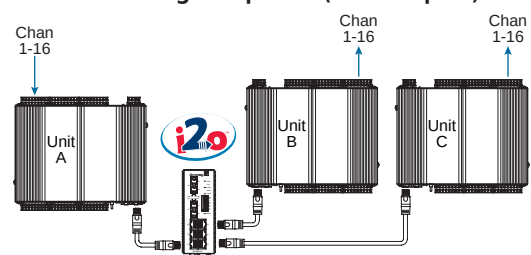
Ethernet-Enable your OEM Machinery

Make your machines Internet-ready with EtherStax and monitor operation from any PC with an Ethernet link. The rugged aluminum housing can bolt directly to your equipment. Alternatively, the open-board version can mount in a NEMA enclosure or inside your machine. Resistant to shock and vibration, EtherStax units provide dependable operation even on moving machinery.

Peer-to-Peer Bi-Directional Communication



Peer-to-Peer Signal Splitter (dual outputs)

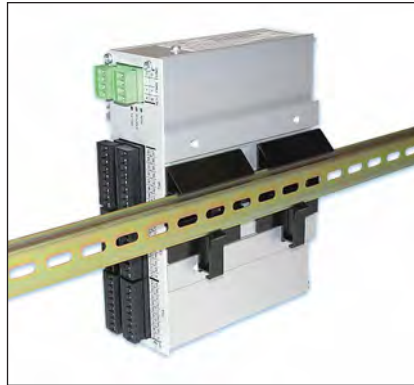


Rugged & Stackable Solution

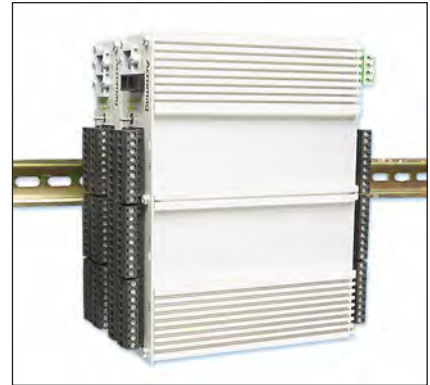
Mounting support to meet your needs



Interlocked units without mounting kit.



ESA-DIN-VMK kit (vertical terminals).



ESA-DIN-VMK supports two stacked units.



ESA-DIN-HMK kit (horizontal terminals).



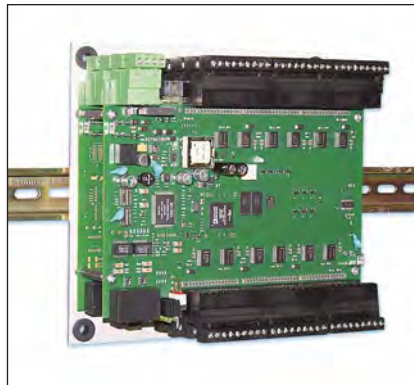
ESA-DIN-HMK supports three stacked units.



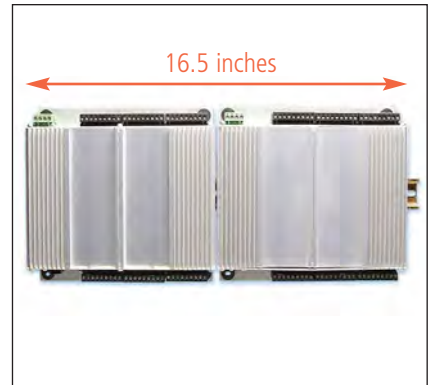
ESA-SMK surface/machine mounting kit.



ESA-OMK open board stacking kit. One kit supplies standoffs to stack two units.



Units stacked with ESA-OMK kit can mount on a DIN rail with ESA-DIN-HMK kit plate.



Side-by-side 19-inch rack mounting with ESA-DIN-HMK kit on a DIN rail.

Rugged & Stackable Solution

General Specifications

For information about specific units, please refer to the model data sheets or manuals.

■ Inputs and Outputs

See individual model data sheets for details.

■ Enclosure and Physical

Dimensions

8.226 inches wide x 2.444 inches tall x 7.25 inches deep. Units stack together on 2.175 inch centers.

I/O Connectors

Plug-in terminal blocks rated for 15A/300V; AWG #12-24 stranded or solid copper wire.

Network Connectors

See Ethernet Interface

Enclosure Material

Extruded aluminum, 6063 T6 alloy, silver anodized finish.

Printed Circuit Boards

Military grade fire-retardant epoxy glass per IPC-4101/98.

Safety Approvals (Pending)

CE marked. UL/cUL Listed.

Hazardous Locations:

Class 1; Division 2; Groups A, B, C, and D.

■ Environmental

Operating Temperature

-40 to 75°C (-40 to 167°F).

Storage Temperature

-40 to +85°C (-40 to +185°F).

Relative Humidity

5 to 95%, non-condensing.

Power Requirements (Unit Main)

18-36V DC. Redundant, diode-coupled terminals. See individual model data sheets for power specifications.

Isolation

I/O, power, relay, and Ethernet port-to-port.

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

Continuous: 250V AC, 354V DC.

Installation Category

Designed for Pollution Degree 2 environment with an Installation Category II rating (over-voltage category).

Electromagnetic Interference Immunity (EMI)

I/O have resistance to inadvertent state changes with interference from switching solenoids, commutator motors, and drill motors.

Electromagnetic Compatibility (EMC)

Meets EN50082-1.

Electrostatic Discharge (ESD) Immunity

Meets EN61000-4-2.

Radiated Field Immunity (RFI)

Meets EN61000-4-3 and ENV50204.

Electrical Fast Transient Immunity (EFT)

Meets EN61000-4-4.

Conducted RF Immunity (CRFI)

Meets EN61000-4-6.

Surge Immunity

Meets EN61000-4-5.

Emissions

Meets EN50081-1.

Radiated Frequency Emissions

Meets EN55022 Class A

Shock and Vibration Immunity

Rating for single surface-mount unit in enclosure.

Mechanical Shock: 50g, 3ms, with 3 half-sine shock pulses in each direction along 3 axes (18 shocks), and 30g, 11ms, with 3 half-sine shock pulses in each direction along 3 axes (18 shocks), per IEC60068-2-27.

Random Vibration: 5g, 5-500Hz, in 3 axes at 2 hours/axis per IEC60068-2-64.

■ Ethernet Interface

Network Connector (Copper)

8-pin RJ-45 sockets for 10Base-T/100Base-TX connections. Wired MDI-X by default but includes automatic MDI/MDI-X crossing.

Network Connector (Fiber)

Duplex SC-type, multi-mode transceiver for IEEE 802.3u 100Base-FX cable connections.

Protocol

Modbus TCP/IP or UDP/IP with integrated web-browser reconfiguration.

i2o Peer-to-Peer Communication

Supported on select models only.

See individual model data sheets for details.

IP Address

Default mode static IP address is 128.1.1.100.

Port

Up to 10 Modbus TCP/IP sockets supported.

Uses port 502 (reserved for Modbus).

Transient Protection

Transient voltage suppressors are applied on all ports (power, I/O, Ethernet ports).

Data Rate

Switch mode: auto-sense 10Mbps or 100Mbps on copper connections, 100Mbps on fiber-optic connection.

Hub/repeater mode: fixed at 100Mbps and auto-negotiation does not apply.

Duplex

Switch mode: auto-negotiated, full or half duplex.

Hub/repeater mode: only half-duplex and auto-negotiation does not apply.

Compliance

IEEE 802.3, 802.3u, 802.3x.

Network Distance

Distance between two devices on an Ethernet network is generally limited to 100 meters using copper cable, and 2km using multi-mode fiber optic cable. Distance may be extended using hubs and switches.

Address

IP address can be preset by the user (static) and loaded from internal non-volatile memory, or it can be automatically acquired at startup via a network server using a BOOTP (Bootstrap Protocol) or DHCP (Dynamic Host Configuration Protocol). Includes default mode toggle switch to revert unit to a "known" fixed static IP address of 128.1.1.100, useful for troubleshooting purposes.

Ordering Information

See individual model data sheets for details.





Distributed I/O

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BusWorks® Ethernet



Choose from EtherNet/IP™ or
Ethernet Modbus TCP/IP Interface

EIS Series



Industrial Ethernet Switches

BusWorks® Profibus



Profibus-DP modules for remote
I/O applications

BusWorks® Modbus



Modbus-RTU modules for remote
I/O applications

1500 Series



Field-mount two-wire transmitters with
optional HART protocol output

Delivery / Warranty

7 YEAR WARRANTY

Products with this symbol can ship in
24 hours and carry a 7 year warranty.



Signal Conditioning

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Digital Panel Meters – APM Series	73
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APM Series



A thrifty digital display or a full-function transmitter/alarm

IntelliPack® Series



PC-configured isolated transmitters, alarms, and computation modules

600 Series



Low-cost and multi-channel, isolated transmitters. Push-button calibration.

ACR Series



Plug-in isolated transmitters with push-button calibration

Flat Pack Series



Isolated analog transmitters and alarms with traditional zero and span pots

1500 Series



Field-mount two-wire transmitters with optional HART protocol output

Delivery / Warranty

24HR 5YR

Products with this symbol can ship in 24 hours and carry a 5 year warranty.



Distributed I/O Product Selection Guide

	EIS Series	Busworks® 900EN Series	Busworks® 900EN Series	Busworks® 900PB Series	Busworks® 900MB Series	1500 Series
	Ethernet Switches	EtherNet/IP I/O Modules	Modbus TCP/IP I/O Modules	Profibus-DP I/O Modules	Modbus-RTU I/O Modules	Field-mount HART Transmitters
INPUTS						
DC Current		p11	p11	p37	p49	p177
DC Voltage		p11	p11	p37	p49	p177
DC Millivolts		p11	p11	p37	p49	p177
Thermocouple		p11	p11	p37	p49	p177
RTD		p11	p11	p37	p49	p177
Resistance		p11		p37	p49	p177
Frequency					p49	
AC Current		p11	p11	p37	p49	p177
Discrete level		p11	p11	p37	p49	
OUTPUTS						
DC Current		p11	p11	p37	p49	p177
DC Voltage		p11	p11	p37	p49	
Display (LCD)						p177
Relay Actuator	p27				p49	
Discrete level		p11	p11	p37	p49	
NETWORKS						
Ethernet	p27	p11	p11			
HART						p177
Profibus-DP				p37		
Modbus-RTU					p49	
Peer-to-Peer			p11			
POWER						
DC Power	p27	p11	p11	p37	p49	
AC Power					p49	
Loop (2-wire)						p177
FUNCTIONS						
Linearizer / Characterizer						p177
Signal Average						p177
Alarms					p49	

For Power Supply information, please refer to Page 199.



Signal Conditioning Product Selection Guide

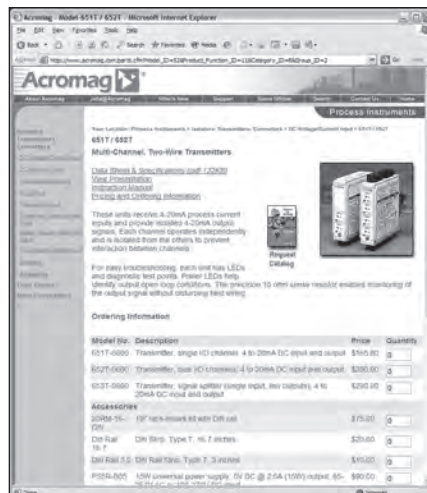
	APM Series	IntelliPack® 800 Series	600 Series	ACR Series	Flat Pack Series	1500 Series
	Digital Panel Meters	Programmable Signal Condition	Multi-Channel Isolated Xmitters	Octal-socket Transmitters	Analog Isolators, Xmitters, Alarms	Field-mount Transmitters
INPUTS						
DC Current	p73	p81	p123	p143	p147	p177
DC Voltage	p73	p81	p123	p143	p147	p177
DC Millivolts		p81	p123		p147	p177
Thermocouple	p73	p81	p123		p147	p177
RTD	p73	p81	p123		p147	p177
Resistance		p81	p123			p177
Pot/Slidewire					p147	p177
Frequency		p81			p147	p177
AC Voltage					p147	
AC Current		p81	p123	p143	p147	p177
Strain / Load		p81				
OUTPUTS						
DC Current	p73	p81	p123	p143	p147	p177
DC Voltage		p81	p123	p143	p147	p177
Display (LCD)						p177
Relay Actuator	p73	p81			p147	
Frequency/Pulse		p81				
NETWORKS						
HART						p177
Modbus-RTU	p73					
POWER						
DC Power	p73	p81	p123	p143	p147	
AC Power	p73		p123	p143	p147	
Loop (2-wire)			p123		p147	p177
FUNCTIONS						
Linearizer / Characterizer		p81	p123		p147	p177
Math Equations		p81				
Signal Average		p81				p177
Integrator / Totalizer		p81				
Track & Hold Min/Max Value		p81				
Alarms	p73	p81			p147	

For Power Supply information, please refer to Page 199.



Online Prices and Ordering

Working late or in another time zone? Now you can get price quotes or place orders 24/7 on Acromag's website. Our secure servers will accept orders placed with a company purchase order or credit card. It's safe, fast and easy.



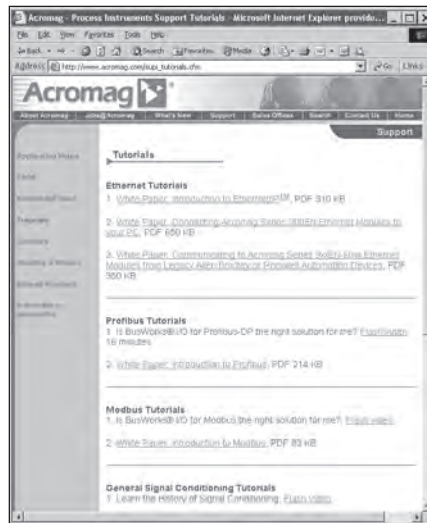
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Discrete I/O Modules



Analog I/O Modules



Combination I/O Modules



BusWorks® 900EN Series Ethernet I/O

Introduction

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Discrete I/O Modules

981EN discrete input Page 25
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983EN discrete I/O 25

Analog I/O Modules

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962EN DC voltage input, differential 20
963EN DC current input, single-ended 21
964EN DC voltage input, single-ended 21
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966EN RTD/Resistance input 23
972EN DC current output 24
973EN DC voltage output 24

Combination I/O Modules

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952EN analog voltage in, analog out, discrete I/O ..18

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	951/952	961/962	963/964	965	966	972/973	981/82/83
DISCRETE INPUTS							
Active low input							X
Active high input	X						
ANALOG INPUTS							
DC current input	X	X	X				
DC voltage input	X	X	X				
DC millivolt input				X			
Thermocouple input				X			
RTD/resistance input					X		
AC current input (requires external sensor)	X	X	X				
DISCRETE OUTPUTS							
Sinking output (low-side switch)							X
Sourcing output (high-side switch)	X						
ANALOG OUTPUTS							
DC current output	X					X	
DC voltage output						X	
POWER REQUIREMENT							
DC-powered	X	X	X	X	X	X	X

Ethernet Remote I/O Protocols:

1) **EtherNet/IP™**
conformance tested
(For Allen-Bradley PLC Systems)

2) **Modbus/TCP**
conformance tested
(Ethernet Modbus TCP/IP)

3) 
(Acromag peer-to-peer protocol)



EtherNet/IP, Modbus TCP/IP



24HR
5YR

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.

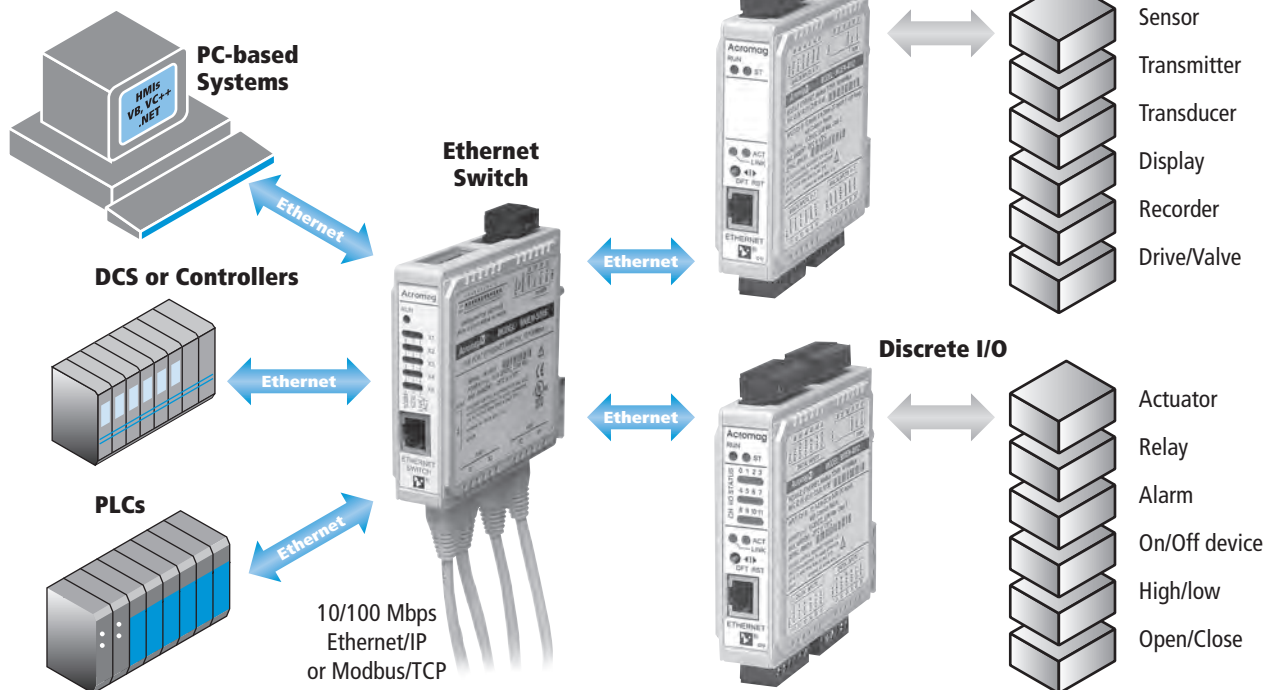
Sophisticated watchdog timers increase system reliability. All I/O modules have a watchdog that monitors the microcontroller for failed operations or a "lock-up" condition and automatically resets the unit. If host communication is lost and a configurable watchdog timer expires, all analog and discrete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

24HR 5YR Ready to ship within 24-hours from stock. Backed by a 5-year warranty.

Special Features

- **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
- **Network Security:**
Configuration enables password protection
- **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 -25 to 70°C

Ethernet Remote I/O Architecture





■ Discrete I/O

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-only, 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

■ Analog Input

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
- Thermocouple
- RTD/resistance
- AC current

Functions

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

■ Analog Output

Analog output modules are ideal for controlling a wide variety of industrial equipment. 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.

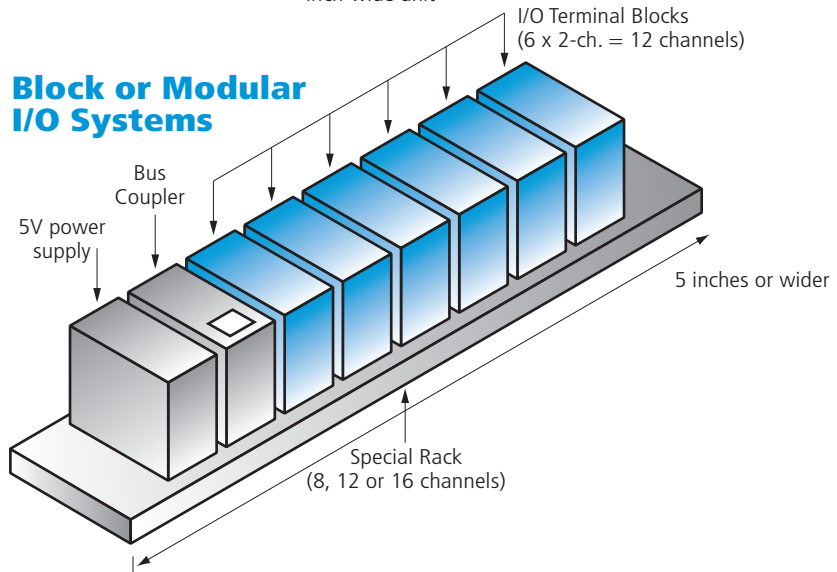
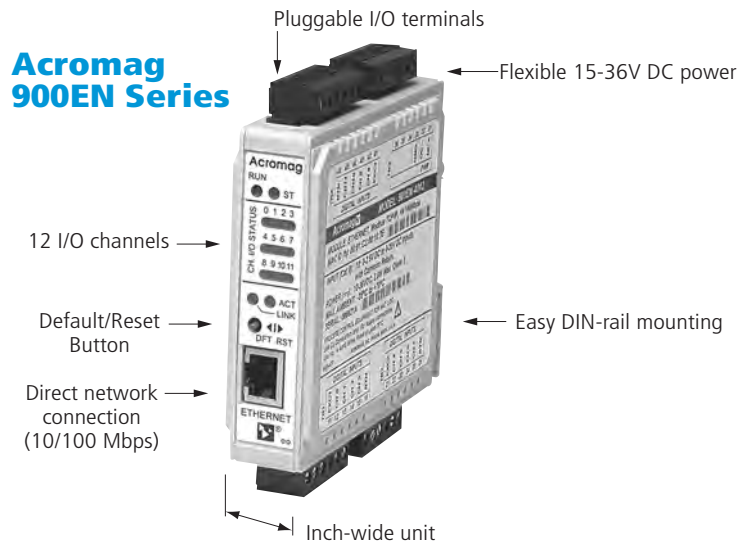
Outputs

- 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

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

- Configures with standard web browser
- Direct connection to network
- Up to 12 channels on one module
- One inch wide for twelve 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: i2o[®] Technology



Easy Peer-to-Peer Communication with Acromag i2o

i2o input-to-output messaging

Acromag's i2o technology is the easy way to transmit input values for remote output without a PLC, PC or master CPU.

With i2o, many Ethernet 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, you can monitor discrete devices at one site by reproducing the discrete levels with a relay output at another location.

Use your existing Ethernet lines to save time and wiring expenses

Connect input modules to 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 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

Peer-to-Peer 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



EtherStax I/O[®] also supports i2o

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Ethernet I/O: i2o[®] Technology

BusWorks Ethernet I/O Modules

900EN Series Modules with i2o

◆ Analog Input Modules

961EN / 962EN

6 differential current/voltage inputs

965EN

6 thermocouple/mV inputs

966EN

6 RTD/resistance inputs

967EN / 968EN

8 differential current/voltage inputs

◆ Analog Output Modules

972EN

4 or 6 current outputs

973EN

4 or 6 voltage outputs

◆ Discrete I/O Modules

982EN

12 solid-state relay outputs

983EN

12 solid-state input/outputs

◆ Combination I/O Modules

951EN

4 analog current inputs,

2 analog current outputs, 6 discrete I/O

952EN

4 analog voltage inputs,

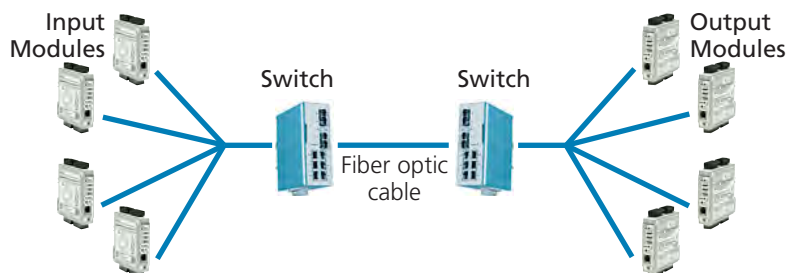
2 analog current outputs, 6 discrete I/O

Installation #1: Copper Ethernet network

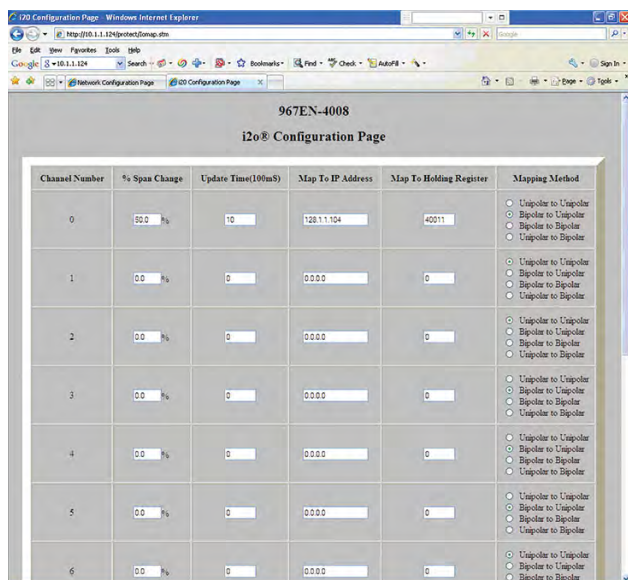
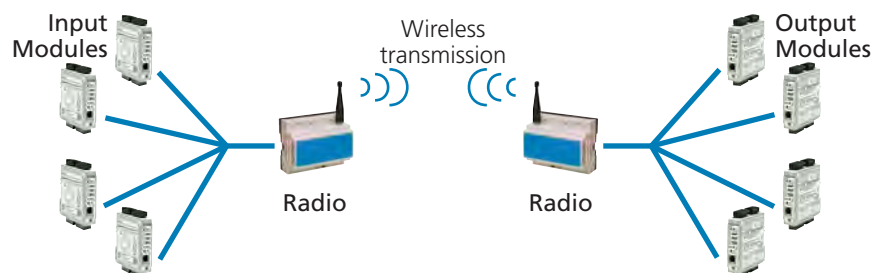


NOTE: Buy modules in pairs. For example:
AI with AO
DIO with DO or DIO
Combo with Combo

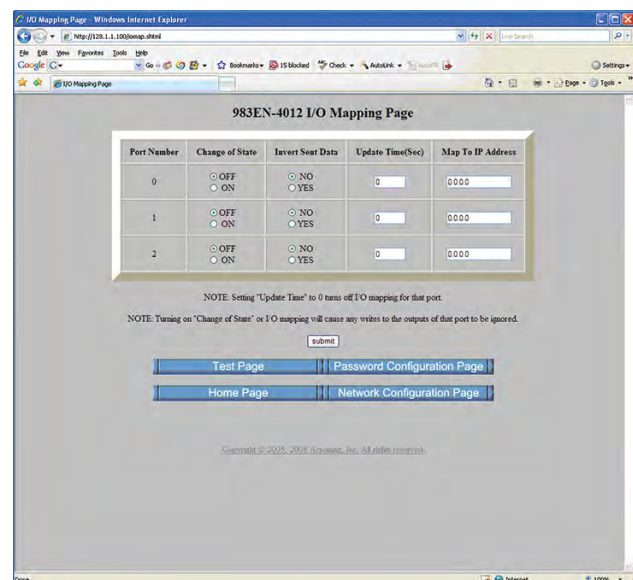
Installation #2: Fiber optic connection



Installation #3: Wireless connection (telemetry systems)



Analog input module configuration screen



Discrete I/O module configuration screen

Ethernet I/O: i2o[®] Technology



EtherStax Ethernet I/O Modules

ES2000 Series Units with i2o

◆ Analog Input Modules

ES2153

16 analog current inputs,
16 analog voltage or 8B inputs

◆ Analog Output Modules

ES2171

16 current outputs

ES2172

16 voltage outputs

◆ Analog I/O Modules

ES2151

16 analog current inputs,
16 analog voltage or 8B inputs,
16 analog current outputs

ES2152

16 analog current inputs,
16 analog voltage or 8B inputs,
16 analog voltage or 8B outputs

◆ Discrete I/O Modules

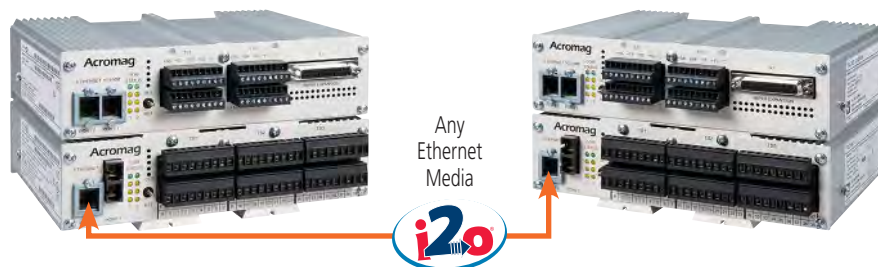
ES2113

96 solid-state input/outputs

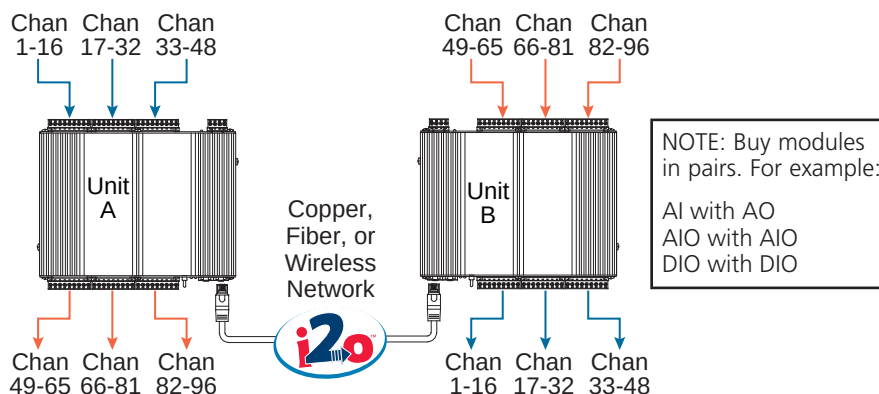
ES2117

32 solid-state inputs

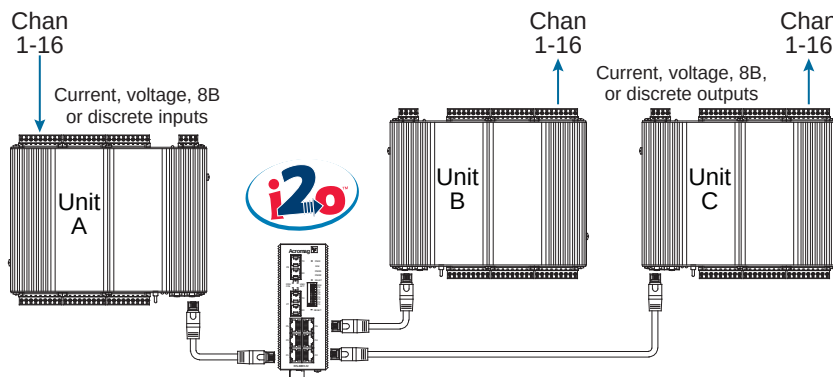
16 relay outputs



Installation #1: Peer-to-Peer Bi-directional Communication



Installation #2: Peer-to-Peer Signal Splitter (dual outputs)



i2o [®] Configuration Page						
Port Number	% Span Change	Update Time(100ms)	Map To IP Address	Map To Holding Register	Mapping Method	Map To Internal Outputs
Port 1 Voltage	0.0 0.0	150 0	128.1.1.102 0.0.0.0	40351 0	☐ Unipolar to Unipolar ☐ Bipolar to Unipolar ☐ Bipolar to Bipolar ☐ Unipolar to Bipolar	☐ NO ☐ YES
Port 2 Voltage	0.0 0.0	0 0	0.0.0.0 0.0.0.0	0 0	☐ Unipolar to Unipolar ☐ Bipolar to Unipolar ☐ Bipolar to Bipolar ☐ Unipolar to Bipolar	☐ NO ☐ YES
Port 1 Current	0.0 0.0	0 0	0.0.0.0 0.0.0.0	0 0	☐ Unipolar to Unipolar ☐ Bipolar to Unipolar ☐ Bipolar to Bipolar ☐ Unipolar to Bipolar	☐ NO ☐ YES
Port 2 Current	0.0 0.0	0 0	0.0.0.0 0.0.0.0	0 0	☐ Unipolar to Unipolar ☐ Bipolar to Unipolar ☐ Bipolar to Bipolar ☐ Unipolar to Bipolar	☐ NO ☐ YES

Analog I/O module (ES2152) configuration screen

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900EN Series Modules with i2o

Analog Input Modules

- 961EN-4006
6 differential current inputs
- 962EN-4006
6 differential voltage inputs
- 965EN-4006
6 thermocouple/mV inputs
- 966EN-4006
6 RTD/resistance inputs

Analog Output Modules

- 972EN-4004
4 current outputs
- 972EN-4006
6 current outputs
- 973EN-4004
4 voltage outputs
- 973EN-4006
6 voltage outputs

Discrete I/O Modules

- 982EN-4012
12 solid-state relay outputs
- 983EN-4012
12 solid-state input/outputs

Combo Modules

- 951EN-4012
4 analog inputs, 2 analog outputs, 6 discrete I/O
- 952EN-4012
4 analog inputs, 2 analog outputs, 6 discrete I/O

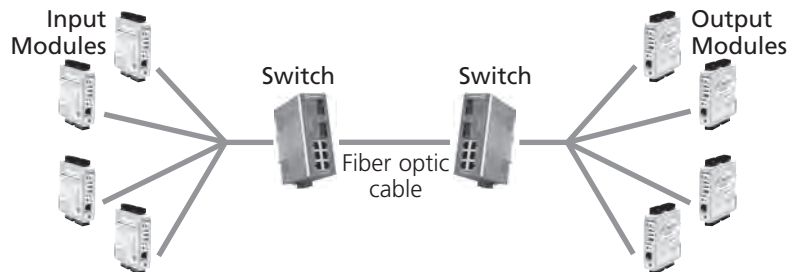
Installation #1: Copper Ethernet network



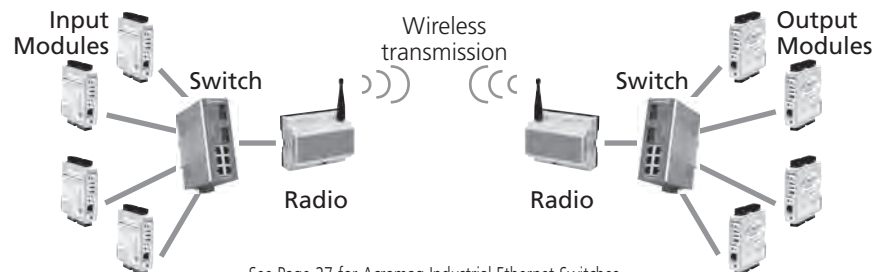
NOTE:
Buy modules
in pairs.

For example:
AI with AO,
DIO with DO or DIO
Combo with Combo

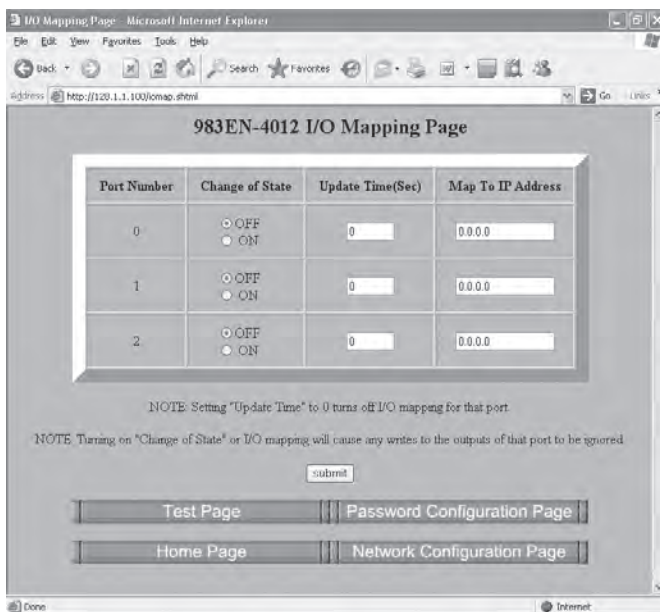
Installation #2: Fiber optic connection



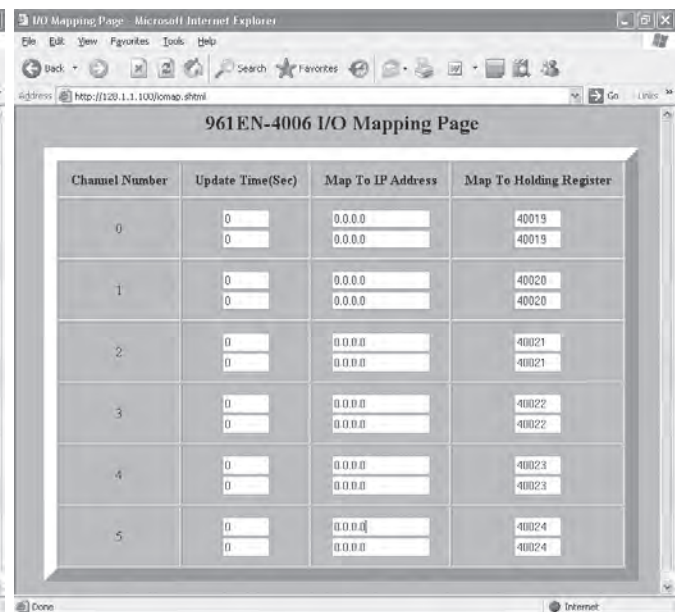
Installation #3: Wireless connection (telemetry systems)



See Page 27 for Acromag Industrial Ethernet Switches.



Discrete I/O Module configuration screen



Analog Input Module configuration screen



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 timeout 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.

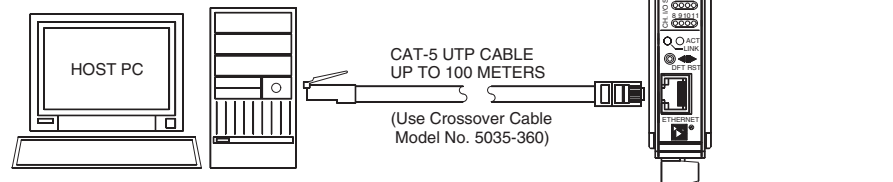


Figure 1: Plug the Ethernet cable from your computer into the I/O module's RJ-45 port to start configuration.

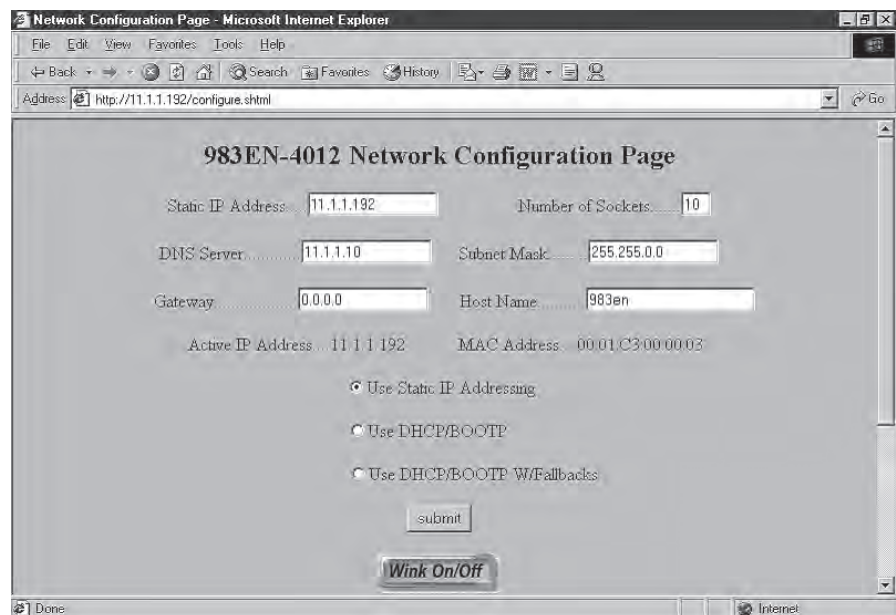


Figure 2: A web page is embedded into each module for easy configuration using a standard web browser.



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



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)

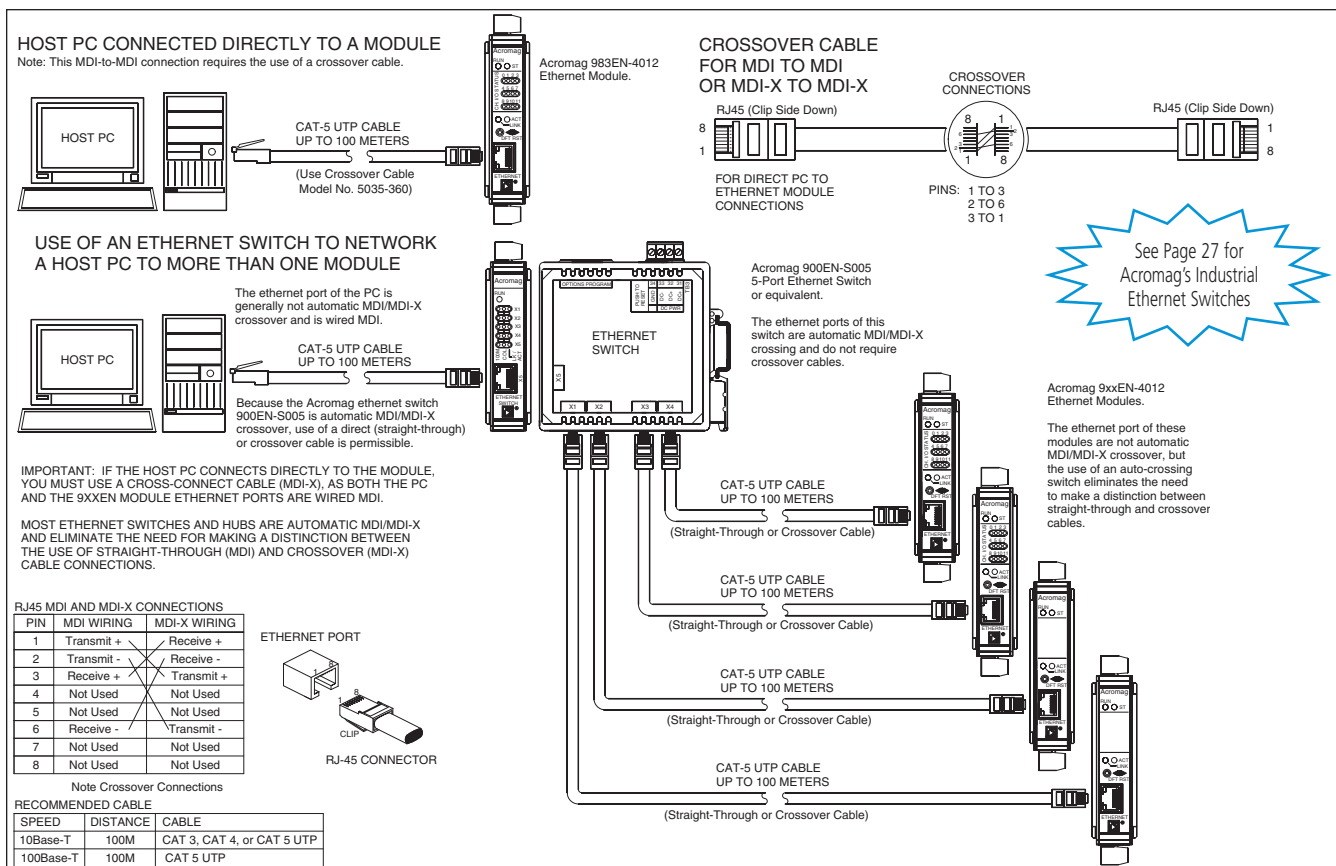
Per EN61000-4-6.

Surge Immunity

Per EN61000-4-5.

Radiated Frequency Emissions

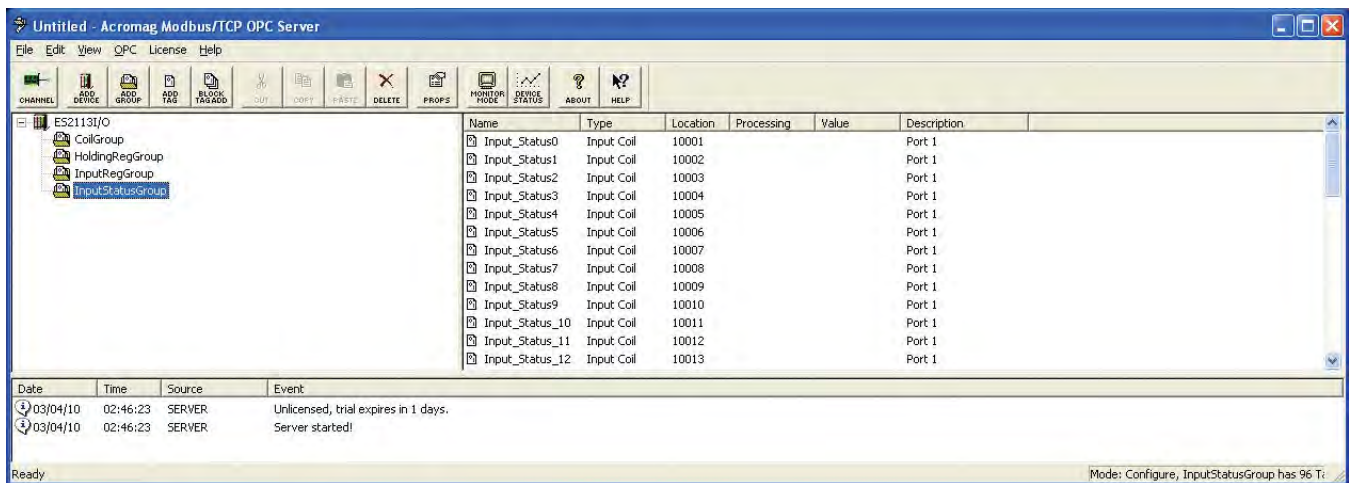
Per EN55022 Class B.





Ethernet I/O: Software Support

ACMBTCP-OPC Modbus/TCP Master OPC DA Server



High-performance OPC Server for all Acromag Ethernet I/O ♦ Low-cost server exclusively for Acromag I/O

Description

Acromag's Modbus/TCP Master OPC DA Server delivers high-speed connectivity to all Acromag Modbus TCP/IP slave devices via Ethernet. This server is designed for all local or remote OPC clients such as HMI, SCADA, operator interface and custom-built (Visual Basic®, Visual C++®) applications.

This OPC server offers the most reliable, cost effective and comprehensive features list available in the OPC/HMI market today.

Our unique read/write tag optimization algorithms provide unmatched data transfer speeds between OPC server and hardware devices.

Acromag's OPC server has passed the OPC Foundation's OPC Data Access 3.00 compliance test.

This server includes comprehensive, context-sensitive help systems, Visual Basic OPC client example application with Visual Basic source code, and a pre-built client executable.

Compatible With Leading HMI and SCADA Packages

Acromag's Data Access Server can be used as a data server to any HMI or SCADA package that is OPC compliant. Additionally, the online help system will guide you through the configuration for popular packages from Wonderware, Intellution, Rockwell, GE, and others.

Key Features & Benefits

- Runs on Windows® XP, Vista, 7, 2003 Server, 2008 Server
- Designed exclusively for use with all Acromag Modbus/TCP Ethernet devices
- OPC compliance tested
- Unlimited OPC clients, devices, or items
- Supports OPC custom and automation interfaces such as Visual Basic and C++
- Easy CSV import / export capability
- Modbus packet optimization for fast transactions
- Runs as a stand-alone executable or unattended with no login required
- Device status dialog for easy diagnostics

Free 30-day Trial Version

Download a no-risk demonstration version and try it free for 30 days. Once you see how easy it is and the robust functionality, you can quickly convert the trial version to a full product license.

Ordering Information

ACMBTCP-OPC*

Modbus/TCP Master OPC DA Server.

Only available online at www.acromag.com/OPC

Free 30-day Trial*

Download a no-risk 30-day demonstration version at www.acromag.com/OPC

*** NOTE:** This software package is only for use with Acromag Ethernet I/O modules. It cannot be used with third-party instrumentation.



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Ethernet I/O: BusWorks® Series



ESW-MBLIB Ethernet Modbus C Library Software



```
Command Prompt - exmbtcpip

Modbus TCP/IP Example 9500-370A

1. Exit this Program
2. Set IP Address: 10.1.1.161
3. Set Register Address: 0
4. Set Register Count: 4
5. Report Slave I.D.
6. Read Output Status
7. Read Input Status
8. Force Single Coil
9. Force Multiple Coils
10. Read Output Registers
11. Read Input Registers
12. Preset Single Register
13. Preset Multiple Registers

Select: 11
00 0002
01 0000
02 0000
03 0000
```

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.

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
- 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

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



Microsoft
Visual C



Linux



VxWorks®



Ordering Information

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





Ethernet I/O: Software Support

AMXX Series ActiveX / .NET Controls for Modbus I/O



Microsoft
Visual Basic



Microsoft
Visual C++



Easy PC-based communication to Acromag BusWorks and EtherStax I/O ♦ Modbus/TCP or Modbus/RTU

Description

Acromag's AMXX Series software controls provide a fast, easy way to communicate with any Modbus/RTU or Modbus/TCP slave devices connected to your PC's serial or network ports. Within minutes, your Visual Basic, Visual C, .NET, Excel, or other compatible applications will be talking Modbus protocol.

AMRX Modbus/RTU ActiveX Control

The AMRX package is an easy to use ActiveX control that provides a convenient way to communicate to Modbus/RTU slave devices. It also includes a timer for polled data acquisition and a floating point conversion ActiveX control.

AMRN Modbus/RTU Forms Control

AMRN is a simple Windows Forms Control that provides a quick way to communicate with Modbus/RTU slave devices connected to your PC's serial port.

AMTX Modbus/TCP ActiveX Control

AMTX is an easy to use ActiveX control that simplifies communication with Modbus/TCP slave devices connected to your PC's wired or wireless network.

AMTN Modbus/TCP Forms Control

AMTN is an easy to use Windows Forms Control for Modbus/TCP to communication with slave devices connected to your PC's Ethernet port. It can be used on a form or optionally without a form.

Demonstration Programs

Demonstration versions are available. The demos are complete operating ActiveX controls that have a time limit. After 60-90 minutes, communication functions will be disabled. Re-starting the application will initiate another functional demonstration period.

Key Features & Benefits

- Any container application that can embed ActiveX controls can use the AMXX software packages
- At design time, you can access your Modbus device from the software's test property page
- Property page device access makes start-up and troubleshooting a snap – all without writing a single line of code
- Talking to a Modbus slave is as simple as calling a function with the necessary arguments
- The software automatically builds the command, appends a CRC, sends the request over the network, and validates the response
- Your program just reads and writes simple 16-bit data values
- ActiveX controls include a help file and examples for Excel, Visual Basic, C++
- .NET controls include a help file and examples for Visual Basic, C#, and Managed C++



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Ethernet I/O: Software Support

Software Controls Selection Guide

Controls	Protocols		Visual Studio 6.0		Visual Studio 2003/2005/2008			Windows			Compatible Products	
Model	Modbus/RTU (RS-485)	Modbus/TCP (Ethernet)	Visual Basic (VB6)	Visual C++ (VC6)	Visual Basic (.NET)	Visual C++ (.NET)	Visual C# (.NET)	Excel	32-bit	64-bit	900MB	900EN ES2000
AMRX	•		•	•				•	•		•	
AMRN	•				•	•	•		•		•	
AMTX		•	•	•				•	•			•
AMTN*		•			•	•	•		•	•		•

* AMTN is not compatible with Visual Studio 2003.

AMTX Modbus/TCP Master ActiveX Control Properties

Server | Test

ServerIPAddress: 192 . 168 . 1 . 200

ListenPort: 502 (502 recommended)

RcvTimeout: 500 ms

ConnectTimeout: 3000 ms

OK Cancel Apply Help

Ordering Information

AMRX-CD

Modbus/RTU ActiveX Control,
Single Development Site License (on CD-ROM).

AMRN-CD

Modbus/RTU Windows Forms Control,
Single Development Site License (on CD-ROM).

AMTX-CD

Modbus/TCP ActiveX Control,
Single Development Site License (on CD-ROM).

AMTN-CD

Modbus/TCP Windows Forms Control,
Single Development Site License (on CD-ROM).

By purchasing a single development site license you may install the software and develop your application on a single PC and distribute it with your compiled application program royalty free an unlimited number of times. When used in a Microsoft Excel, Word, PowerPoint or other non-compiling end-user application program where full development capabilities are always present, a separate license file must be purchased and installed on each computer that the end-user application program is installed and running on. Please see the EULA included with the demo for complete licensing information.

AMTX Modbus/TCP Master ActiveX Control Properties

Server | Test

Modbus

UnitID: 1 StartReg: 0 NumReg: 16

Access: ☐ Input Register(s) ☒ Holding Register(s) ☐ Coil(s) ☐ Discrete Input(s)

Format: ☒ Hex ☐ Decimal

Buttons: Read, Write, Report Slave ID, Read Exp. Stat

Status: No Error

Data: 000F, 0000, 0000, 0000, 0000, 0000, 0000, 0000, 0000, 0000, 0000, 0000, 0000, 0000, 0000, 0000

OK Cancel Apply Help



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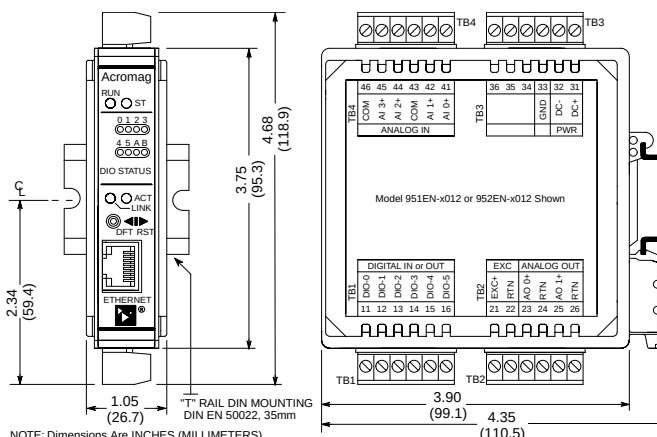
Ethernet I/O: BusWorks® Series

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



24 HR
STOCK ITEM

7 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 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

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■ Performance

■ General Specifications

See Page 17 for communication and other specs.

■ 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 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 $\pm 0.05\%$ 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 Info

NOTE: i2o function is only available on Ethernet Modbus TCP/IP modules

Models

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

See Page 26 for cables, power supplies, mounting hardware, optional terminal blocks and AC sensors.

Industrial Ethernet Switches

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.

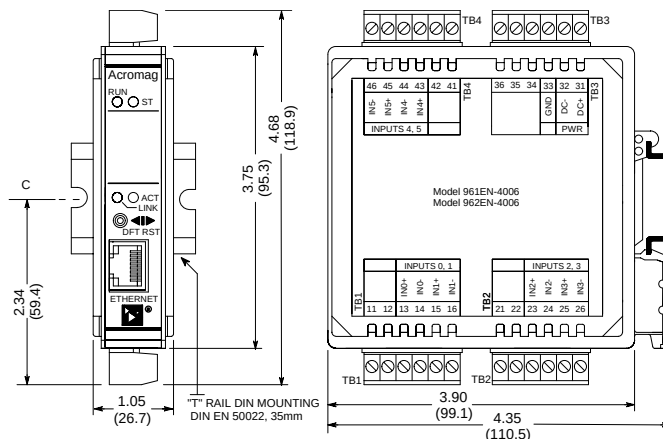
Ethernet I/O: BusWorks® Series

961EN, 962EN Ethernet Analog Input Modules



24 HR
STOCK ITEM

7 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 $\pm 0.05\%$ 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

See Page 25.

Hardware Accessories and Power Supplies

See Page 26.

Software Support

See Page 27.

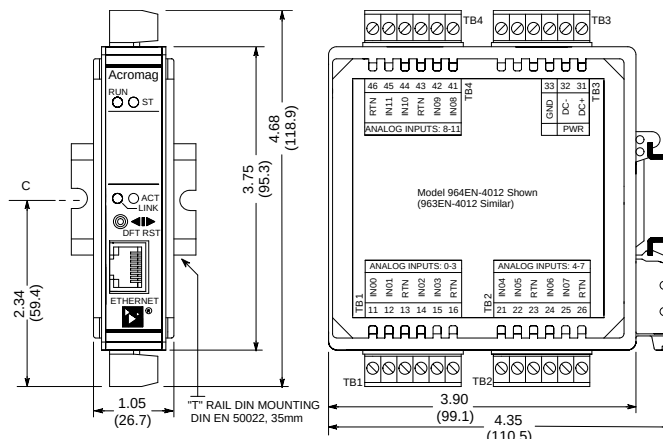
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Ethernet I/O: BusWorks® Series



963EN, 964EN Ethernet Analog Input Modules



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 $\pm 0.05\%$ 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

See Page 25.

Hardware Accessories and Power Supplies

See Page 26.

Software Support

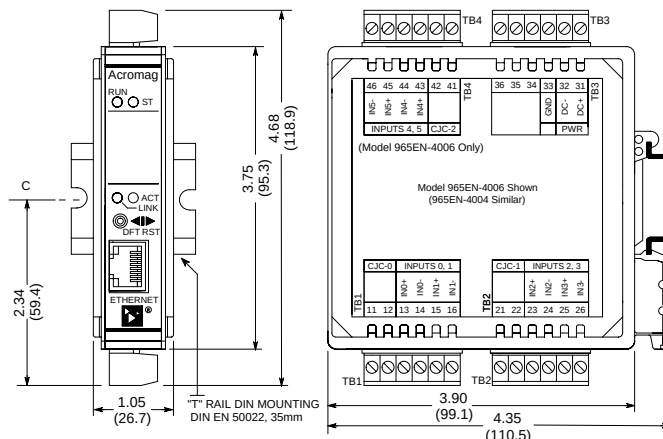
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Ethernet I/O: BusWorks® Series

965EN Ethernet Temperature Input Modules



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

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

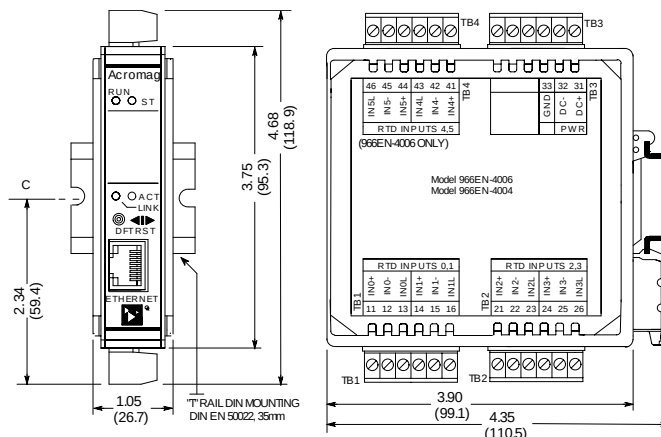
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Ethernet I/O: BusWorks® Series



966EN Ethernet Temperature Input Modules



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.

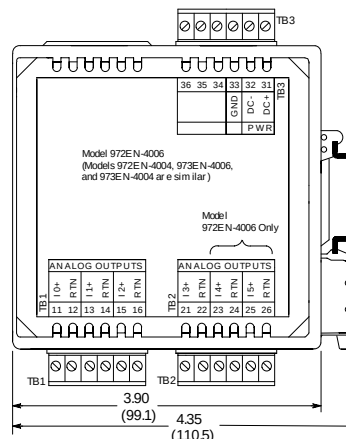
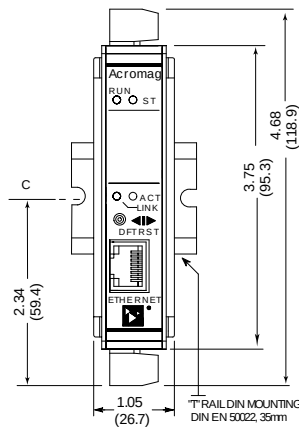
Software Support

See Page 27.

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THE LEADER IN INDUSTRIAL I/O

Ethernet I/O: BusWorks® Series

972EN, 973EN Ethernet Analog Output Modules



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/IP 10/100Mbps 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-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

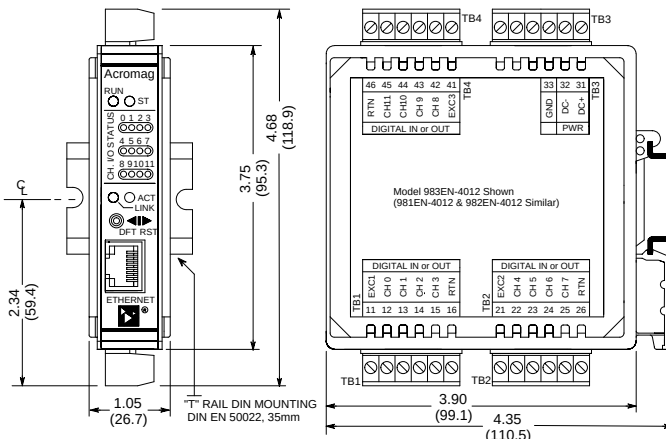
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THE LEADER IN INDUSTRIAL I/O

Ethernet I/O: BusWorks® Series



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



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 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

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

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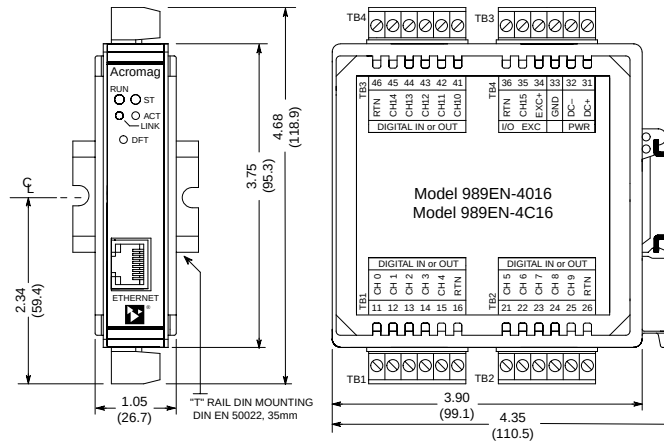
Ethernet I/O: BusWorks® Series

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



24 HR
STOCK ITEM

7 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 fail-safe 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.

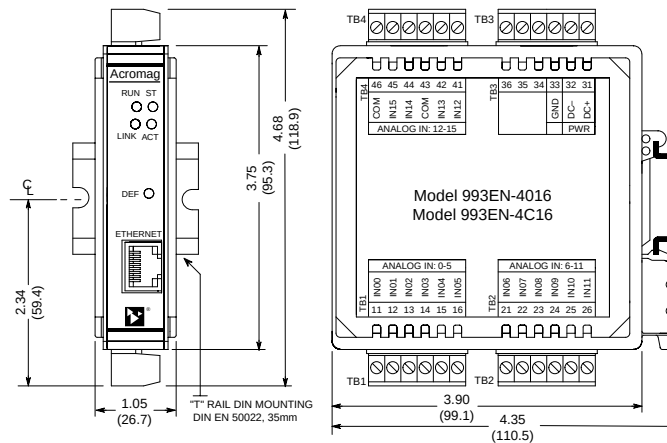




Ethernet I/O: BusWorks® Series

993EN Ethernet Analog Input Modules

CE 24HR
5YR



Standard model includes cage clamp terminal blocks. Optional terminals available (see Catalog 8400-100).

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 (pending)

CE, UL/cUL (industrial-grade units only)
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

See www.acromag.com for Ethernet switches, cables, power supplies, software and other items.

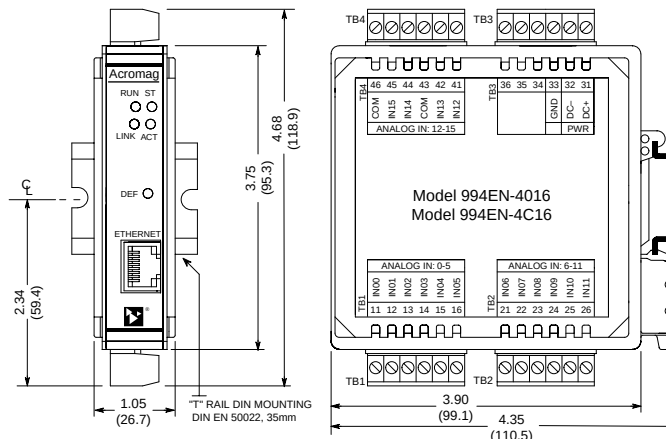
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Ethernet I/O: BusWorks® Series

994EN Ethernet Analog Input Modules

CE 24HR
5YR



Standard model includes cage clamp terminal blocks. Optional terminals available (see Catalog 8400-100).

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

$\pm 5V$, $\pm 10V$ DC
(selectable on each channel)

Ethernet Communication

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

Power Requirement

18 to 36V DC, 2.0W

Approvals (pending)

CE, UL/cUL (industrial-grade units only)
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

See www.acromag.com for Ethernet switches, cables, power supplies, software and other items.

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900EN Series, EIS Series Industrial Ethernet Switches

◆ 5-Port Switch, Unmanaged



◆ 8-Port Switch, Unmanaged



◆ 8-Port Switch, Managed, FX



900EN-S005 Ethernet Switches

Acromag's five-port Ethernet switch is designed for use in industrial applications. Rugged construction and a variety of security features ensure reliable operation under demanding conditions. Internal intelligence enables "connect and go" operation for fast and easy network installation with auto-negotiation of data rate, flow control, and crossover signal compatibility. No configuration is necessary when the 900EN-S005 is used as a simple switch with Acromag I/O modules. For advanced users, this switch offers numerous control functions that are easily configured through DIP-switch settings or programmed using your computer.

- Five shielded RJ-45 sockets, 8-pin, 10Base-T / 100Base-TX
- 1500V port-to-port isolation
- Redundant power support
- -25 to 70°C operating range
- CE, ATEX marked. UL, cUL listed, Class I; Div. 2; Groups A, B, C, D.

EIS Series Ethernet Switches

Models

- EIS-308: 8-port (Cu), unmanaged
- EIS-358: 8-port (Cu), redundancy, unmanaged
- EIS-408: 8-port (Cu/fiber), redundancy, managed

EIS series switches are designed for harsh environments. They feature a rugged IP30 aluminum case, 300,000 hour MTBF, and power supply redundancy for dependable networking.

Managed or unmanaged operation

With web-based setup, managed switches ensure easy installation and maintenance. Managed switches also support many powerful Ethernet features such as port VLAN, Quality of Service (QoS), Internet Group Management Protocol (IGMP) Snooping, and failure alarms.

Self-healing redundant ring capability

Some models employ redundancy to provide self-recovery if the primary communication path fails. Redundant ring technology instantly reconfigures to provide an alternate path. The fast recovery time protects mission-critical applications from interruptions and temporary malfunctions.

- Ultra-fast redundant ring technology (<300ms) supports STP, RSTP and proprietary protocols
- -10 to 70°C operating temperature range
- Port-to-port isolation (1200V AC)
- Built-in RFI/EMI and surge/transient protection

Ordering Information

◆ Switches

For more information please visit www.acromag.com.

900EN-S005

Ethernet switch, 5-port Copper

EIS-308

Ethernet switch, 8-port Copper

EIS-358

Ethernet switch with redundancy, 8-port Copper

EIS408FX-M

Ethernet switch with redundancy, 6 Cu / 2 Fiber-optic, multi-mode fiber (up to 2 km).

EIS-408FX-S

Ethernet switch with redundancy, 6 Cu / 2 Fiber-optic, single-mode fiber (up to 30 km).

◆ Accessories

Hardware Accessories and Power Supplies
See Page 26.



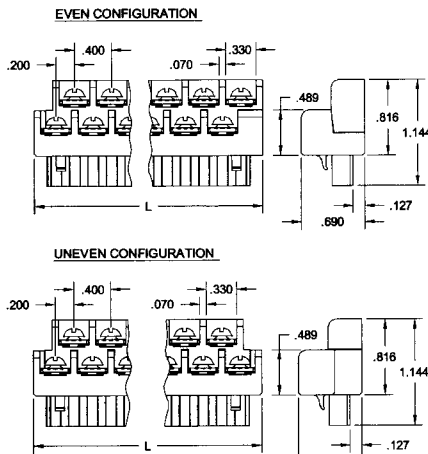
Ethernet I/O: BusWorks® Series

Accessories

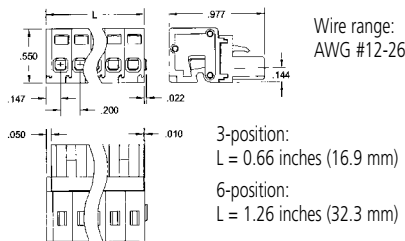
◆ Terminal Blocks



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

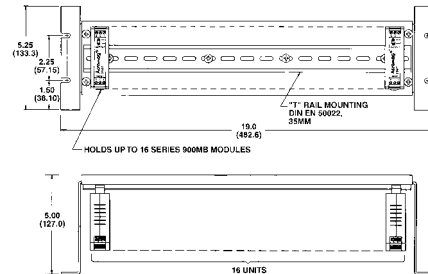
TBK-S03
Terminal block kit, one 3-position and three 6-position pieces

◆ 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.

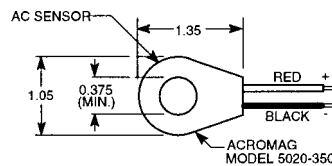


Ordering Information

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-SB24
Power supply, 15W, 0.65A at 24V DC

PS5R-SD24
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

5035-365
Configuration cable for advanced features, DB-25 PC parallel port to dual row connector, 4 feet long

4001-096
USB Ethernet adapter

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Ethernet I/O: BusWorks® Series



ESW-MBLIB Ethernet Modbus C Library Software



```
Command Prompt - exmbtcpip

Modbus TCP/IP Example 9500-370A

1. Exit this Program
2. Set IP Address: 10.1.1.161
3. Set Register Address: 0
4. Set Register Count: 4
5. Report Slave I.D.
6. Read Output Status
7. Read Input Status
8. Force Single Coil
9. Force Multiple Coils
10. Read Output Registers
11. Read Input Registers
12. Preset Single Register
13. Preset Multiple Registers

Select: 11
00 0002
01 0000
02 0000
03 0000
```

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.

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
- 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

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



Microsoft
Visual C



Linux



VxWorks®



Ordering Information

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





EIS Series Switches



900EN Series Switches



Industrial Ethernet Switches

Unmanaged Switches

EIS-308	8-port Copper	Page 28
EIS-358	8-port Copper with redundancy and fault relay	30
900EN-S005	5-port Copper	34

Web-Managed Switches

EIS-408FX	8-port Copper & Fiber with redundancy and fault relay	Page 32
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Technical Documentation

Accessories	Page 36
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	EIS-308	EIS-358	EIS-408FX	900EN
# OF PORTS				
Copper	8	8	6	5
Fiber			2	
REDUNDANCY				
Web-managed with redundancy			x	
Unmanaged with redundancy		x		
ALARM OUTPUT				
Fault relay		x	x	
POWER REQUIREMENT				
12- 48V DC-powered	x	x	x	
15- 36V DC-powered				x



EIS-308 Ethernet Industrial Switch

8-Ports, Unmanaged

Description

The EIS-308 is a value-packed, 8-port entry-level industrial switch. This DIN rail-mounted switch provides simple unmanaged Ethernet switching in a rugged aluminum enclosure offering IP30 standard protection. For power redundancy requirements, the EIS-308 has a terminal block with dual power inputs and reverse polarity protection. Store-and-forward switching architecture greatly increases network efficiency. It delivers true non-blocking switching performance to all ports running at full wire speed without any loss of packets.

Network Communication

8-port Copper 10Base-T / 100Base-TX switch

IEEE 802.3, 802.3u compliance

IEEE 802.3x flow control on full-duplex, back pressure on half-duplex

Power Requirement

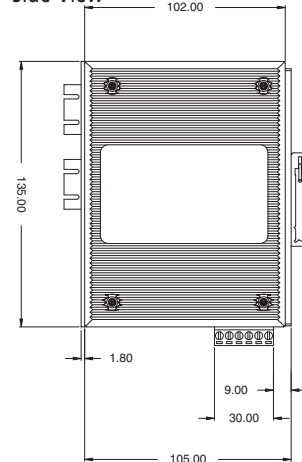
12 to 48V DC supply (4.6 Watts) required

Approvals

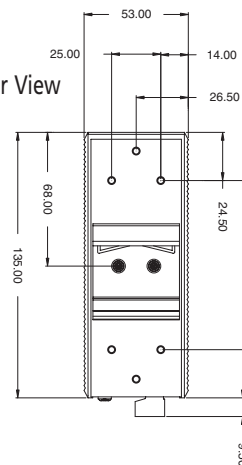
CE marked. UL, cUL listed.

Dimensions

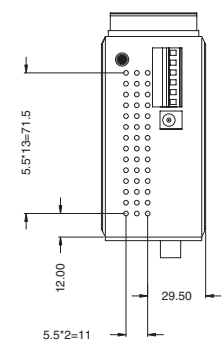
Side View



Rear View



Bottom View



Dimensions in millimeters.

Power



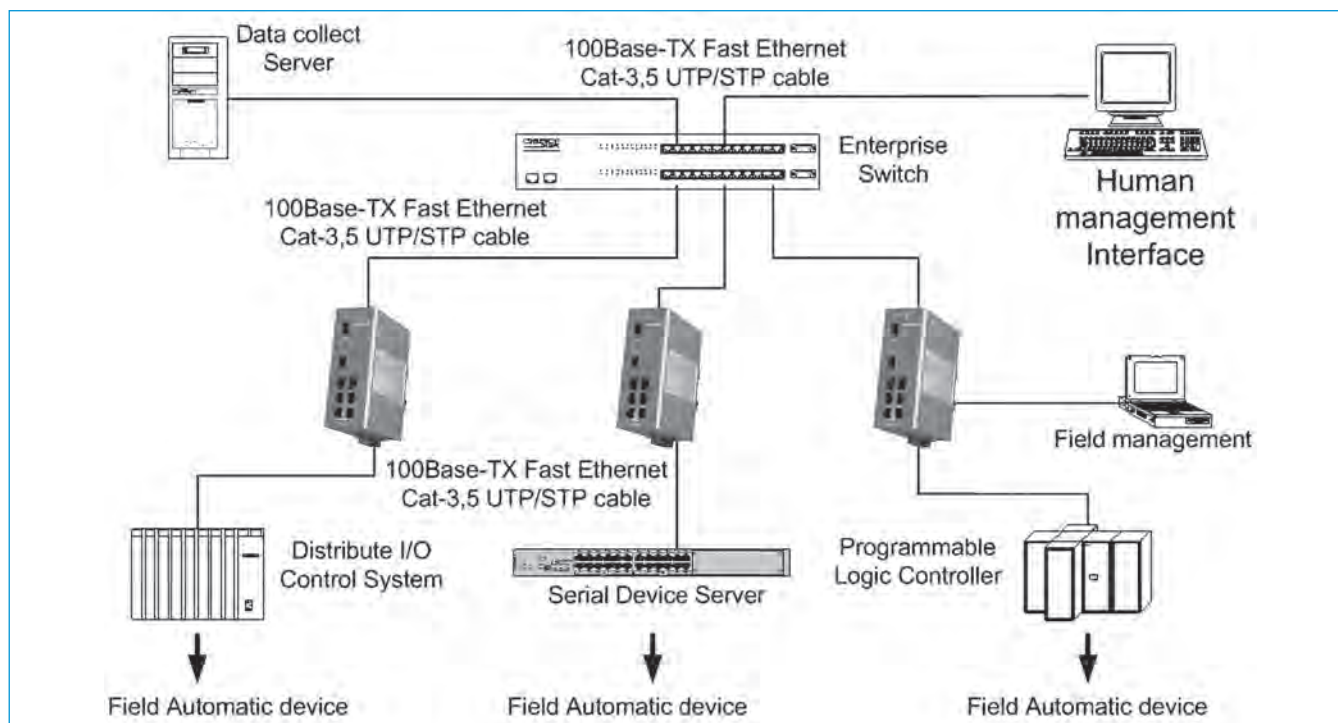
Special Features

Rugged Industrial-Grade

- Extended operating temperature -10 to 70°C
- Port-to-port isolation (1200V AC)
- Resists shock, vibration, and free-fall impacts
- Built-in RFI/EMI and surge/transient protection
- Rugged IP30 aluminum enclosure
- Wide-Range, redundant DC-power with reverse polarity protection
- Includes DC input jack for AC/DC wall transformer power
- Quick disconnect plug terminals
- Supports DIN rail, wall, or surface mounting
- 5-year warranty

High-Performance

- 1.19 Mpps transmission rates for eight active ports at 100Base-TX
- Store-and-forward operation with 1 Mbit embedded memory buffer and 2K MAC address table
- Auto MDI/MDI-X crossover & auto-polarity eliminates special up-link/down-link ports or crossover cables
- Half-duplex back pressure flow controls defer transmission by other stations to avoid network congestion.
- Two LED's per port indicate activity and full/half duplex mode
- Unmanaged stand-alone operation does not require PC control



Performance

Ethernet Interface

Connectors

Eight shielded RJ-45 sockets, 8-pin, 10BaseT/100BaseTX.

Standards

IEEE 802.3 10BaseT Ethernet.
IEEE 802.3u 100BaseTX Fast Ethernet.
IEEE 802.3x Flow Control and Back Pressure.

Protocols

CSMA/CD.

Technology

Non-blocking, store-and-forward switching architecture.

Transmission Rate

14880 pps for 10Base-T, 148800 pps for 100BaseTX.

Packet Throughput

1.19 Mpps with 64 bytes/packet and 8 active ports.

MAC Address Table Size

2K MAC address table.

Memory Buffer

1024 Kbits.

LEDs

Per port: Green Link/Activity,
Orange/Yellow Full-Duplex/Collision.

Per unit: Green Power, Power 1, and Power 2.

Network Cables

10BaseT: Twisted-pair UTP/STP Cat. 3, 4, 5 cable
EIA/TIA-568 100-ohm (100m maximum).

100BaseT(X): twisted-pair UTP/STP Cat. 5 cable
EIA/TIA-568 100-ohm (100m).

Environmental

Port Isolation

Port-to-port isolation of 1200V AC.

Ambient Temperature

Operating: -10 to 70°C (14 to 158°F).
Storage: -40 to 85°C (-40 to 185°F).

Relative Humidity

Operating: 5 to 95%, non-condensing.
Storage: 5 to 95%, non-condensing.

Power Supply

12 to 48 VDC, redundant dual DC power inputs with reverse polarity protection and a removable terminal block.

Power consumption

4.6 Watts.

Installation

DIN-Rail kit (attached) and wall mounting plate (included accessory).

Dimensions

54 mm (W) x 135 mm (H) x 105mm (D).

Electromagnetic Interference Immunity (EMI)

FCC Class A.

Electromagnetic Compatibility (EMC)

EN61000-4-2, EN61000-4-3, EN-61000-4-4,
EN61000-4-5, EN61000-4-6, EN61000-4-8,
EN61000-4-11.

Safety

UL, CUL, CE/EN60950, IP-30.

Stability

IEC60068-2-32 (Free fall), IEC60068-2-27 (Shock),
IEC60068-2-6 (Vibration).

Ordering Info

Models

EIS-308

Ethernet switch, 8-port Copper

Each unit shipped with DIN rail clip installed, wall/surface mounting plate, user manual CD ROM, and Quick Install Guide.

Accessories

See Page 36 for cables, power supplies, and mounting hardware.

5035-355

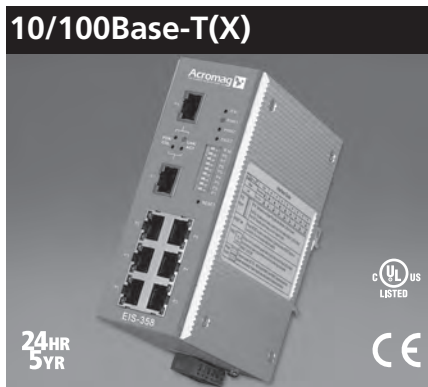
Ethernet straight cable, CAT5, 3 feet long, shielded

5035-360

Crossover cable for module configuration, CAT5E, 5 feet long, shielded

PS5R-D24

Power supply (24V DC, 2.1A)



EIS-358 Ethernet Industrial Switch

8-Ports, Unmanaged with Redundancy

Description

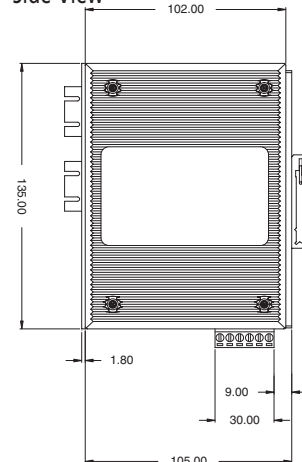
The EIS-358 is an 8-port unmanaged redundant Ethernet switch, specially designed for industrial applications. This DIN rail switch supports a plug-n-play redundant communication ring and also has redundant DC power inputs. A relay output provides alarms for media or power failures. To meet the requirements of your harsh environment, the EIS-358 features a rugged aluminum case offering IP30 standard protection.

Redundant Ring Recovery Time < 300ms

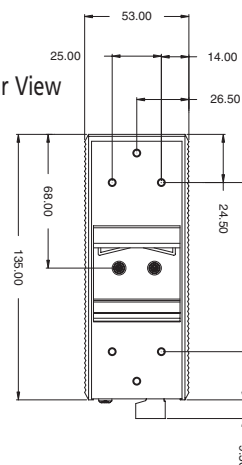
A critical criteria for industrial automation applications is the ability to ensure non-stop system operation. If a minor failure in the communication process occurs, you could suffer substantial damage in terms of extra time and monetary losses. EIS-358 Series switches are your ultimate solution. With self-healing redundant ring technology, the EIS-358 provides you with an automatic self-recovery mechanism. If any segment of your primary communication path is broken or disconnected, redundant ring technology allows this switch to self-reconfigure and to provide a redundant path in the network. With ultra-fast recovery time (less than 300ms), your mission-critical applications are protected from any network interruptions or temporary malfunctions. You won't even notice a network failure.

Dimensions

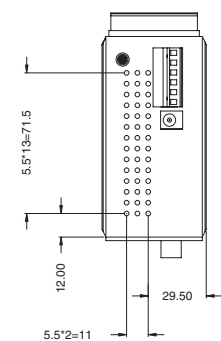
Side View



Rear View



Bottom View



Dimensions in millimeters.

Power

V2- V2+ N/A V1- V1+



Alarm Relay Output

The EIS-358 has a built-in alarm relay contact to signal power or media failures. This relay output function forms a short circuit when power fails or a port link breaks. It will automatically form an open circuit when a port link or power input resumes. The EIS-358 also uses the relay output to trigger your warning system and inform your maintenance engineers of the problems.

Network Communication

8-port Copper 10Base-T / 100Base-TX switch

IEEE 802.3, 802.3u compliance

IEEE 802.3x flow control on full-duplex, back pressure on half-duplex

Power Requirement

12 to 48V DC supply (4.6 Watts) required

Approvals

CE marked. UL, cUL listed.

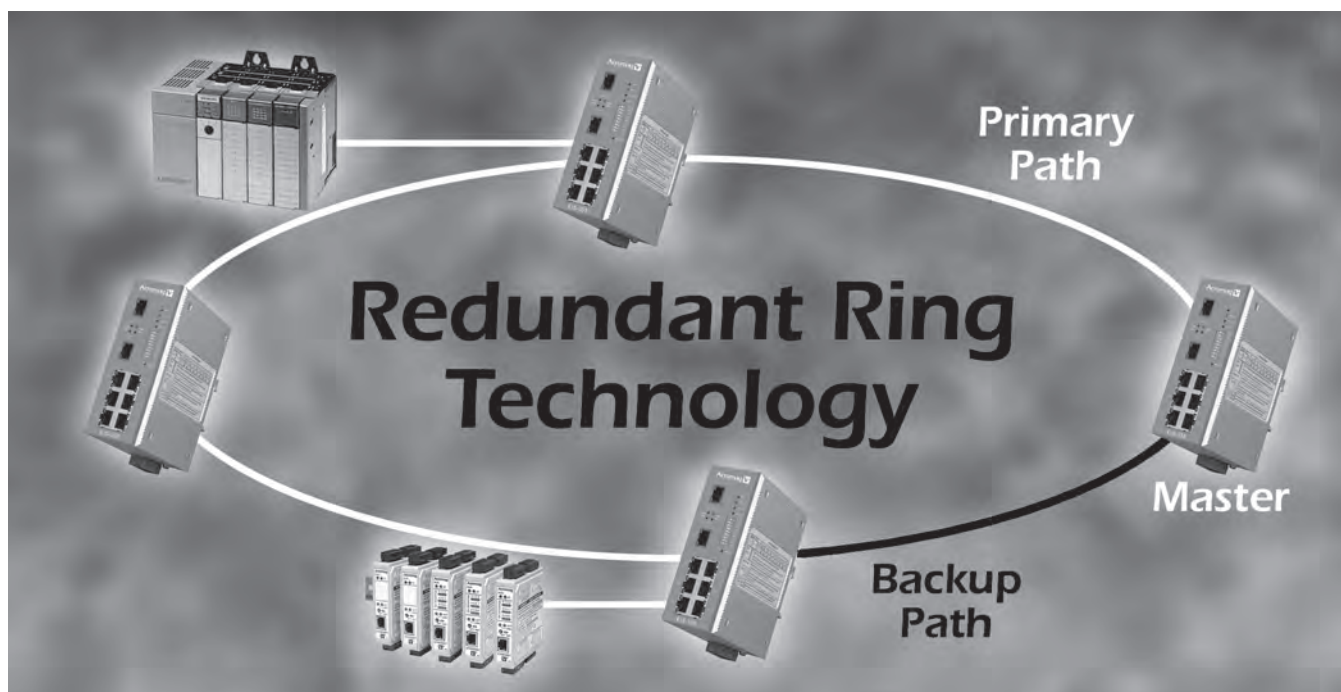
Special Features

Rugged Industrial-Grade

- Fast redundant ring technology (<300ms)
- Extended operating temperature -10 to 70°C
- Alarm relay output for media/power failure
- Port-to-port isolation (1200V AC)
- Resists shock, vibration, and free-fall impacts
- Built-in RFI/EMI and surge/transient protection
- Rugged IP30 aluminum enclosure
- Wide-Range, redundant DC-power with reverse polarity protection
- Includes DC input jack for AC/DC wall transformer power
- Quick disconnect plug terminals
- Supports DIN rail, wall, or surface mounting
- 5-year warranty

High-Performance

- 1.19 Mpps transmission rates for eight active ports at 100Base-TX
- Store-and-forward operation with 1 Mbit memory buffer and 2K MAC address table
- Auto MDI/MDI-X on each port



Performance

Ethernet Interface

Connectors

Eight shielded RJ-45 sockets, 8-pin, 10BaseT/100BaseTX.

Standards

IEEE 802.3 10BaseT Ethernet.
IEEE 802.3u 100BaseTX Fast Ethernet.
IEEE 802.3x Flow Control and Back Pressure.

Protocols

CSMA/CD.

Technology

Non-blocking, store-and-forward switching architecture.

Transmission Rate

14880 pps for 10Base-T, 148800 pps for 100BaseTX.

Transfer packet size

64 bytes to 1522 bytes (with VLAN tag).

Packet Throughput

1.19 Mpps with 64 bytes/packet and 8 active ports.

MAC Address Table Size

2K MAC address table.

Memory Buffer

1 Mbits.LEDs

Per port: Green Link/Activity,
Orange/Yellow Full-Duplex/Collision.

Per unit: Green Power, Power 1, and Power 2.
Orange Fault, and green Ring Master.

Network Cables

10BaseT: Twisted-pair UTP/STP Cat. 3, 4, 5 cable
EIA/TIA-568 100-ohm (100m maximum).

100BaseT(X): twisted-pair UTP/STP Cat. 5 cable
EIA/TIA-568 100-ohm (100m).

Backplane

1.6 Gbps.

Relay Alarm Current/Voltage

Up to 1A and 24V DC.

Environmental

Port Isolation

Port-to-port isolation of 1200V AC.

Ambient Temperature

Operating: -10 to 70°C (14 to 158°F).
Storage: -40 to 85°C (-40 to 185°F).

Relative Humidity

Operating: 5 to 95%, non-condensing.
Storage: 5 to 95%, non-condensing.

Power Supply

12 to 48 VDC, redundant dual DC power inputs with reverse polarity protection and a removable terminal block.

Power consumption

4.6 Watts.Installation

DIN-Rail kit (attached) and wall mounting plate (included accessory).

Electromagnetic Interference Immunity (EMI)
FCC Class A.

Electromagnetic Compatibility (EMC)

EN61000-4-2, EN61000-4-3, EN-61000-4-4,
EN61000-4-5, EN61000-4-6, EN61000-4-8,
EN61000-4-11.

Safety

UL, CUL, CE/EN60950, IP-30.

Stability

IEC60068-2-32 (Free fall), IEC60068-2-27 (Shock),
IEC60068-2-6 (Vibration).

Ordering Info

Models

EIS-358

Ethernet switch with redundancy, 8-port

Accessories

See Page 36 for cables, power supplies, and mounting hardware.

5035-355

Ethernet straight cable, CAT5, 3 feet long, shielded

5035-360

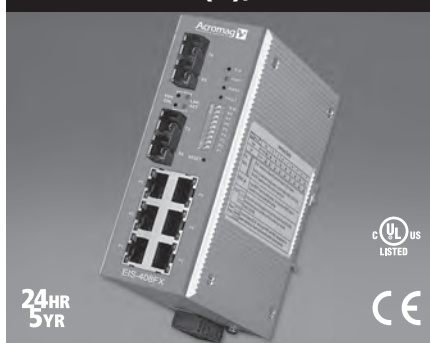
Crossover cable for module configuration, CAT5E,
5 feet long, shielded

PS5R-D24

Power supply (24V DC, 2.1A)



10/100Base-T(X), 100Base-FX



EIS-408FX Ethernet Industrial Switch

8 Ports (6 Cu, 2 Fiber), Web-Managed, with Redundancy

Description

The EIS-408 is an 8-port web-managed industrial switch. It supports many powerful industrial Ethernet features such as redundant ring technology, port VLAN, Quality of Service (QoS), Internet Group Management Protocol (IGMP) Snooping, and a media/power failure alarm.

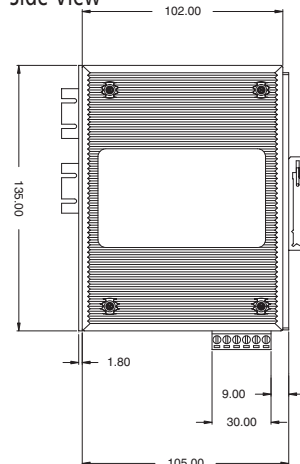
This switch has six 10/100Base-TX ports and two 100Base-FX ports for extending communication distance from 2,000 meters (multi-mode fiber) to 30 km (single-mode fiber). The EIS-408 also has redundant DC power inputs. With the web-based configuration interface, this switch ensures easy installation and management of your switches. The IP30 robust aluminum case and 300,000 hours of MTBF make the EIS-408 the best solution to enhance your industrial networking automation.

Redundant Ring Recovery Time < 300ms

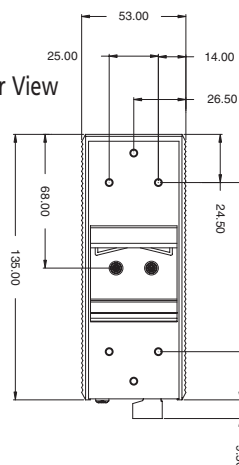
A critical criteria for industrial automation applications is the ability to ensure non-stop system operation. If a minor failure in the communication process occurs, you could suffer substantial damage in terms of extra time and monetary losses. EIS-408 Series switches are your ultimate solution. With self-healing redundant ring technology, the EIS-408 provides you with an automatic self-recovery mechanism. If any segment of your primary communication path is broken or

Dimensions

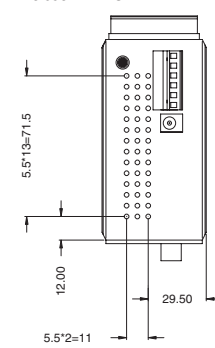
Side View



Rear View



Bottom View



Dimensions in millimeters.

Power

V2- V2+ N/A V1- V1+



disconnected, redundant ring technology allows this switch to self-reconfigure and to provide a redundant path in the network. With ultra-fast recovery time (less than 300ms), your mission-critical applications are protected from any network interruptions or temporary malfunctions. You won't even notice a network failure.

Advanced Management

In addition to redundant ring technology, the EIS-408 provides many advanced features for network management. The EIS-408 supports Quality of Service (QoS) which classifies the importance of each packet and prioritizes the tasks. Ethernet packets, such as control messages, are handled first followed by lower priority packets such as collected data. QoS provides an ideal solution for real-time systems.

With the port-based VLAN function, devices are put into logical subgroups within a local area network regardless of the physical LAN segment they are on. Devices from a different VLAN cannot communicate or access your LAN, providing extra security to the entire network. VLAN functions can also restrain the traffic within a VLAN to improve network performance in a large scale.

IGMP Snooping can manage multicasting traffic in a switched network. By filtering the multicasting traffic and sorting it to the corresponding group of devices, the EIS-408 forwards messages

only to the devices that are interested in the messages. It will reduce the total amount of traffic on the entire network substantially.

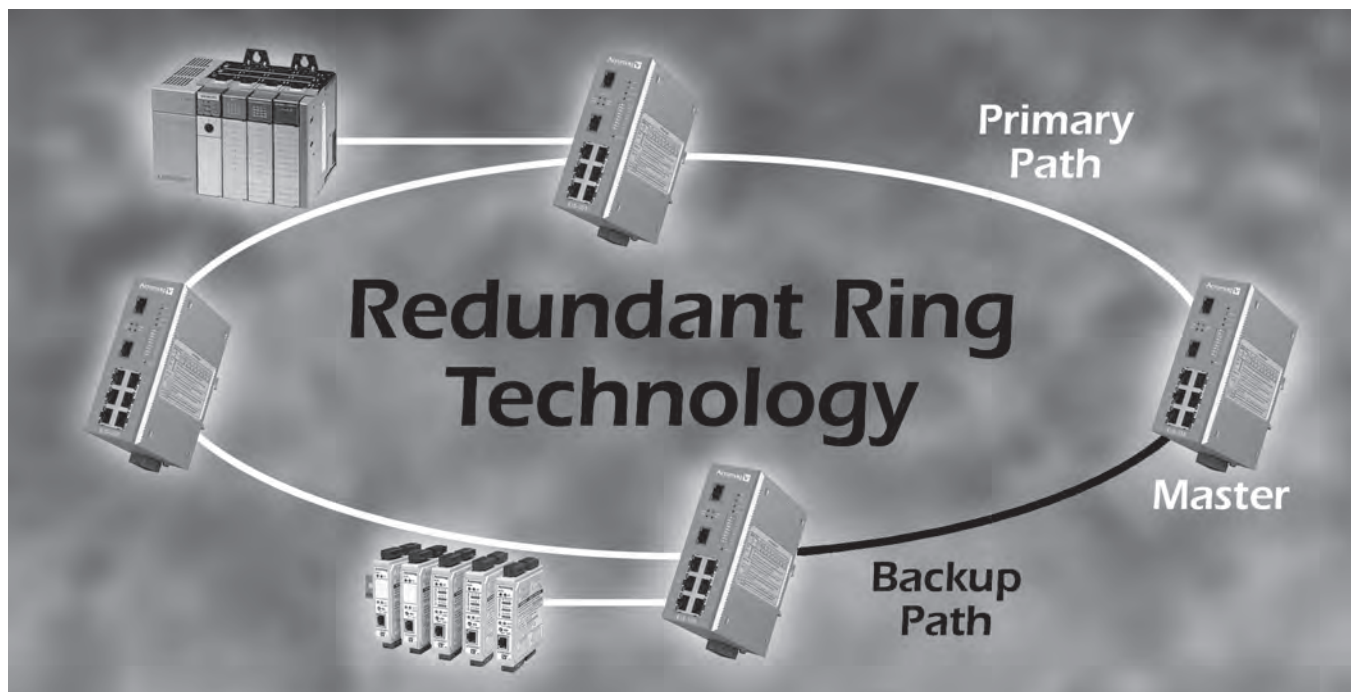
Special Features

Rugged Industrial-Grade

- 6 copper, 2 fiber port web managed redundant switch with media/power fault alarm relay
- IEEE 802.3, 3u, 3x compliant
- Fast redundant ring technology (<300ms)
- Supports open STP & RSTP redundant protocols
- Extended operating temperature -10 to 70°C
- Port-to-port isolation (1200V AC)
- Built-in RFI/EMI and surge/transient protection
- Wide range 12-48V DC redundant power with reverse polarity protection

High-Performance

- Supports VLAN/QoS/IGMP snooping
 - IGMP with query mode
 - VLAN/802.1Q Tag VLAN
 - Class of Service (COS) and (TOS)
 - STMP, online port mirroring & IP security
 - Broadcast packet filtering
- Rugged IP30 aluminum enclosure
- 5-year warranty



Performance

Ethernet Interface

Ports

Six copper 10/100Base-TX, auto-MDI/MDIX.
Two fiber optic 100Base-FX, SC connectors.

Standards

IEEE 802.3 10BaseT Ethernet.
IEEE 802.3u 100BaseTX Fast Ethernet.
IEEE 802.3x flow control and back pressure.
IEEE 802.1p class of service.
IEEE 802.1Q VLAN.

Processing

Non-blocking, store-and-forward switching architecture.

Packet Filter

Broadcast packet filtering.

Protocols

CSMA/CD.

Transmission Rate

14880pps 10Base-T, 148800pps 100Base-TX/FX.

Transfer packet size

64 bytes to 1522 bytes (with VLAN tag).

Packet Throughput

1.19 Mpps with 64 bytes/packet and 8 active ports.

MAC Address Table Size

2K MAC address table.

Memory Buffer

1 Mbits.

LEDs

Per port: Link/Activity (Green).
Full-Duplex/Collision (Orange/Yellow).

Per unit: Power, Power 1, and Power 2 (Green).
Fault (Orange). Ring Master (Green).

Network Cables

10Base-T: Twisted-pair UTP/STP Cat. 3, 4, 5 cable
EIA/TIA-568 100-ohm (100m maximum).

100Base-TX: Twisted-pair UTP/STP Cat. 5 cable
EIA/TIA-568 100-ohm (100m).

100Base-FX: Select multi-mode or single-mode cables.

Backplane

1.6 Gbps.

Relay Alarm Current/Voltage

Up to 1A and 24V DC.

Environmental

Port Isolation

Port-to-port isolation of 1200V AC.

Ambient Temperature

Operating: -10 to 70°C (14 to 158°F).
Storage: -40 to 85°C (-40 to 185°F).

Relative Humidity

5 to 95%, non-condensing.

Power Supply

12 to 48 VDC, redundant dual DC power inputs with reverse polarity protection and a removable terminal block.

Power consumption

6 Watts.

Installation

DIN-Rail kit (attached) and wall mounting plate (included accessory).

Electromagnetic Interference Immunity (EMI)

FCC Class A.

Electromagnetic Compatibility (EMC)

EN61000-4-2, EN61000-4-3, EN-61000-4-4,
EN61000-4-5, EN61000-4-6, EN61000-4-8,
EN61000-4-11.

Safety

UL, CUL, CE/EN60950, IP-30.

Stability

IEC60068-2-32 (Free fall), IEC60068-2-27 (Shock),
IEC60068-2-6 (Vibration).

Ordering Info

Models

EIS-408FX-S

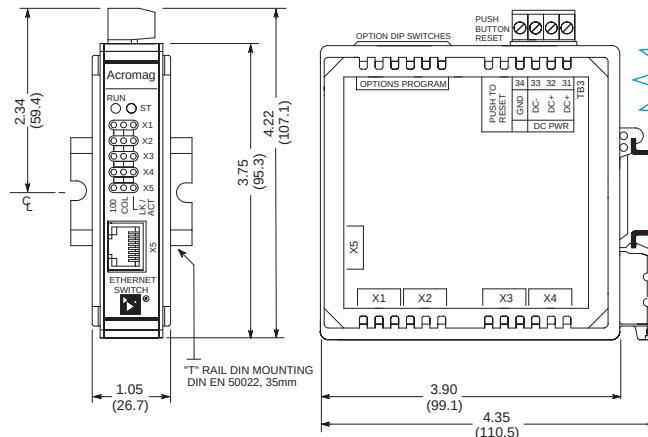
Ethernet switch with redundancy, 6 Cu / 2 FO, single-mode fiber (up to 30 km).

EIS408FX-M

Ethernet switch with redundancy, 6 Cu / 2 FO, multi-mode fiber (up to 2 km).

Accessories

See Page 36 for cables, power supplies, and mounting hardware.



No configuration required when used as a simple switch with Acromag I/O modules.

900EN-S005 Ethernet Switch:

5-Ports, 10/100Mbps

Description

Acromag's five-port Ethernet switch is specially designed for use in industrial applications. Rugged construction and a variety of security features ensure reliable operation under demanding conditions. Internal intelligence enables "connect and go" operation for fast and easy network installation with auto-negotiation of data rate, flow control, and crossover signal compatibility. No configuration is necessary when the 900EN-S005 is used as a simple switch with Acromag I/O modules. For advanced users, this switch offers numerous control functions that are easily configured through DIP-switch settings or programmed using your computer.

Network Communication

Five shielded RJ-45 sockets, 8-pin, 10Base-T / 100Base-TX

Wired MDI-X with automatic MDI-X / MDI crossover

Auto-negotiated 10Mbps or 100Mbps

Auto-negotiated full or half duplex

IEEE 802.3, 802.3u, 802.3x compliance

Power Requirement

15 to 36V DC supply (2.6 Watts) required

Approvals

CE/ATEX marked.

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

Special Features

Industrial-Grade

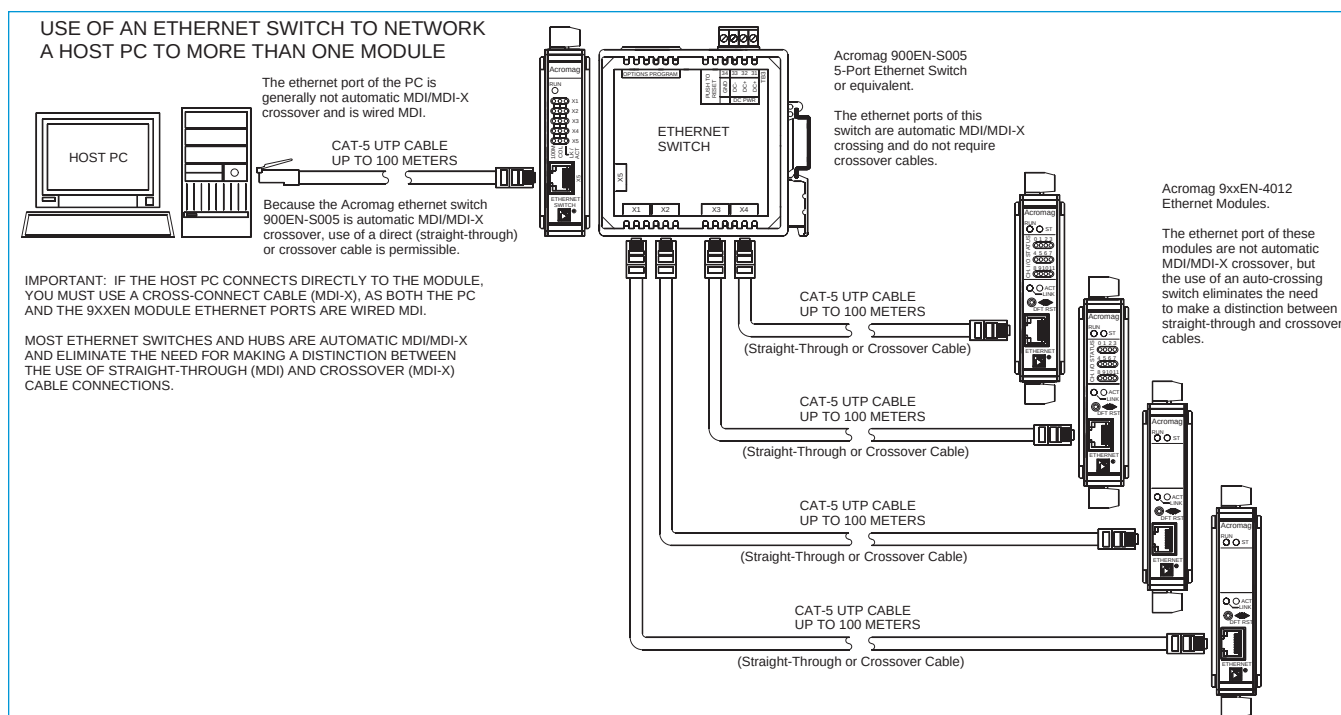
- Reliable performance over wide -25 to 70°C ambient temperature range
- Wide-Range DC-power with redundant power connection for optional standby backup power
- Hardened for harsh environments to protect from RFI, EMI, ESD, EFT, and surges
- Fully isolated for safety and increased noise immunity with power-to-network and port-to-port isolation
- Easy mounting, removal, and replacement with plug-in terminal and DIN-rail mount

High-Performance

- 10Base-T and 100Base-TX support automatically negotiates 10/100Mbps, half or full duplex with flow controls per IEEE 802.3
- Store and forward operation for 1024 frames provides integrated address look-up supporting 1K absolute MAC addresses
- Auto MDI/MDI-X crossover & auto-polarity eliminates special up-link/down-link ports or crossover cables
- Unmanaged stand-alone operation does not require PC control
- Broadcast storm protection helps unburden switch resources from excessive broadcast messaging
- Integrated 128KB (32Kx32-bit) high-speed SRAM frame buffer is shared by all five ports and supports 1.4Gbps memory bandwidth

Advanced Features

- Three programmable LED's per port provide link, activity, full/half duplex, speed indication
- Optional DIP-switch programming offers alternative control of switch functions
- Half-duplex back pressure flow controls defer transmission by other stations to avoid network congestion.
- Energy miser function shuts down individual port power if no cable is connected to conserve energy
- Toggle switch reset and default address generator is also useful to invoke DIP switch field programming and to restore communications to a known state
- Smart address management features automatic address learning, address aging, and address migration
- Advanced options are programmable via connection to your PC parallel port – LPTx (requires optional configuration cable)
- Supports virtual LAN definitions with port-based VLAN controls allowing establishment of VLAN groups for additional security between groups and applications (requires optional configuration cable)
- Queue priority management controls with advanced quality of service (QoS) supports "DiffServ" and IEEE 802.1p-based priority to prioritize different classes of voice, video, and data traffic, plus port-based priority (requires optional configuration cable)



Performance

Ethernet Interface

Connector

Five shielded RJ-45 sockets, 8-pin, 10BaseT/100BaseTX.

Wiring

Wired MDI-X w/ automatic MDI-X / MDI crossover.

Data Rate

Auto-negotiated, 10Mbps or 100Mbps.

Duplex

Auto-negotiated, Full or Half Duplex.

Compliance

IEEE 802.3, 802.3u, 802.3x.

Port Status Indicators

Three LED's per port - red, yellow, and green. Two selectable indication modes combine speed, link status, activity indication, and duplex indication.

Address Learning

Automatic, stores up to 1K (1024) MAC addresses.

Address Aging

Automatic, 5 minute default, can be disabled.

Address Migration

Automatic.

Broadcast Storm Protection

Disabled (default), but may optionally select a variable receive threshold.

Priority

Transmit all high priority before any low priority (default) with a variable high:low interleave (optional). Optionally select DiffServ, 802.1p, and port-based priority controls.

Virtual LAN

Supports virtual LAN definitions.

Communication Distance

Distance between two devices generally limited to 100 meters. Hubs and switches can extend distance.

Program Interface

DIP-switches and EEPROM/I²C interfaces allow some operating parameters to be modified and optional modes of operation to be set with or without a PC.

Environmental

Ambient Temperature

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

Relative Humidity

5 to 95%, non-condensing.

Isolation

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).

Power Requirements

Non-polarized 15-36V DC SELV (2.6 Watts).

Electromagnetic Interference Immunity (EMI)

Product has demonstrated resistance to digital upsets with interference from switching solenoids, commutator motors, and drill motors.

Regulatory Approvals

Electromagnetic Compatibility (EMC): EN50082-1.

ESD: EN61000-4-2.

RFI: EN61000-4-3 and EN50204.

EFT: EN61000-4-4.

Surge: EN61000-4-5.

CRFI: EN61000-4-6.

Emissions: EN50081-1.

Radiated Emissions: EN55022 Class A.

Ordering Info

Models

900EN-S005

Ethernet switch, 5-port

Accessories (See Page 36)

5035-355

Ethernet straight cable, CAT5, 3 feet long, shielded

5035-360

Crossover cable for module configuration, CAT5E, 5 feet long, shielded

5035-365

Configuration cable for advanced features, DB-25 PC parallel port to dual row connector, 4 feet long

PSSR-D24

Power supply (24V DC, 2.1A)



Accessories

Cables

STRAIGHT CAT5 CABLE



CONNECTS 900EN-S005 SWITCH
TO 9XXEN ETHERNET I/O MODULE

Ordering Information

5035-355

Ethernet straight cable, CAT5, 3 feet long, shielded

5035-360

Ethernet crossover cable, CAT5E, 5 feet long, shielded

5035-365

Configuration cable for advanced features, DB-25 PC parallel port to dual row connector, 4 feet long

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

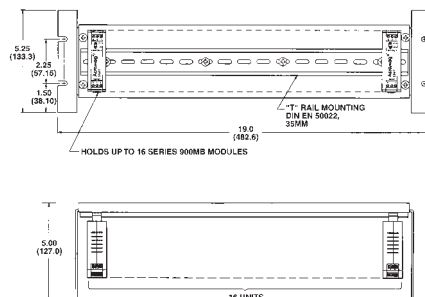
20RM-16-DIN

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)



Power Supplies



50W Supply

Input Power Requirement

85 to 264V AC or 105 to 370V DC

Output

24V DC, 2.1A (50W)

Ordering Information

PS5R-D24

Universal 50W power supply

See Page 199 for other models and more information.



Profibus Distributed I/O



Discrete I/O Modules



Analog I/O Modules



BusWorks® 900PB Series Profibus-DP I/O

Introduction

Series overview Page 38

Discrete I/O Modules

981PB discrete input Page 46
982PB discrete output 46
983PB discrete I/O 46

Analog I/O Modules

961PB DC current input, differential Page 41
962PB DC voltage input, differential 41
963PB DC current input, single-ended 42
964PB DC voltage input, single-ended 42
965PB Thermocouple/millivolt input 43
966PB RTD/Resistance input 44
972PB DC current output 45
973PB DC voltage output 45

Technical Documentation

Operation and performance specifications .Page 47
Accessories 48

	961/962	963/964	965	966	972/973	981/82/83
DISCRETE INPUTS						
Active low input						X
ANALOG INPUTS						
DC current input	X	X				
DC voltage input	X	X				
DC millivolt input			X			
Thermocouple input			X			
RTD/resistance input				X		
AC current input (requires external sensor)	X	X				
DISCRETE OUTPUTS						
Sinking output (low-side switch)						X
ANALOG OUTPUTS						
DC current output					X	
DC voltage output					X	
POWER REQUIREMENT						
DC-powered	X	X	X	X	X	X



ProfiBus-DP / RS485



900PB Series ProfiBus-DP I/O Modules

The 900PB series is a high-performance line of networked I/O modules. These units 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 module provides a direct network interface for your I/O signals. Unlike "block I/O" devices that combine a large and expensive processor block with snap-on I/O terminal blocks, 900PB modules handle the network interface and I/O processing in a single, compact multi-channel module. This space-saving approach is very cost-effective for systems that need to add some I/O channels at an existing control site or network new, remote sites.

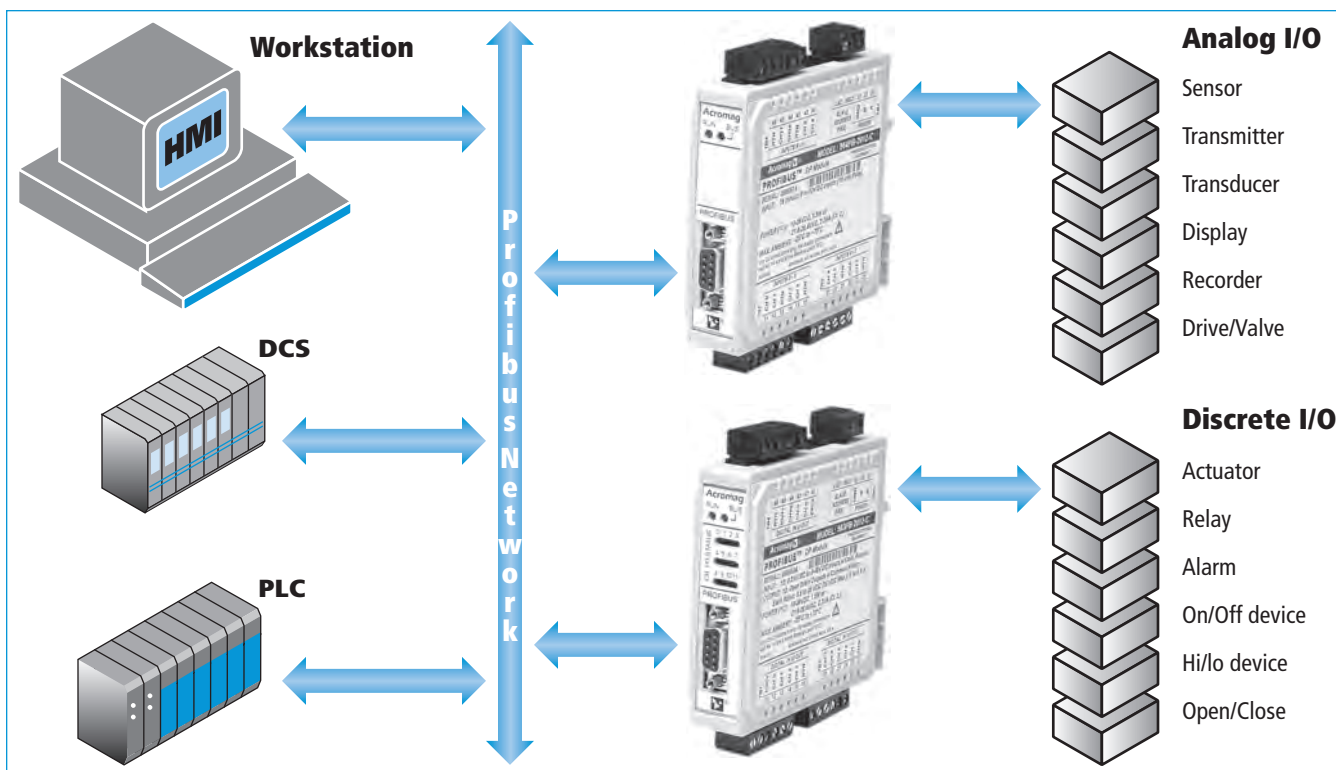
To ensure unsurpassed performance, these I/O modules employ advanced microcontroller technology. Isolated input, output, power, and network circuits increase noise/transient immunity and prevent ground loops. Status LEDs provide diagnostic feedback.

Self-diagnostics and sophisticated watchdog timers simplify maintenance and troubleshooting. The watchdog timer invokes a failsafe condition if host communication is lost. For further security, a second watchdog monitors the microcontroller for failed operations or a "lock-up" condition and automatically resets the unit.

24HR 5YR Ready to ship within 24-hours from stock. Backed by a 5-year warranty.

Special Features

- **Direct Network Interface:**
Each module has a built-in microcontroller for communication. No bus coupler required.
- **RS485/ProfiBus Network Communication:**
Highly immune to noise and operates over long distances
- **Industry Standard ASIC:**
Siemens SPC3 intelligent ASIC to talk ProfiBus
- **High-Speed Data Rates:**
Half-duplex RS485 with rates up to 12M baud
- **Auto-Baud Rate Detection:**
Baud rate is set automatically
- **Fully Isolated:**
I/O, network, and power circuits isolated from each other for safety and noise immunity
- **Nonvolatile Reprogrammable Memory:**
Allows the functionality of this device to be reliably reprogrammed thousands of times
- **Self-Diagnostics & Watchdog Timers:**
Self-test simplifies maintenance. Profibus has defined failsafe mode for lost communication.





■ Discrete I/O

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-only, 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

■ Analog Input

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
- Thermocouple
- RTD/resistance
- AC current

Functions

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

■ Analog Output

Analog output modules are ideal for controlling a wide variety of industrial equipment. 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

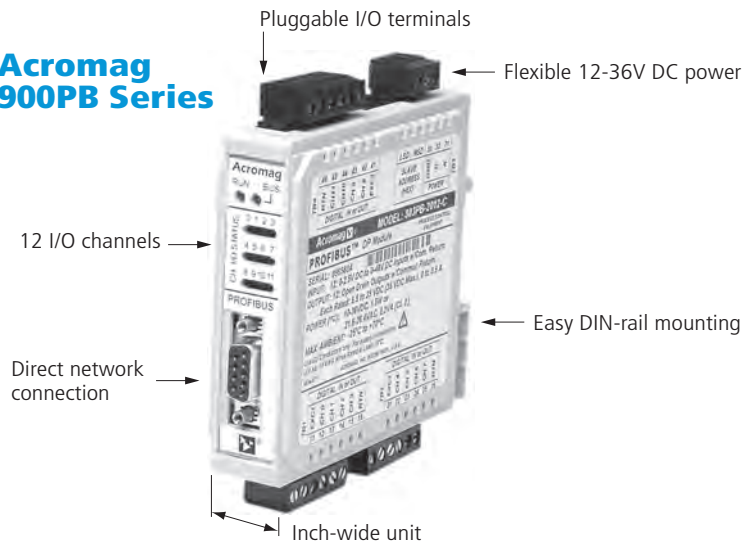
- DC voltage
- DC current

Functions

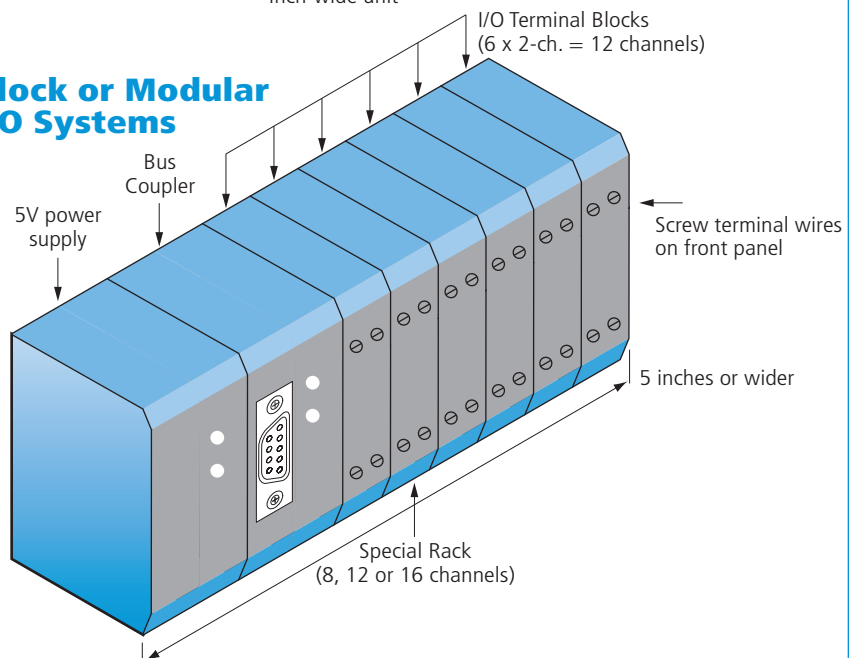
- Write data to local displays or recorders
- Control drives, valves, and positioners

Save 50% compared to "Block I/O"

Acromag 900PB Series



Block or Modular I/O Systems



Acromag 900PB Series I/O

Stand-alone I/O modules are very economical.

- Direct connection to network
- Up to 12 channels on one module
- One inch wide for twelve channels
- Flexible 12-36V DC power requirement
- Pluggable terminal blocks on top and bottom

Block and Modular I/O Systems

Block I/O systems have high start-up costs.

- Expensive bus coupler required
- Plug-in I/O modules or terminal blocks required
- Five inches wide or more for twelve channels
- May require special 5V power supply
- Fixed wiring terminals on front of unit



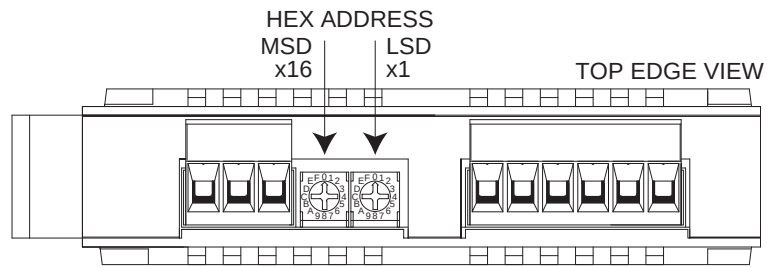
Easy to Use

Profibus-DP networks offer several advantages. They are proven, fast (up to 12Mbps without fiber optic cable), deterministic, and ideal for transmitting analog or discrete data. I/O devices are also easy to install and maintain. More than 1000 organizations worldwide, plus the Profibus Trade Organization (PTO), help nurture a growing user base, introduce new products, and provide technical support for this network technology.

Network devices, including Acromag's 900PB I/O modules, are easily installed and configured using network management software typically provided by the supplier of the host or master controller. The startup process is shown below.

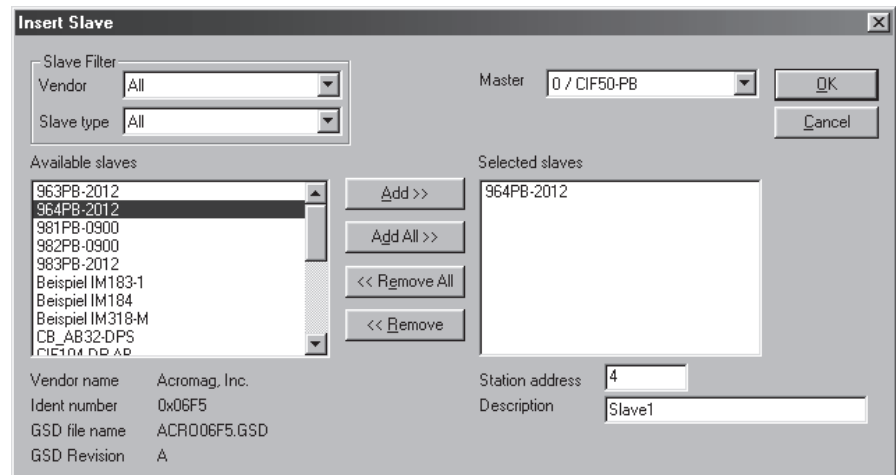
Step 1: Set the slave address

Using two rotary switches, as shown, set the slave address between 0 and 125 (00 to 7D Hex). The factory default setting is 126 (7EH) which allows programming via the network. Once the address is set, the module may be physically connected to the network or master.



Set switches to a valid slave address from 0 to 125 (00H to 7DH)

Step 1: Rotate the switches on top of each 900PB module to set the desired network address.



Step 2: The network management software (SyCon from Lantronix shown above) lists Profibus devices available for configuration after their GSD files are copied to the software's directory using Windows Explorer.

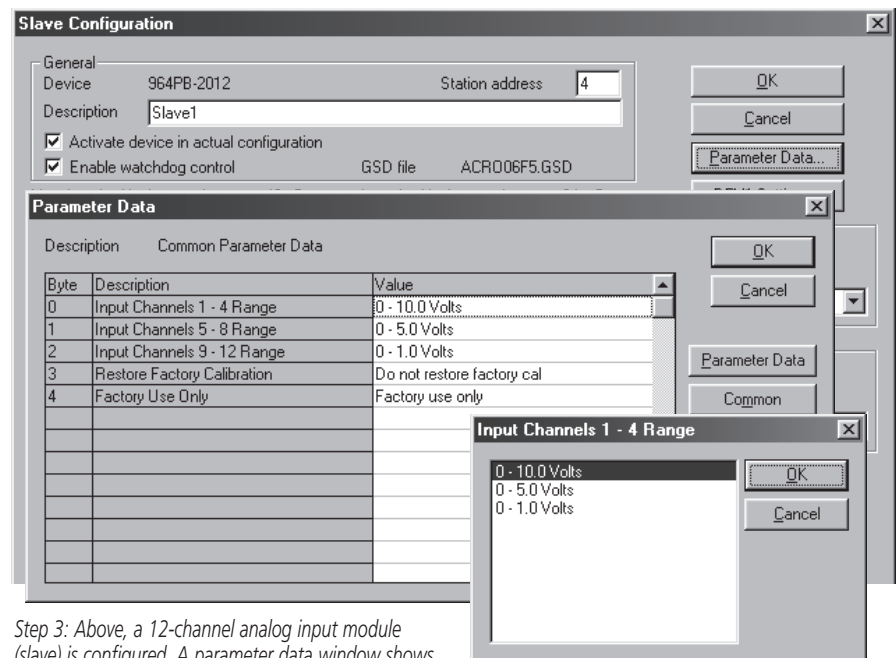
Step 2: Add the I/O module to the network database

Each I/O module, like all slave devices, is defined by a unique software file (*.gsd file). The GSD file for each module is installed (or imported) into a network database for identification by the network management software.

Acromag GSD files are supplied at no-charge with each module. They are also available for download on the Acromag website or from the PTO at www.profibus.com.

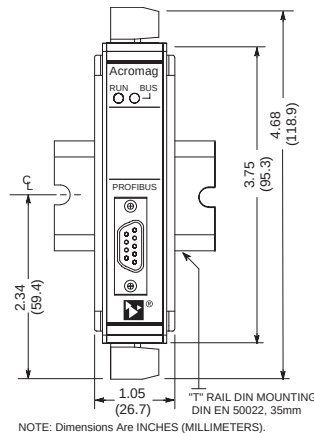
Step 3: Configure the module

Using the network management software, you configure each device as desired (address, ranges, sensor break detection, failure modes, etc.). When finished, the software will download the configuration to the master controller for communication.

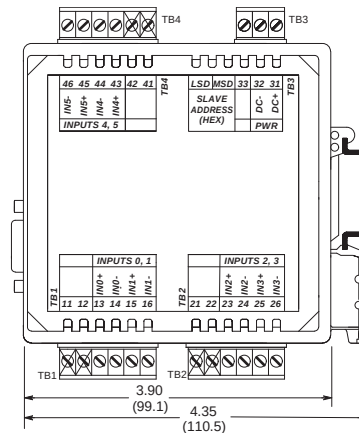


Step 3: Above, a 12-channel analog input module (slave) is configured. A parameter data window shows the user-selected voltage input ranges.

The menu above lists input range options individually selectable for each 4-channel group.



NOTE: Dimensions Are INCHES (MILLIMETERS).



961PB, 962PB Analog Input:

6-Channel Differential Input: DC Current or DC Voltage Signals

Models

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

Description

These modules provide an isolated Profibus-DP 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 sensor and devices. High-resolution, low noise, A/D converters deliver high accuracy and reliability.

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)

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

Network Communication

Profibus-DP, RS-485 network up to 12Mbaud

Power Requirement

12 to 36V DC supply required

Approvals

Profibus PNO certified.
CE marked. UL, cUL listed.
Class I; Division 2; Groups A, B, C, D.

Special Features

- Standard Profibus-DP network communication with industry-standard ASIC (Siemens SPC3)
- 6-input stand-alone module is very economical
- Differential inputs eliminate ground loops
- Universal inputs support a variety of sensors
- High-resolution 16-bit Σ - Δ A/D converters ensure precise, high accuracy measurements
- Compact packaging with pluggable terminals saves space and simplifies wiring
- Wide operational temperature range permits installation in extreme environments

Performance

General Specifications

See Page 47 for communication and other specs.

Input

Configuration

Input ranges are selectable for a 3-channel group.

Accuracy

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

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 Filter Bandwidth

-3dB at 3Hz, typical.

DC Current Input impedance

24.9 ohms.

DC Voltage Input impedance
Greater than 110.5K ohms.

Environmental

Ambient Temperature

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

Relative Humidity

5 to 95%, non-condensing.

Isolation

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

Ordering Info

Models

961PB-2006

DC current input module, 6 differential channels

962PB-2006

DC voltage input module, 6 differential channels

NOTE: Modules include GSD files on CD-ROM.

Accessories (see Page 48)

5020-350

AC current sensor. Used with 961PB DC current input models. One sensor per channel is required.
See page 205.

P55R-D24

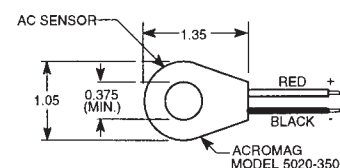
Power supply (24V DC, 2.1A).
See Power Supplies on Page 199.

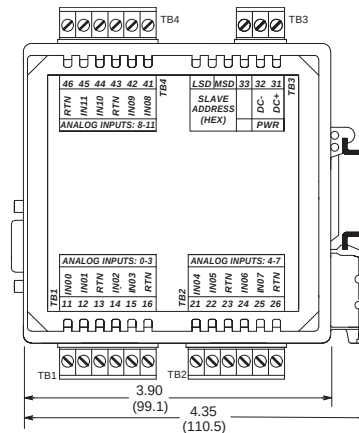
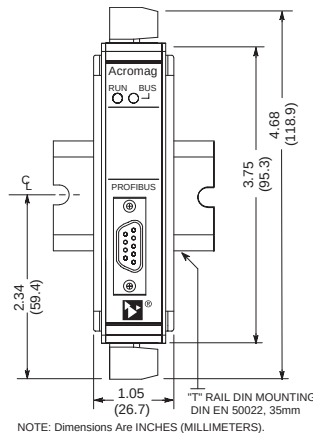
TBK-B03

Optional terminal block kit, barrier strip style, 4 pcs.

TBK-S03

Optional terminal block kit, spring clamp style, 4 pcs.





963/964PB Analog Input:

12-Channel Single-Ended Input: DC Current or DC Voltage Signals

Models

963PB: 12 DC current input channels
964PB: 12 DC voltage input channels

Description

These modules provide an isolated Profibus-DP 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

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, or ±10V DC

Network Communication

Profibus-DP, RS-485 network up to 12Mbaud

Power Requirement

12 to 36V DC supply required

Approvals

Profibus PNO certified.
CE marked. UL, cUL listed.
Class I; Division 2; Groups A, B, C, D.

Special Features

- Standard Profibus-DP network communication with industry-standard ASIC (Siemens SPC3)
- 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
- Compact packaging with pluggable terminals saves space and simplifies wiring
- Wide operational temperature range permits installation in extreme environments

Performance

General Specifications

See Page 47 for communication and other specs.

Input

Configuration

Input ranges are selectable on each terminal block for a group of four input channels (4-channel basis).

Accuracy

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

Analog to Digital Converter (A/D)

16-bit Σ - Δ converter.

Resolution

0.005% or 1 part in 20000, typical.

Noise Rejection

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

Input Filter Bandwidth

-3dB at 3Hz, typical.

DC Current Input impedance

49.9 ohms.

DC Voltage Input impedance
Greater than 110.5K ohms.

Environmental

Ambient Temperature

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

Relative Humidity

5 to 95%, non-condensing.

Isolation

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

Ordering Info

Models

963PB-2012

DC current input module, 12 single-ended channels

964PB-2012

DC voltage input module, 12 single-ended channels

NOTE: Modules include GSD files on CD-ROM.

Accessories (see Page 48)

5020-350

AC current sensor. Used with 963PB DC current input models. One sensor per channel is required.
See page 205.

PS5R-D24

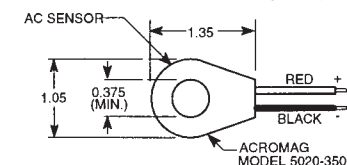
Power supply (24V DC, 2.1A).
See Power Supplies on Page 199.

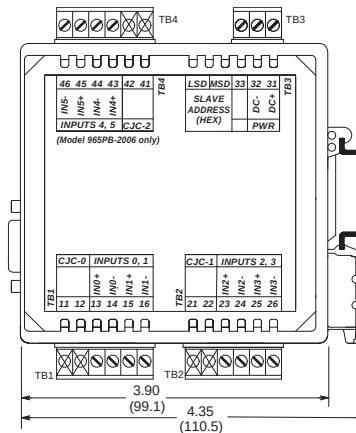
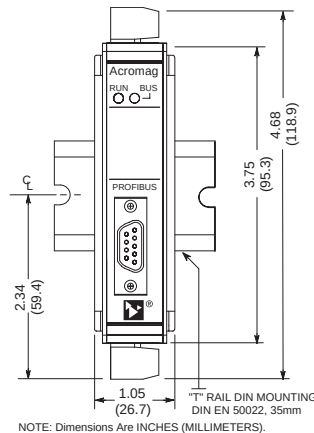
TBK-B03

Optional terminal block kit, barrier strip style, 4 pcs.

TBK-S03

Optional terminal block kit, spring clamp style, 4 pcs.





NOTE: Dimensions Are INCHES (MILLIMETERS).

965PB Analog Input:

4 or 6-Channel Input: Thermocouple or Millivolt Signals

Description

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

Input Ranges

Thermocouple (user-selectable type)

Type J, K, T, R, S, E, B, or N

DC Millivolts (user-selectable range)

±100mV or ±1V DC

Network Communication

Profibus-DP, RS-485 network up to 12Mbaud

Power Requirement

12 to 36V DC supply required

Approvals

Profibus PNO certified.
CE marked. UL, cUL listed.
Class I; Division 2; Groups A, B, C, D.

Special Features

- Standard Profibus-DP network communication with industry-standard ASIC (Siemens SPC3)
- 6-input stand-alone module is very economical
- Universal inputs support a variety of sensors
- Built-in CJC sensor on each terminal block produces more precise temperature measurements
- Thermocouple break detection (upscale or downscale) identifies sensor wiring failures
- High-resolution 16-bit Σ - Δ A/D converters ensure precise, high accuracy measurements
- Compact packaging with pluggable terminals saves space and simplifies wiring
- Wide operational temperature range permits installation in extreme environments

Performance

General Specifications

See Page 47 for communication and other specs.

Input

Configuration

Input ranges are selectable for a 3-channel group.

Accuracy

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

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

Thermocouple Break Detection

Upscale or downscale selection applies to all channels.

Analog to Digital Converter (A/D)

16-bit Σ - Δ converter.

Noise Rejection

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

Input Filter Bandwidth

-3dB at 3Hz, typical.

Environmental

Ambient Temperature

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

Relative Humidity

5 to 95%, non-condensing.

Isolation

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

Ordering Info

Models

965PB-2004

4-channel thermocouple/millivolt input module

965PB-2006

6-channel thermocouple/millivolt input module

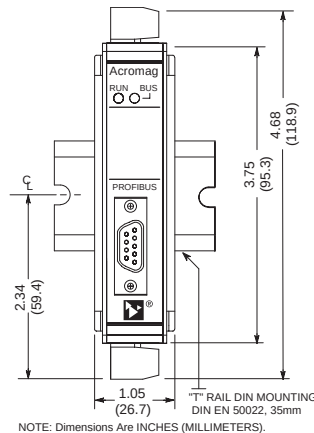
NOTE: Modules include GSD files on CD-ROM.

Accessories (see Page 48)

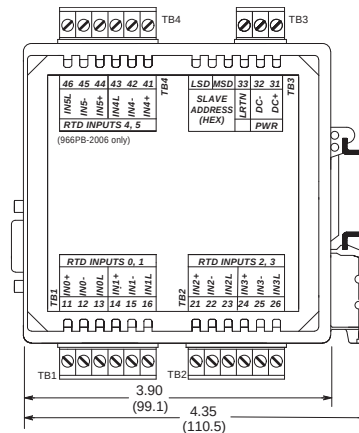
P55R-D24

Power supply (24V DC, 2.1A).

See Power Supplies on Page 199.



NOTE: Dimensions Are INCHES (MILLIMETERS).



966PB Analog Input:

4 or 6-Channel Input: RTD or Resistance Signals

Description

These modules provide an isolated Profibus-DP 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

RTD (user-selectable type)

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

Profibus-DP, RS-485 network up to 12Mbaud

Power Requirement

12 to 36V DC supply required

Approvals

Profibus PNO certified.

CE marked. UL, cUL listed.

Class I; Division 2; Groups A, B, C, D.

Special Features

- Standard Profibus-DP network communication with industry-standard ASIC (Siemens SPC3)
- 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
- Compact packaging with pluggable terminals saves space and simplifies wiring
- Wide operational temperature range permits installation in extreme environments

Performance

General Specifications

See Page 47 for communication and other specs.

Input

Configuration

Input ranges are selectable for a 3-channel group.

Accuracy

Input Type	Input Range	Accuracy (typical)
Pt 100 ohm	-200 to 850°C	$\pm 0.25^\circ\text{C}$
Ni 120 ohm	-80 to 320°C	$\pm 0.25^\circ\text{C}$
Cu 10 ohm	-200 to 260°C	$\pm 1.25^\circ\text{C}$
Resistance	0 to 500 ohms	± 0.05 ohms

RTD Break Detection

Upscale or downscale selection applies to all channels.

Analog to Digital Converter (A/D)

16-bit Σ - Δ converter.

Noise Rejection

Normal Mode: Better than 40dB @ 60Hz.

Common Mode: Better than 130dB @ 60Hz.

Input Filter Bandwidth

-3dB at 3Hz, typical.

Excitation Current

1mA DC typical, all RTD types.

Environmental

Ambient Temperature

Operating: -25 to 70°C (-13 to 158°F).

Storage: -40 to 85°C (-40 to 185°F).

Relative Humidity

5 to 95%, non-condensing.

Isolation

1500V AC for 60 seconds or 250V AC continuous.

3-way isolation between I/O, network, and power.

Inputs share a common.

Ordering Info

Models

966PB-2004

4-channel RTD/resistance input module

966PB-2006

6-channel RTD/resistance input module

NOTE: Modules include GSD files on CD-ROM.

Accessories (see Page 48)

PS5R-D24

Power supply (24V DC, 2.1A).

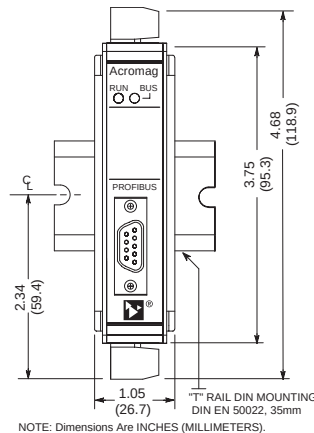
See Power Supplies on Page 199.

TBK-B03

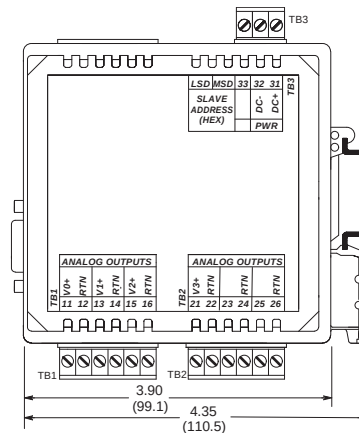
Optional terminal block kit, barrier strip style, 4 pcs.

TBK-S03

Optional terminal block kit, spring clamp style, 4 pcs.



NOTE: Dimensions Are INCHES (MILLIMETERS).



972/973PB Analog Output:

4 or 6-Channel Output: DC Current or DC Voltage Signals

Models

972PB: DC current output channels

973PB: DC voltage output channels

Description

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

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

Profibus-DP, RS-485 network up to 12Mbaud

Power Requirement

16 to 36V DC supply required

Approvals

Profibus PNO certified.

CE marked. UL, cUL listed.

Class I; Division 2; Groups A, B, C, D.

Special Features

- Standard Profibus-DP network communication with industry-standard ASIC (Siemens SPC3)
- 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
- Compact packaging with pluggable terminals saves space and simplifies wiring
- Wide operational temperature range permits installation in extreme environments

Performance

General Specifications

See Page 47 for communication and other specs.

Configuration

Output ranges are selectable on a channel to channel basis.

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

Operating:

972PB-200x models -25 to 60°C (-13 to 158°F).

973PB-200x models: -25 to 70°C (-13 to 140°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 Info

Models

972PB-2004

DC current output module, 4 channels

972PB-2006

DC current output module, 6 channels

973PB-2004

DC voltage output module, 4 channels

973PB-2006

DC voltage output module, 6 channels

NOTE: Modules include GSD files on CD-ROM.

Accessories (see Page 48)

PS5R-D24

Power supply (24V DC, 2.1A).

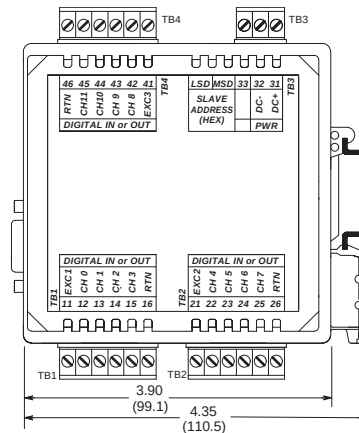
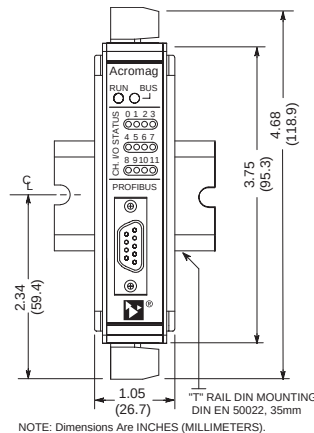
See Power Supplies on Page 199.

TBK-B03

Optional terminal block kit, barrier strip style, 4 pcs.

TBK-S03

Optional terminal block kit, spring clamp style, 4 pcs.



NOTE: Dimensions Are INCHES (MILLIMETERS).

981/982/983PB Discrete I/O:

12-Channel I/O: Active-Low Inputs, Sinking Outputs (Low-Side Switching)

Models

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

Description

These modules provide an isolated Profibus-DP 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 983PB 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

Profibus-DP, RS-485 network up to 12Mbaud

Power Requirement

12 to 36V DC supply required

Approvals

Profibus PNO certified.
CE marked. UL, cUL listed.
Class I; Division 2; Groups A, B, C, D.

Special Features

- Standard Profibus-DP network communication with industry-standard ASIC (Siemens SPC3)
- 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
- Compact packaging with pluggable terminals saves space and simplifies wiring
- Wide operational temperature range permits installation in extreme environments

Performance

General Specifications

See Page 47 for communication and other specs.

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, DMOS MOSFET switches.

Output Voltage Range

0 to 35V DC max. (0 to 500mA/channel continuous).

Output ON Resistance

0.28 ohms maximum.

Environmental

Ambient Temperature

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

Relative Humidity

5 to 95%, non-condensing.

Isolation

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

Ordering Information

Models

981PB-2012
Discrete input module, 12 channels

982PB-2012
Discrete output module, 12 channels

983PB-2012
Discrete input/output module, 12 channels
NOTE: Modules include GSD files on CD-ROM.

Accessories (see Page 48)

PS5R-D24

Power supply (24V DC, 2.1A).
See Power Supplies on Page 199.

TBK-B03

Optional terminal block kit, barrier strip style, 4 pcs.

TBK-S03

Optional terminal block kit, spring clamp style, 4 pcs.



General Operation and Performance Specifications

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

■ Communication

Interface Standard

Isolated, 3-wire RS-485 multi-drop, half-duplex, asynchronous.

Command/Response Protocol

Standard ProfiBus DP (Master/Slave) protocol per European Norm EN50170.

Baud Rate

Supports rates of 9600, 19.2K, 44.45K, 93.75K, 187.5K, 500K, 1.5M, and 12M bits per second, auto-detected.

Communication Distance

Up to 1200 meters without a repeater using Type A wire (<30pF/m).

1200m @ 115Kbps or less

1000m @ 187.5Kbps

400m @ 500Kbps

200m @ 1.5Mbps

100m @ 12Mbps

Address

Set via two rotary hexadecimal switches or via the Set Slave Address command. Valid setting is 0-125.

Address 126 (7EH) is factory default address.

Maximum Message Size

Up to 32 bytes recommended, extendable up to 244 bytes of data/node/message, plus 11 bytes of overhead (data frame).

Network Capacity

Multi-drop up to 31 modules, plus a host, without a repeater. Up to 125 modules plus a host if four repeaters are used (one for every 31 nodes).

■ 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 EN50204.

Electrical Fast Transient Immunity (EFT)

Per EN61000-4-4.

Conducted RF Immunity (CRFI)

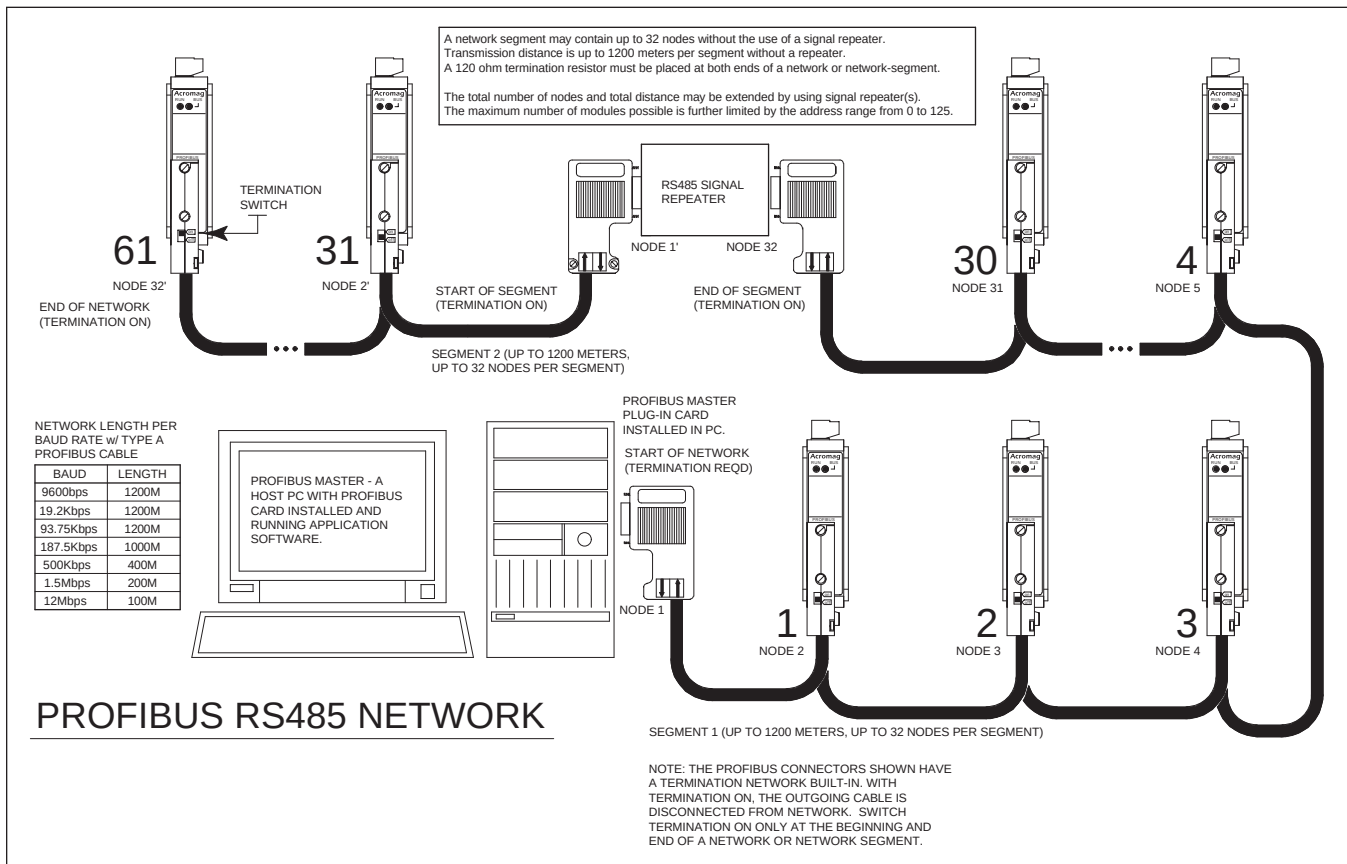
Per EN61000-4-6.

Surge Immunity

Per EN61000-4-5.

Radiated Frequency Emissions

Per EN55022 Class B.





Accessories

Terminal Blocks

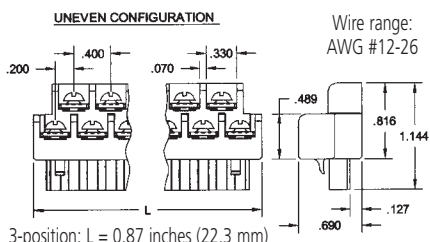
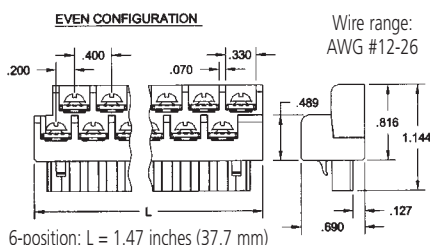


Barrier strip (left) and spring clamp (right).

Ordering Information

See individual I/O modules for compatibility.

Barrier Strip Terminal Blocks

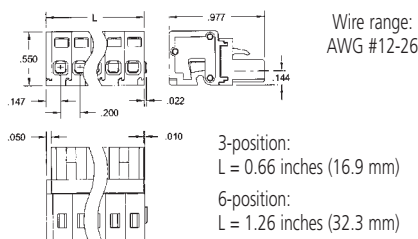


TBK-B01
Terminal block kit,
two 6-position pieces

TBK-B03
Terminal block kit,
one 3-position and
three 6-position pieces

TBK-B02
Terminal block kit,
four 6-position pieces

Spring Clamp Terminal Blocks



TBK-S01
Terminal block kit,
two 6-position pieces

TBK-S03
Terminal block kit,
one 3-position and
three 6-position pieces

TBK-S02
Terminal block kit,
four 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.

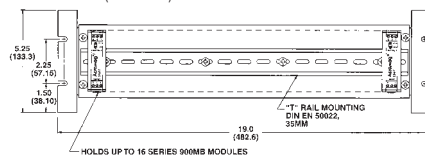
Ordering Information

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)



Power Supplies



50W Supply

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

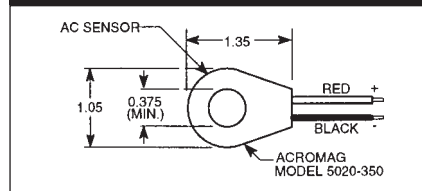
Output
24V DC, 2.1A (50W)

Ordering Information

P55R-D24
Universal 50W power supply

See Power Supplies on Page 199 for other models and more information.

AC Current Sensor



Ordering Information

5020-350
AC current sensor (See page 205)



BusWorks® 900MB Series Modbus-RTU I/O

Introduction

Series overview Page 50

Discrete I/O Modules

901MB active low inputs Page 54
902MB sinking outputs 54
903MB active low inputs, sinking outputs 54

904MB active high inputs 56
905MB sourcing outputs 56
906MB active high inputs, sourcing outputs 56

Analog I/O Modules

913MB DC current input Page 58
914MB DC voltage input 58
917MB DC current output 60
918MB DC voltage output 60
924MB Thermocouple/millivolt input 62
932/934MB RTD input 64
942MB Frequency/counter input 66

Accessories

Software interface package Page 69
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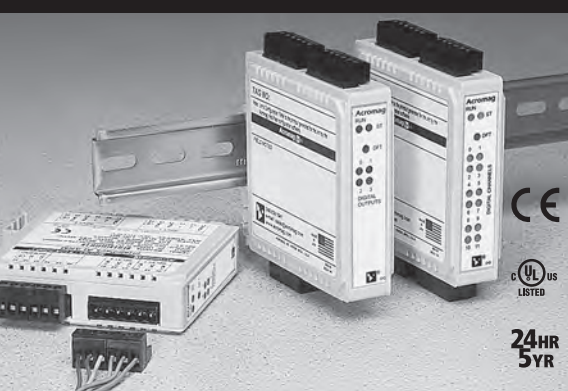
Technical Documentation

Dimension diagrams Page.68

	901/2/3	904/5/6	913/914	917/918	924	932/934	942
DISCRETE INPUTS							
Active low input	X						
Active high input		X					
ANALOG INPUTS							
DC voltage/current input			X				
DC millivolt input					X		
Thermocouple input					X		
RTD/resistance input						X	
Frequency input							X
AC current input (requires external sensor)			X				
DISCRETE OUTPUTS							
Sinking output (low-side switch)	X						
Sourcing output (high-side switch)		X					
Limit alarm (open-drain MOSFETs or relays)			X	X	X	X	X
ANALOG OUTPUTS							
DC voltage/current				X			
POWER CONFIGURATION							
DC-powered	X	X	X	X	X	X	X
AC-powered	X	X	X	X	X	X	X



Modbus I/O Network



900MB Series Modbus-RTU I/O Modules

The 900MB series is a high-performance line of multi-function I/O modules. These units 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.

To ensure unsurpassed performance, these I/O modules employ the latest digital technology. State-of-the-art flash microcontrollers plus optically isolated input, output, power, and network circuits increase noise/transient immunity and prevent ground loops. Status LEDs provide diagnostic feedback and visually indicate which channels are outside their calibrated range.

Sophisticated watchdog timer functions allow the application to define the module's failsafe output state. The watchdog timer invokes the failsafe condition when communication between the host and module exceed a duration specified by the application. For further security, a second hardware watchdog timer monitors the microcontroller for failed operations or a "lock-up" condition and automatically resets the unit.

■ Special Features

- High-speed RS-485 communication allows data transfers up to 115K baud
- Modbus RTU protocol interfaces to popular HMI and SCADA software packages
- Wide-range, polarity-insensitive power supply supports 10-36V DC and 24V AC sources
- Powerful watchdog timers allow user-defined failsafe state when host communication is lost
- Isolation eliminates potential ground loops between I/O, power, and network circuitry
- Default switch allows user to set module to known communication parameters
- Menu-based Windows® configuration software simplifies setup and trouble-shooting

■ Discrete I/O

These modules monitor discrete levels of various devices and/or provide on/off control capabilities depending on the model selected. Each module offers high channel density to save space and keep costs low. Models are available with twelve inputs, twelve outputs, or twelve bidirectional I/O channels.

Inputs

- Active-high inputs, 0 to 35V DC
- Active-low inputs, 0 to 35V DC

Outputs

- Sourcing outputs, 5.5 to 35V DC, 250mA
- Sinking outputs, 0 to 35V DC, up to 1A

Functions

- Monitor discrete state or level
- On/off control
- Activate audible or visual alarms
- Transmit discrete data to other control systems

■ Analog Input

These units monitor DC or thermocouple sensor inputs and provide alarm outputs if conditions exceed user-defined limits. Each module has four analog input channels and four discrete outputs for independent local alarms or host-controlled on/off switching.

Inputs

- DC current
- DC voltage
- DC millivolts
- Thermocouple
- RTD/resistance
- Frequency
- AC current

Outputs

- Open drain MOSFETs (1A solid-state switches)

Functions

- Temperature monitoring
- Process variable measurement
- Limit alarms with high and/or low setpoints
- On/off control

■ Analog Output

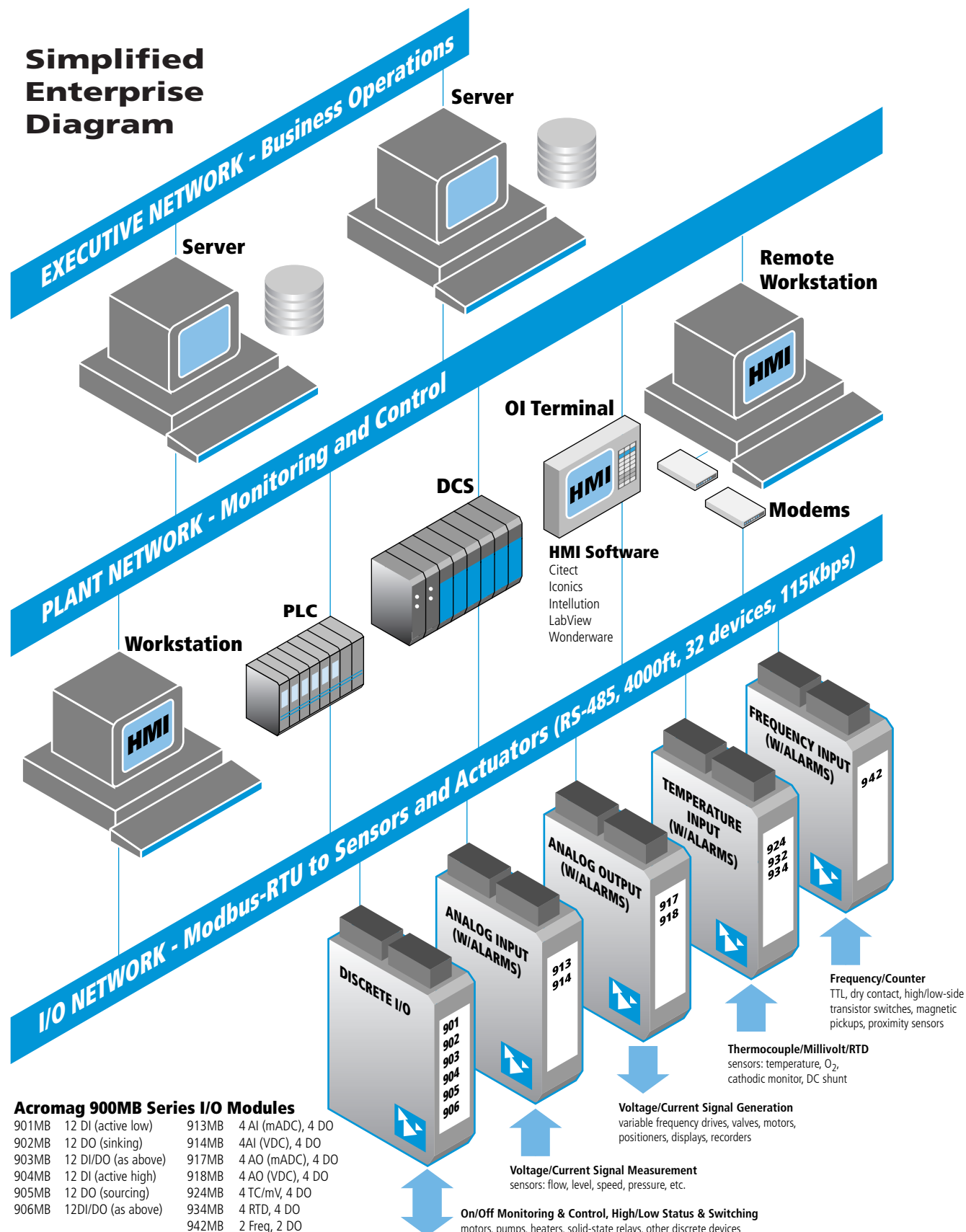
Analog output modules are ideal for controlling a wide variety of industrial machinery. The host defines the output of voltage or current signals to control speed, flow, temperature, frequency, level, force, torque, intensity, and many other properties. Each module has four analog output channels plus four discrete outputs for on/off switching applications.

Outputs

- DC voltage
- DC current
- Open drain MOSFETs (1A solid-state switches)

Functions

- Write data to local displays or recorders
- Control drives, valves, and other equipment
- Transmit discrete data to other control systems
- On/off control (alarms)





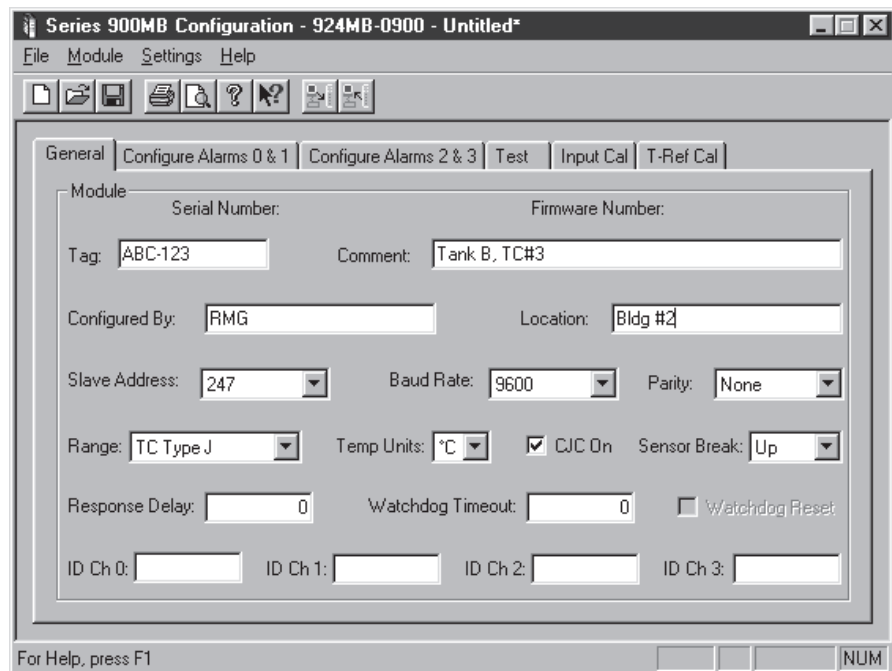
Software Support

Series 900 I/O modules are compatible with popular Human-Machine Interface (HMI) software packages that support Modbus communication. The I/O modules may be configured using generic drivers provided with the HMI software to access the Modbus register maps.

A list of popular third-party HMI software manufacturers:

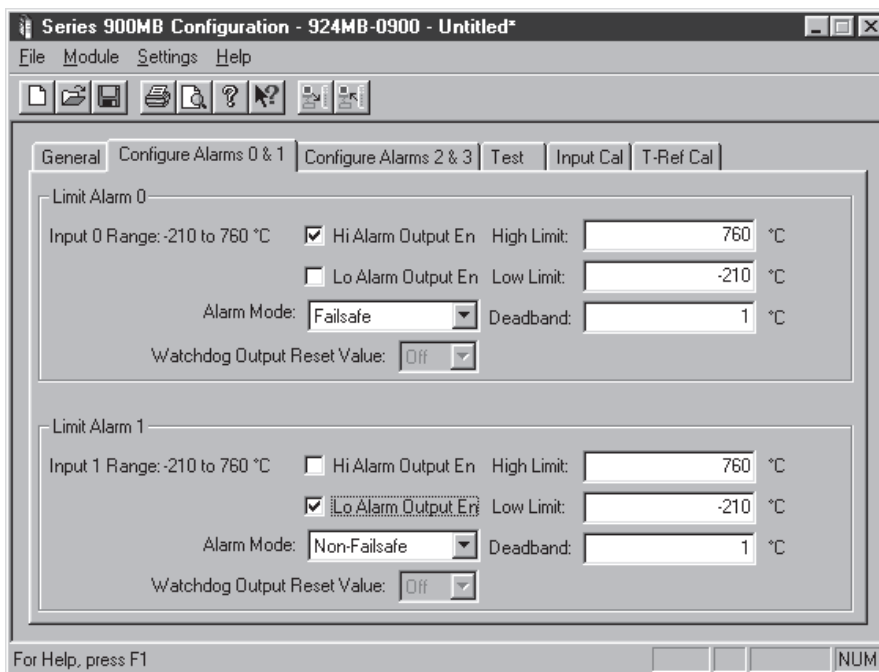
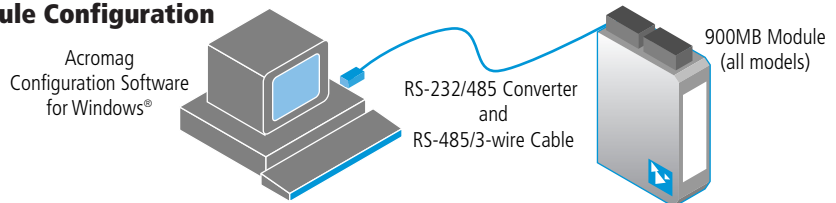
- AB/Rockwell
- Citect
- Iconics
- Intellution
- National Instruments
- Steeplechase
- Think and Do
- Wonderware

Acromag also offers a configuration utility for faster and easier setup. This software provides an intuitive approach to select configuration options for your application. Familiar Windows pull-down selection menus and fill-in-the-blank fields speed you through a few brief configuration screens. No programming is required. The utility also helps you monitor and verify proper operation of the module outside the main control software. This diagnostic tool provides a simple alternative to using Modbus register maps.



Acromag's configuration software can be used offline to set up a module and save the configuration to a file.

Module Configuration



Limit alarms are easy to configure with fill-in-the-blank fields in engineering units for high/low alarm setpoints.

Easy Configuration

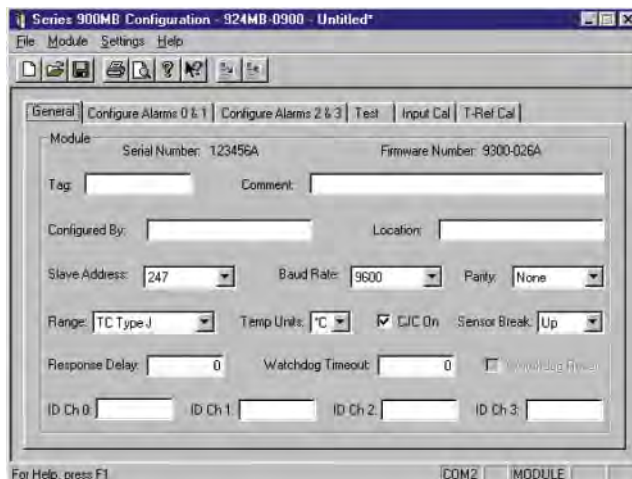
Acromag's configuration software is designed for offline setup at a bench or in the field with a laptop computer. Configuration settings can be saved to a file or printed for archival purposes. Setup is quick and easy using the steps below.

- 1) Connect the module to a PC with the cable and RS-232/485 converter (typical system). Apply power.
- 2) In the software, open a saved configuration or select the Module Upload option.
- 3) Configure the operating parameters as desired and download the configuration into the module.
- 4) Use the software's Test function to verify module operation and communication.
- 5) Install the module on the network.



Series 900MB Modbus RTU I/O

Model 900C-SIP Configuration Software Interface Package



Configuration Software ♦ USB-to-RS232 Adapter ♦ RS232-to-RS485 Adapter ♦ Interface Cable

Description

Acromag's configuration software is the key to the I/O modules' easy-to-use operation. The software employs the friendly Windows® interface with pull-down selection menus and fill-in-the-blank fields to speed you through a few brief configuration screens. No programming is required.

This package includes the Configuration Software, an RS232-to-485 Serial Port Converter, RS485 Signal Cable, and an USB to Serial adapter. These components provide everything you need to set up a Series 900 I/O module from your desktop PC before installing it on the network.

Software Compatibility

Windows 98, 2000, ME, NT, XP, Vista, 7.

Ordering Information

NOTE: For more information, visit www.acromag.com.

Models

900C-SIP

Configuration Software Interface Package. Includes user manual, CD, non-isolated RS232-to-RS485 serial port converter (5034-214), RS485 cable (5034-202), and USB adapter (4001-095).

4001-095

USB-to-DB9 serial port (RS232) adapter.

5034-186

Configuration software on CD-ROM.

5034-202

RS485 to 3-wire cable converter and cable, DB-9M to 3 x 12AWG RS485 cable, 8 ft.

5034-214

Non-isolated RS232-to-RS485 serial port converter, RS232 port-powered, DB-9F to DB-9F.

Connection Diagram

See following page.

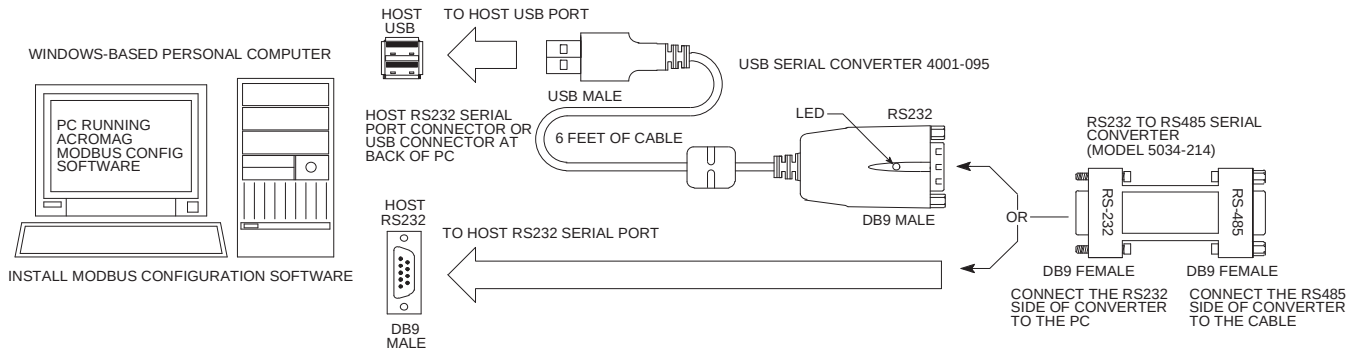


Tel: 248-295-0880 ■ Fax: 248-624-9234 ■ sales@acromag.com ■ www.acromag.com ■ 30765 S Wixom Rd, Wixom, MI 48393 USA

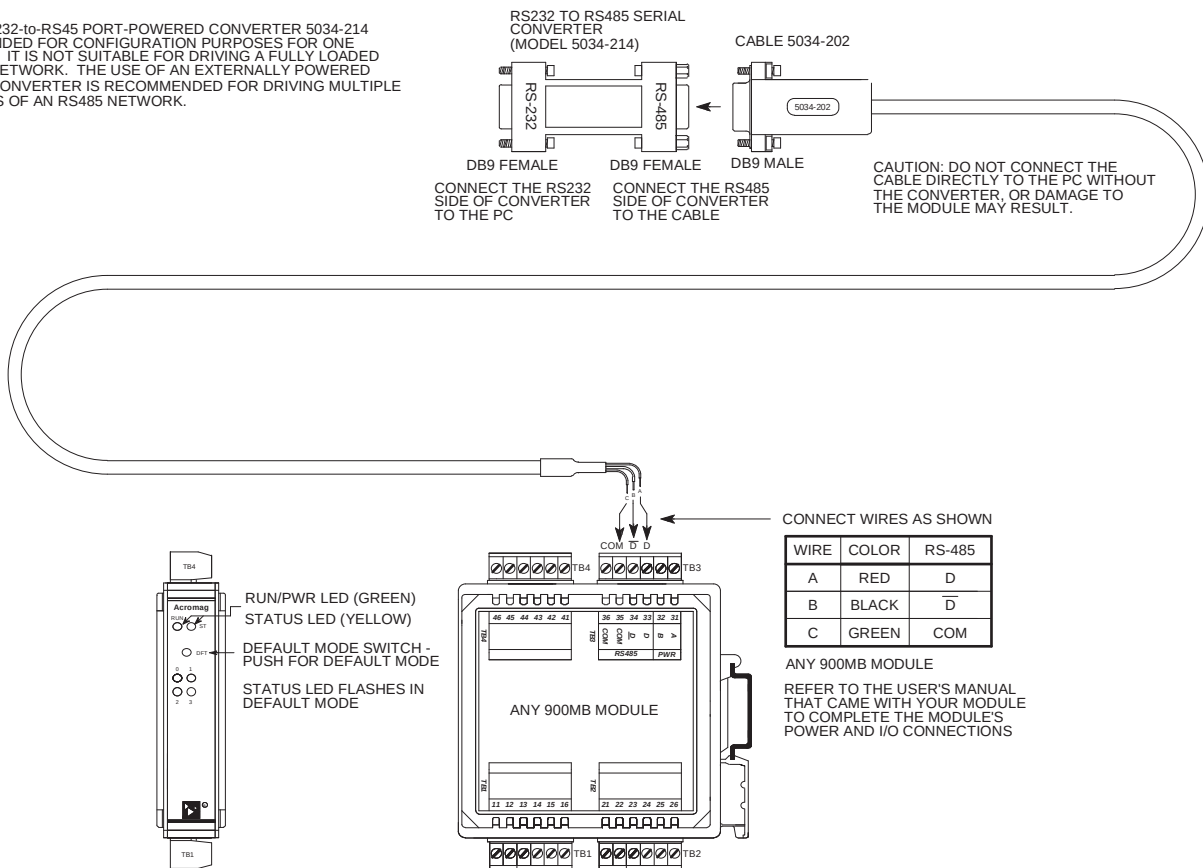


Series 900MB Modbus RTU I/O

900C-SIP COMMUNICATION CONNECTIONS



THE RS232-to-RS485 PORT-POWERED CONVERTER 5034-214 IS INTENDED FOR CONFIGURATION PURPOSES FOR ONE DEVICE. IT IS NOT SUITABLE FOR DRIVING A FULLY LOADED RS485 NETWORK. THE USE OF AN EXTERNALLY POWERED RS485 CONVERTER IS RECOMMENDED FOR DRIVING MULTIPLE DEVICES OF AN RS485 NETWORK.





■ Accessories

■ Configuration Tools

Acromag provides a full set of tools to help you get your modules set up and ready to install.

Software Interface Package

See Page 69 for more information.

Includes the following:

- Configuration Software Utility
- Instruction manuals
- Serial port converter
- Interface cable

■ Network Devices

Everything you need to drive your network is available from Acromag: isolators, converters, signal boosters, and power sources.

Universal 50W Power Supply (Page 69)

Isolated RS-232/485 Converter (Page 70)

Isolated RS-485 Network Repeater (Page 70)

■ Mounting Hardware

Installation is a snap with Acromag accessories.

DIN RAIL Bars (Page 69)

19" Rack-Mount Kit (Page 69)

■ General Module Specifications

■ Communication Interface

Network Communication

Modbus-RTU protocol, RS485 (3-Wire). Standard Protocol implementation as defined under "Modicon Modbus Reference Guide" PI-MBUS-300 Rev. J. Reference: <http://public.modicon.com>. Search on: PI-MBUS-300 for technical publication.

Baud Rate

2400, 4800, 9600, 14.4k, 19.2k, 28.8k, 38.4k, 57.6k, 76.8k, or 115.2k baud. Default 9600 baud.

Module Addressing

0 to 247, selectable. Default address 247.

Network Distance

4000 feet without network repeater.

Nodes

Supports up to 32 modules without the use of a network repeater.

Parity

Odd, even, or none. Default setting none.

Stop Bits

One with parity, one or two with no parity. Default setting is two stop bits with no parity.

Watchdog Timer (Hardware)

A hardware watchdog timer is built into each module to perform a reset if the microcontroller fails to return from an operation in a timely manner or "locks up".

Watchdog Timer (Network Communication)

All modules have a communication watchdog timer function. The watchdog timer is configurable for timeout periods of up to 18 hours. This timer function monitors I/O communications with the host controller. In the event of lost communications, output ports optionally reset to a user-defined state or level. The watchdog timer restarts with a read/write to an I/O channel.

■ Environmental

Ambient Temperature

Operation: -25°C to +70°C (-13°F to +158°F). Storage: -40°C to +85°C (-40°F to +185°F).

Relative Humidity

5 to 95% non-condensing.

Radiated Field Interference Immunity (RFI)

Complies with EN61000-4-3 Level 2 and EN50082-1 (3V/M, 80 to 1000MHz AM and 900MHz keyed).

Electrical Fast Transient Immunity (EFT)

EN61000-4-4 Level 1 and EN50082-1 (0.5KV power, signal lines).

Electrostatic Discharge (ESD) Immunity

EN61000-4-2 Level 3 and EN50082-1 (8KV/4KV air/direct discharge).

Surge Immunity

EN61000-4-5 (0.5KV) and EN50082-1.

Radiated Emissions

Meets EN50081-1 for Class B equipment.

Approvals

CE marked. UL listed for US and Canada. Class I; Division 2; Groups A, B, C, D.

■ Enclosure/Physical

Enclosure

Self-extinguishing NYLON type 6.6 polyamide thermoplastic UL94 V-2, color beige; general purpose NEMA Type 1 enclosure.

Connectors (Removable Terminal Blocks)

Wire Range: AWG #12-24, stranded or solid copper.

Dimensions

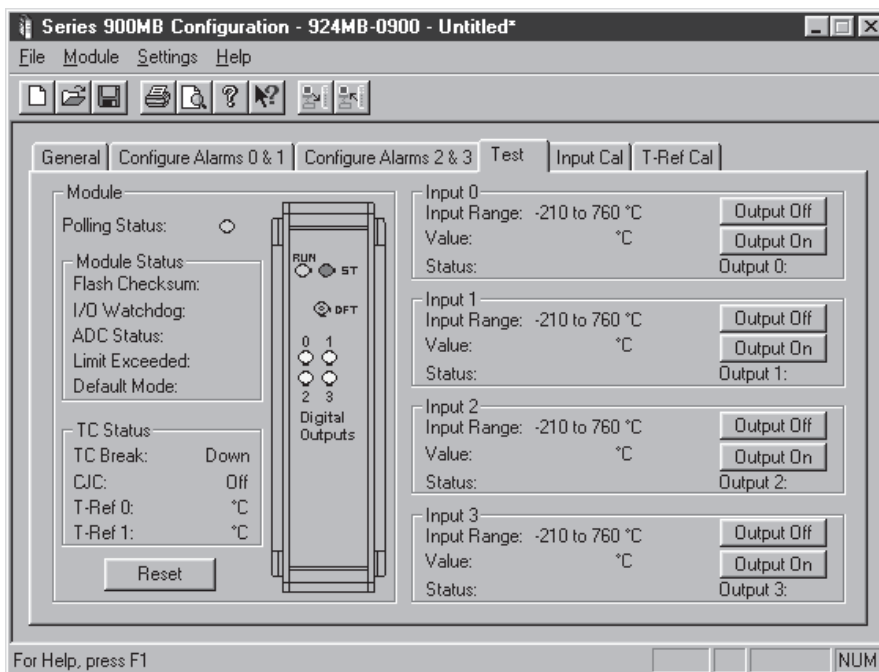
1.05W x 4.68H x 4.35D inches
26.7W x 118.9H x 110.5D mm.

DIN Rail Mounting

DIN rail mount, Type EN50022; "T" rail (35mm).

Shipping Weight

1 pound (0.45 Kg) packed.





Modbus/RS-485



901/902/903MB Multi-Channel Discrete I/O Modules

Active-Low Inputs Sinking Outputs (Low-Side Switching)

Models

901MB: 12 input channels
902MB: 12 output channels
903MB: 12 input/output channels

Input

Twelve input channels (901, 903 models only)
0 to 35V DC

Output

Twelve output channels (902, 903 models only)
0 to 35V DC

Network Communication

Modbus-RTU high-speed RS-485

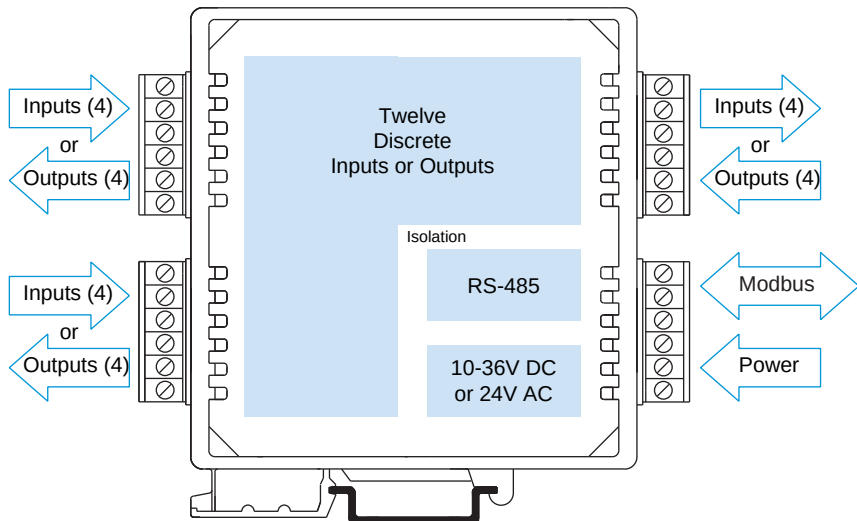
Power Requirement

10 to 36V DC,
24V AC

Approvals

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

High-Density Discrete I/O Module



Description

These modules provide twelve discrete input and/or output channels. Isolation separates the I/O, power, and network circuits. Network communication adheres to the industry-standard RS-485 Modbus RTU protocol. Both AC and DC power sources are supported with wide range, nonpolarized, diode-coupled terminals.

The open-drain outputs are intended for current-sinking or low-side switching applications. The buffered inputs are active-low. These models are the complement of the 904, 905, and 906 units which have open-source, high-side output switches and active-high inputs. Socketed pull-up resistors are easily removed or exchanged to satisfy your application requirements.

The 903MB model has twelve input/output points that may be used as inputs or outputs on a bit-by-bit basis. Outputs may be read back to verify output settings.

Combining flexible I/O types, wide I/O ranges, and a network interface in a single package, makes this instrument extremely powerful. Multi-channel design adds cost-efficiency and allows high-density mounting. Plus, safe, rugged construction makes these modules reliable for use in both control room and distributed field I/O applications. Custom module configurations are also possible (consult factory for details).

Special Features

- Standard Modbus RTU protocol with high-speed RS-485 communication (up to 115K bps)
- Twelve I/O channels in a single inch-wide unit reduces system costs and saves panel space
- High-voltage, high-current, open-drain outputs enable direct (low-side) control of external devices
- High-voltage buffered inputs monitor discrete levels from a variety of industrial devices
- Tandem input/output circuitry (903 models only) connects input buffers with open-drain outputs for convenient loopback monitoring of the output state
- Outputs have built-in over-temperature and over-current shut-down protection, plus active clamping circuits for switching inductive loads
- Watchdog timers provide a configurable failsafe output state for use when host I/O communication is lost
- Three-way isolation eliminates potential ground loops between power, I/O, and network circuitry
- Self-diagnostics monitor microcontroller activity to detect operational failures (lock-up) and execute a reset to restore communication



■ Performance

■ Discrete Inputs (901 & 903 models only)

Input Type

12 active-low, buffered inputs, with a common connection. Inputs include transient suppression devices and series connected 100K ohm resistors, plus diode over-voltage clamps to the internal +5V supply.

Input Signal Voltage Range

0 to 35V DC, maximum.

Input Current

293µA, typical at 35V DC.

Input Signal Threshold

TTL compatible with 100mV of hysteresis, typical. Low-to-High threshold is 1.7VDC, High-to-Low is 1.6VDC, typical. Limited to TTL levels of 0.8VDC (max. LOW level) and 2.0VDC (min. HIGH level).

Input Resistance

100K ohms, typical.

Input Hysteresis

100mV DC, typical.

■ Discrete Outputs (902 & 903 models only)

Output Type

12 independent, open-drain, DMOS MOSFET switches with a common source connection that operate as low-side switches.

Output Voltage Range

0 to 35V DC max. (0 to 500mA/channel continuous). External voltage source required.

Output ON Resistance

0.28 ohms maximum.

Output Response Time

Force Single Coil: Output updates within 250µs of receipt of a command.

Force Multiple Coils: First coil updates in 250µs, followed successively by additional coils every 180µs.

■ General

I/O Pull-ups and Socket

5.6K ohm pull-up resistor SIPs are installed in sockets at each port (four-channels per port).

Excitation (per port)

External excitation voltage for each four-channel port is limited to 35V or less.

Supported Modbus Commands

The command/response protocol for communicating with this module adheres to the Modbus/RTU standard for the following Modbus Functions.

Read Coil (Output) Status
Read Input Status
Read Holding Registers
Force Single Coil (Output)
Preset Single Register
Reset Slave
Force Multiple Coils (Outputs)
Preset Multiple Registers
Report Slave ID

LED Indicators

LEDs indicate power, status, and discrete level.

Power Requirements

10 to 36V DC,
22 to 26V AC.

Supply Current

Supply	Current Draw
10V DC	130mA maximum
24V DC	54mA maximum
24V AC	95mA maximum

Isolation

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

■ Ordering Information

Models

901MB-0900

Discrete input module

902MB-0900

Discrete output module

903MB-0900

Discrete input/output module

Accessories

900C-SIP

Configuration Software Interface Package (includes software CD-ROM for Windows, RS-232/485 converter, and RS-485/three-wire cable)

5034-225

USB-to-RS232 adapter. See page 68 for more info.

TBK-B02

Optional terminal block kit, barrier strip style, 4 pcs.

TBK-S02

Optional terminal block kit, spring clamp style, 4 pcs.

P55R-D24

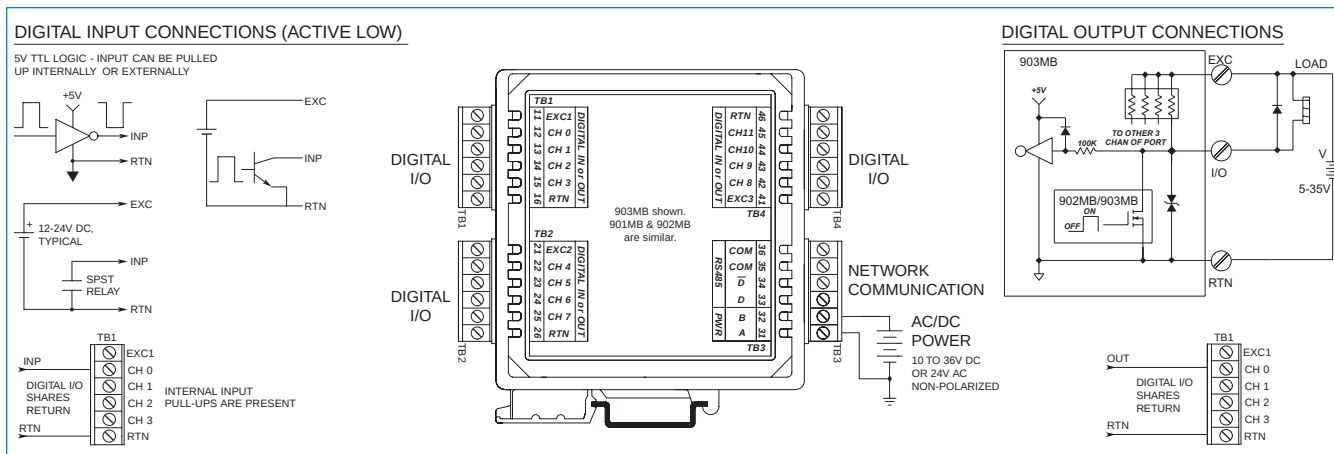
Power supply (24V DC, 2.1A).

See Power Supplies on Page 199.

For more information on software, network hardware, and mounting accessories, please see Pages 69-71.



Optional terminal blocks: barrier strip (left) and spring clamp (right). Cage clamp terminal is standard.





Modbus/RS-485



904/905/906MB Multi-Channel Discrete I/O Modules

Active-High Inputs Sourcing Outputs (High-Side Switching)

Models

904MB: 12 input channels
905MB: 12 output channels
906MB: 12 input/output channels

Input

Twelve input channels (904, 906 models only)
0 to 35V DC

Output

Twelve output channels (905, 906 models only)
5.5 to 35V DC

Network Communication

Modbus-RTU high-speed RS-485

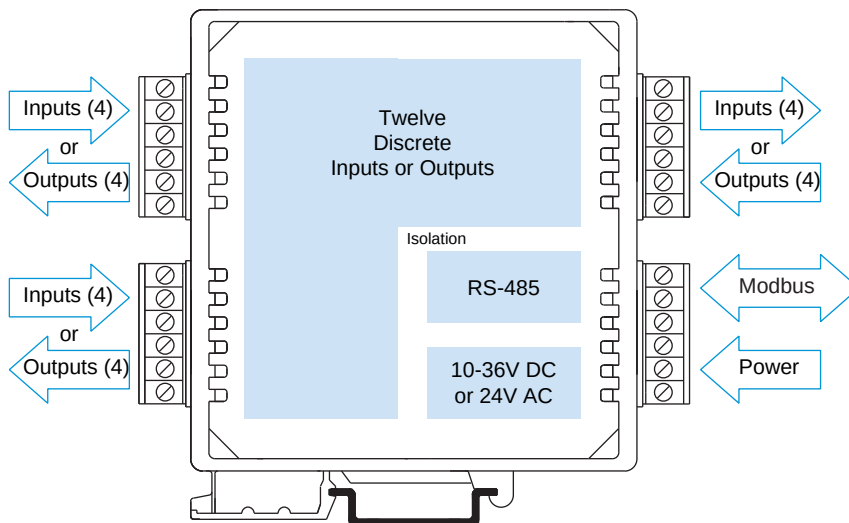
Power Requirement

10 to 36V DC,
24V AC

Approvals

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

High-Density Discrete I/O Module



Description

These modules provide twelve discrete input and/or output channels. Isolation separates the I/O, power, and network circuits. Network communication adheres to the industry-standard RS-485 Modbus RTU protocol. Both AC and DC power sources are supported with wide range, nonpolarized, diode-coupled terminals.

The outputs are intended for current-sourcing or high-side switching applications. The buffered inputs are active-high. These models are the complement of the 901, 902, and 903 units which have low-side output switches and active-low inputs. Socketed pull-down resistors are easily removed or exchanged to satisfy your application requirements.

The 906MB model has twelve input/output points that may be used as inputs or outputs on a bit-by-bit basis. Outputs may be read back to verify output settings.

Combining flexible I/O types, wide I/O ranges, and a network interface in a single package, makes this instrument extremely powerful. Multi-channel design adds cost-efficiency and allows high-density mounting. Plus, safe, rugged construction makes these modules reliable for use in both control room and distributed field I/O applications. Custom module configurations are also possible (consult factory for details).

Special Features

- Standard Modbus RTU protocol with high-speed RS-485 communication (up to 115K bps)
- Twelve I/O channels in a single inch-wide unit reduces system costs and saves panel space
- High-voltage, high-current, open-source outputs enable direct (high-side) control of external devices
- High-voltage buffered inputs monitor discrete levels from a variety of industrial devices
- Tandem input/output circuitry (906 models only) connects input buffers with open-source outputs for convenient loopback monitoring of the output state
- Watchdog timers provide a configurable failsafe output state for use when host I/O communication is lost
- Three-way isolation eliminates potential ground loops between power, I/O, and network circuitry
- Self-diagnostics monitor microcontroller activity to detect operational failures (lock-up) and execute a reset to restore communication



Performance

Discrete Inputs (904 & 906 models only)

Input Type

12 active-high, buffered inputs, with a common connection. Inputs include transient suppression devices and series connected 100K ohm resistors, plus diode over-voltage clamps to the internal +5V supply.

Input Signal Voltage Range

0 to 35V DC, maximum.

Input Current

293µA, typical at 35V DC.

Input Signal Threshold

TTL compatible with 100mV of hysteresis, typical. Thus, Low-to-High threshold is 1.5VDC, High-to-Low is 1.4VDC, typical. Limited to TTL levels of 0.8VDC (max. LOW level) and 2.0VDC (min. HIGH level).

Input Resistance

5.6K ohms with standard factory pull-down resistors installed. 100K ohms without pull-downs.

Input Hysteresis

100mV DC, typical.

Input Response Time

500ns for low-to-high, 2µs for high-to-low, typical. Microcontroller samples inputs as a group every 10mS.

Discrete Outputs (905 & 906 models only)

Output Type

12 independent, open-source, MOSFET switches that operate as high-side switches.

Output Voltage Range

5.5 to 35V DC (0 to 250mA/channel continuous). External excitation voltage required.

Output ON Resistance

0.15 ohms maximum.

Output Response Time

Outputs update within 50ms of a write command and switch within 5mS of receipt of command. Loopback response (906MB) is 1µs low-to-high, 5µs high-to-low.

General

I/O Pull-downs and Socket

5.6K ohm pull-down resistor SIPs are installed in sockets at each port (four-channels per port).

Excitation (per port)

External excitation voltage for each four-channel port is limited to 35V or less.

Supported Modbus Commands

The command/response protocol for communicating with this module adheres to the Modbus/RTU standard for the following Modbus Functions.

Read Coil (Output) Status
Read Input Status
Read Holding Registers
Read Input Registers
Force Single Coil (Output)
Preset Single Register
Reset Slave
Force Multiple Coils (Outputs)
Preset Multiple Registers
Report Slave ID

LED Indicators

LEDs indicate power, status, and discrete level.

Power Requirements

10 to 36V DC,
22 to 26V AC.

Supply Current

Supply	Current Draw
10V DC	90mA maximum
24V DC	40mA maximum
24V AC	75mA rms maximum

Isolation

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

Ordering Information

Models

904MB-0900

Discrete input module

905MB-0900

Discrete output module

906MB-0900

Discrete input/output module

Accessories

900C-SIP

Configuration Software Interface Package (includes software CD-ROM for Windows, RS-232/485 converter, and RS-485/three-wire cable)

5034-225

USB-to-RS232 adapter. See page 68 for more info.

TBK-B02

Optional terminal block kit, barrier strip style, 4 pcs.

TBK-S02

Optional terminal block kit, spring clamp style, 4 pcs.

P55R-D24

Power supply (24V DC, 2.1A).
See Power Supplies on Page 199.

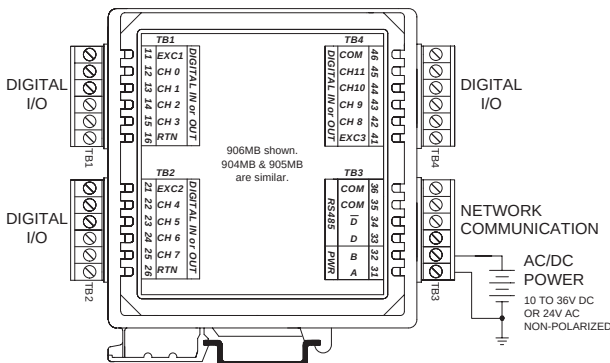
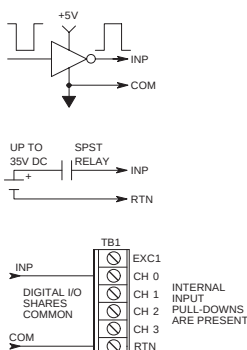
For more information on software, network hardware, and mounting accessories, please see Pages 69-71.



Optional terminal blocks: barrier strip (left) and spring clamp (right). Cage clamp terminal is standard.

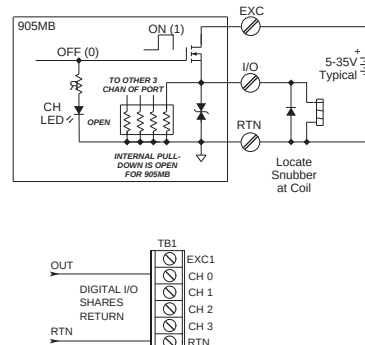
DIGITAL INPUT CONNECTIONS (ACTIVE HIGH)

5V TTL LOGIC INPUT IS ACTIVE HIGH AND PULLED DOWN INTERNALLY



DIGITAL OUTPUT CONNECTIONS

RELAY COIL/SOLENOID DRIVER (905MB/906MB)





Modbus/RS-485



913/914MB Multi-Channel Analog Input Modules

DC Current, DC Voltage or AC Current Input

Limit Alarms or Discrete Outputs

Models

913MB: 4 current input channels
914MB: 4 voltage input channels

Input Ranges

0 to 20mA DC,
±10V DC,
0 to 20A AC (with 5020-350 sensor)

Output

Four output channels:
Open-drain MOSFETs (1A DC loads)
0 to 35V DC

Network Communication

Modbus-RTU high-speed RS-485

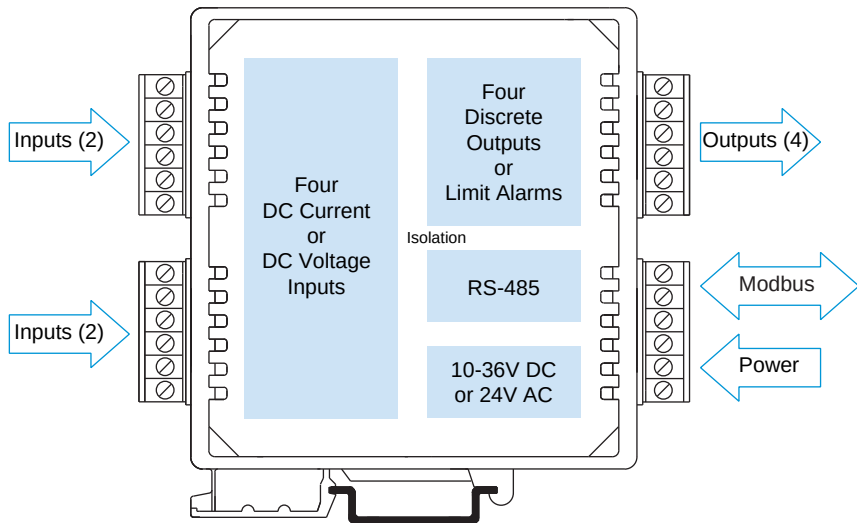
Power Requirement

10 to 36V DC,
24V AC

Approvals

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

DC Current/Voltage Input Module



Description

This signal conditioner is a four-channel analog input module with four discrete outputs. It provides isolation between input, output, power, and network circuits. Network communication adheres to the industry-standard RS-485 Modbus RTU protocol. AC and DC power sources are supported with nonpolarized, diode-coupled terminals.

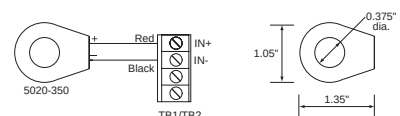
The inputs accommodate wide DC voltage or current ranges. Flexible discrete outputs operate as alarms or on/off controllers. As limit alarms, each discrete output can be configured with high and/or low setpoints exclusively tied to an analog input channel. Alarm trips function without host communication enabling low-cost stand-alone alarms, as well as local backup for the primary control system. Otherwise, on/off control is based on commands issued by the host system.

Combining flexible transmitter functions, mixed signal I/O, alarm support, and a network interface in a single package, makes this instrument extremely powerful. Multi-channel design adds cost-efficiency and allows high-density mounting. Plus, safe, rugged construction makes these modules reliable for use in both control room and distributed field I/O applications. Custom module configurations are also possible (consult factory for details).

Special Features

- Standard Modbus RTU protocol with high-speed RS-485 communication (up to 115K bps)
- 16-bit sigma-delta A/D yields 0.1% of range resolution and accuracy
- Four inputs in a single inch-wide module reduces system costs and saves panel space
- Four discrete outputs enable local limit alarms or host-controlled on/off switching
- Heavy-duty 1A solid-state relays provide dependable on/off control of industrial devices
- Self-calibration lowers maintenance costs by reducing periodic manual calibration checks
- Watchdog timers provide a configurable failsafe output state for use when host I/O communication is lost
- Four-way isolation eliminates potential ground loops between power, input, output, and network circuitry
- Self-diagnostics monitor microcontroller activity to detect operational failures (lock-up) and execute a reset to restore communication

AC Current Sensor Model 5020-350



For 913MB. Order separately (one per channel).



■ Performance

■ Discrete Inputs (904 & 906 models only)

Input Type

12 active-high, buffered inputs, with a common connection. Inputs include transient suppression devices and series connected 100K ohm resistors, plus diode over-voltage clamps to the internal +5V supply.

Input Signal Voltage Range

0 to 35V DC, maximum.

Input Current

293µA, typical at 35V DC.

Input Signal Threshold

TTL compatible with 100mV of hysteresis, typical. Thus, Low-to-High threshold is 1.5VDC, High-to-Low is 1.4VDC, typical. Limited to TTL levels of 0.8VDC (max. LOW level) and 2.0VDC (min. HIGH level).

Input Resistance

5.6K ohms with standard factory pull-down resistors installed. 100K ohms without pull-downs.

Input Hysteresis

100mV DC, typical.

Input Response Time

500ns for low-to-high, 2µs for high-to-low, typical. Microcontroller samples inputs as a group every 10mS.

■ Discrete Outputs (905 & 906 models only)

Output Type

12 independent, open-source, MOSFET switches that operate as high-side switches.

Output Voltage Range

5.5 to 35V DC (0 to 250mA/channel continuous). External excitation voltage required.

Output ON Resistance

0.15 ohms maximum.

Output Response Time

Outputs update within 50ms of a write command and switch within 5mS of receipt of command. Loopback response (906MB) is 1µs low-to-high, 5µs high-to-low.

■ General

I/O Pull-downs and Socket

5.6K ohm pull-down resistor SIPs are installed in sockets at each port (four-channels per port).

Excitation (per port)

External excitation voltage for each four-channel port is limited to 35V or less.

Supported Modbus Commands

The command/response protocol for communicating with this module adheres to the Modbus/RTU standard for the following Modbus Functions.

- Read Coil (Output) Status
- Read Input Status
- Read Holding Registers
- Read Input Registers
- Force Single Coil (Output)
- Preset Single Register
- Reset Slave
- Force Multiple Coils (Outputs)
- Preset Multiple Registers
- Report Slave ID

LED Indicators

LEDs indicate power, status, and discrete level.

Power Requirements

10 to 36V DC,
22 to 26V AC.

Supply Current

Supply	Current Draw
10V DC	140mA maximum
24V DC	56mA maximum
24V AC	95mA maximum

Isolation

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

■ Ordering Information

Models

904MB-0900

Discrete input module

905MB-0900

Discrete output module

906MB-0900

Discrete input/output module

Accessories

900C-SIP

Configuration Software Interface Package (includes software CD-ROM for Windows, RS-232/485 converter, and RS-485/three-wire cable)

5034-225

USB-to-RS232 adapter. See page 68 for more info.

TBK-B02

Optional terminal block kit, barrier strip style, 4 pcs.

TBK-S02

Optional terminal block kit, spring clamp style, 4 pcs.

PS5R-D24

Power supply (24V DC, 2.1A). See Power Supplies on Page 199.

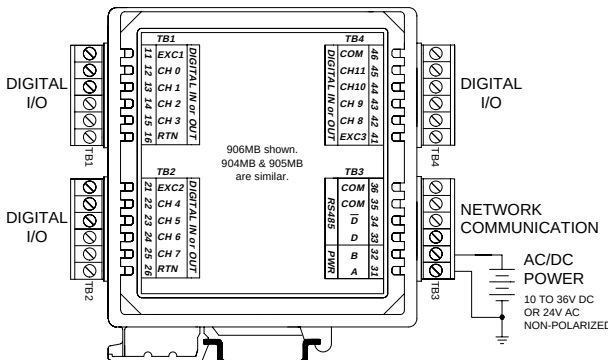
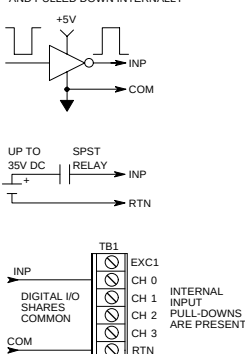
For more information on software, network hardware, and mounting accessories, please see Pages 69-71.



Optional terminal blocks: barrier strip (left) and spring clamp (right). Cage clamp terminal is standard.

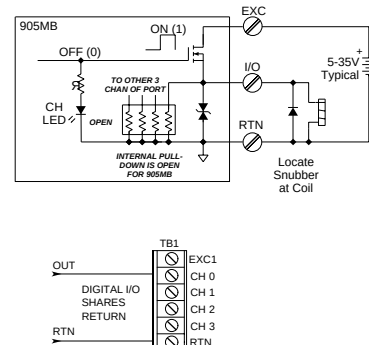
DIGITAL INPUT CONNECTIONS (ACTIVE HIGH)

5V TTL LOGIC INPUT IS ACTIVE HIGH AND PULLED DOWN INTERNALLY



DIGITAL OUTPUT CONNECTIONS

RELAY COIL/SOLENOID DRIVER (905MB/906MB)





Modbus/RS-485



917/918MB Multi-Channel Analog Output Modules

DC Current or DC Voltage Outputs Discrete Outputs

Models

917MB: 4 current output channels

918MB: 4 voltage output channels

Analog Output

917MB: 0 to 20mA, 4 to 20mA, 0 to 1mA DC

918MB: 0 to 10V, 0 to 5V, 0 to 1V DC

Discrete Output

Four output channels:

Open-drain MOSFETs (1A DC loads)

0 to 35V DC

Network Communication

Modbus-RTU high-speed RS-485

Power Requirement

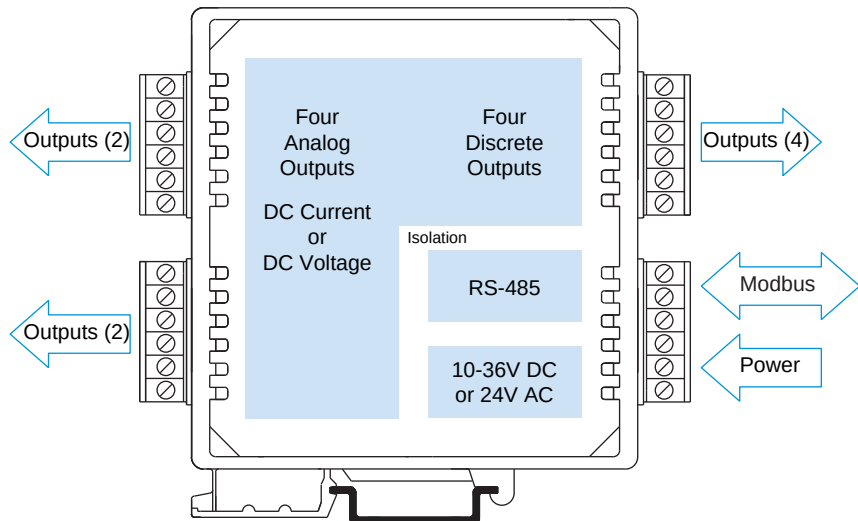
12 to 36V DC (917MB), 10 to 36V DC (918MB),
24V AC

Approvals

CE marked. UL, cUL listed

Class I; Division 2; Groups A, B, C, D.

Analog Output Module



Description

These modules drive four analog output channels and also feature four discrete outputs for on/off control. Isolation separates the output, power, and network circuits. Network communication adheres to the industry-standard RS-485 Modbus RTU protocol. AC and DC power sources are supported with nonpolarized, diode-coupled terminals.

The analog outputs generate a signal based on communication from the host. They accommodate wide DC voltage or current ranges.

Discrete outputs provide simple on/off switching capability (open-drain) for external devices.

Combining analog outputs, on/off controllers, and a network interface in a single package, makes this instrument extremely powerful. Multi-channel design adds cost-efficiency and allows high-density mounting. Plus, safe, rugged construction make it reliable for both control room and distributed field I/O use in a broad range of temperature control applications. Custom module configurations are also possible (consult factory for details).

Special Features

- Standard Modbus RTU protocol with high-speed RS-485 communication (up to 115K bps)
- 12-bit D/A yields 0.1% of span resolution and accuracy
- Four analog outputs in an inch-wide module reduces system costs and saves panel space
- Four discrete outputs enable host-controlled on/off switching
- Heavy-duty 1A solid-state relays provide dependable on/off control of industrial devices
- Self-calibration lowers maintenance costs by reducing periodic manual calibration checks
- Watchdog timers provide a configurable failsafe output state for use when host I/O communication is lost
- Three-way isolation eliminates potential ground loops between power, output, and network circuitry
- Self-diagnostics monitor microcontroller activity to detect operational failures (lock-up) and execute a reset to restore communication



Modbus/RS-485



924MB Multi-Channel Temperature Control Modules

Thermocouple or Millivolt Input

Limit Alarms or Discrete Outputs

Model

924MB: 4 input channels

Input

Four input channels:
Thermocouple (types J, K, T, R, S, E, B, N),
±100mV DC

Output

Four output channels:
Open-drain MOSFETs (1A DC loads)
0 to 35V DC

Network Communication

Modbus-RTU high-speed RS-485

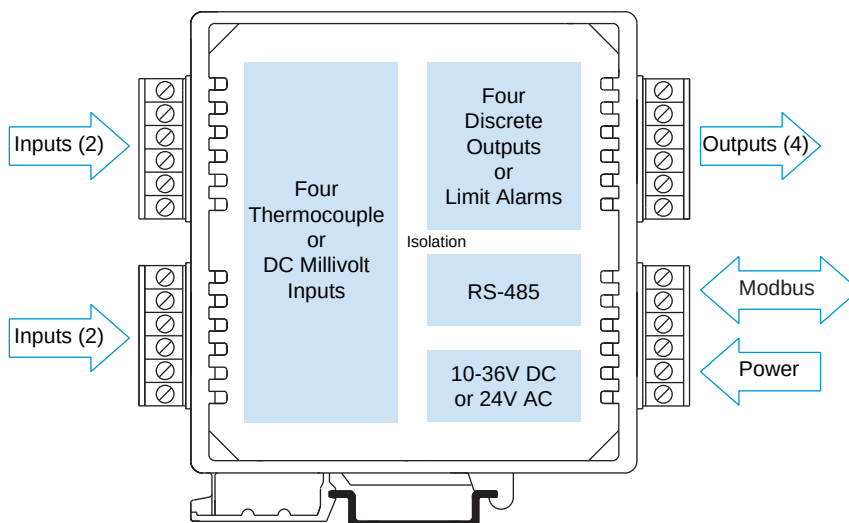
Power Requirement

10 to 36V DC,
24V AC

Approvals

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

Thermocouple/Millivolt Input Module



Description

This signal conditioner is a four-channel analog input module with four discrete outputs. It filters and linearizes thermocouple inputs while providing isolation between input, output, power, and network circuits. Cold junction compensation and upscale/downscale sensor break detection are standard. AC and DC power sources are supported with nonpolarized, diode-coupled terminals.

The programmable inputs accommodate eight thermocouple types plus wide-range millivolt signals. Flexible discrete outputs operate as alarms or on/off controllers. As limit alarms, each discrete output can be configured with high and/or low setpoints exclusively tied to an analog input channel. Alarm trips function without host communication enabling low-cost stand-alone alarms as well as local backup for the primary control system. Otherwise, on/off control is based on commands issued by the host system.

Combining flexible transmitter functions, mixed signal I/O, alarm support, and a network interface in a single package, makes this instrument extremely powerful. Multi-channel design adds cost-efficiency and allows high-density mounting. Plus, safe, rugged construction makes these modules reliable for use in both control room and distributed field I/O applications. Custom module configurations are also possible (consult factory for details).

Special Features

- Standard Modbus RTU protocol with high-speed RS-485 communication (up to 115K bps)
- 16-bit sigma-delta A/D yields 0.1°C resolution and 0.5°C measurement accuracy
- Thermocouple linearization and sensor break detection ensure reliable measurements
- Four discrete outputs enable local temperature limit alarms or host-controlled on/off switching
- Heavy-duty 1A solid-state relays provide dependable on/off control of industrial devices
- Self-calibration lowers maintenance costs by reducing periodic manual calibration checks
- Watchdog timers provide a configurable failsafe output state for use when host I/O communication is lost
- Four-way isolation eliminates potential ground loops between power, input, output and network circuitry
- Self-diagnostics monitor microcontroller activity to detect operational failures (lock-up) and execute a reset to restore communication



Performance

General Input

Resolution

±100mV DC input: 0.1%.
Thermocouple input: 0.1°C (0.18°F).

Ambient Temperature Effect

Better than ±0.005% of input span per °C, or
±1.0uV/°C, whichever is greater.

Noise Rejection

Normal mode: 40dB @ 60Hz, typical.
Common mode: 140dB @ 60Hz, typical.

Input Filter Bandwidth

-3dB at 3Hz, typical.

Input Conversion Rate

90ms per channel.

Thermocouple Input

Thermocouple Input Ranges

Thermocouple type user-configured. Type selected applies to all channels. Signal linearization, cold-junction compensation, and open circuit or lead break detection are included.

TC	°C Range (°F Range)	Accuracy
J	-210 to 760°C (-346 to 1400°F)	±0.5°C
K	-200 to 1372°C (-328 to 2502°F)	±0.5°C
T	-260 to 400°C (-436 to 752°F)	±0.5°C
R	-50 to 1768°C (-58 to 3214°F)	±1.0°C
S	-50 to 1768°C (-58 to 3214°F)	±1.0°C
E	-200 to 1000°C (-328 to 1832°F)	±0.5°C
B	260 to 1820°C (500 to 3308°F)	±1.0°C
N	-230 to 1300°C (-382 to 2372°F)	±1.0°C

Note 1: Accuracy is given with CJC switched off.

Relative inaccuracy with CJC enabled may increase by ±0.5°C.

Thermocouple Break Detection

TC sensor failure can be configured for either upscale or downscale. Selection applies to all channels.

DC Millivolt Input

Millivolt Input Ranges

±100mV DC.

Millivolt Input Accuracy

±0.1% of input range.

Discrete Output

Output Type

Four independent open drain MOSFET switches with a common return that operate as low-side switches.

Output Voltage Range

0 to 35V DC, 1A DC maximum for each output.
External voltage source required.

Output ON Resistance

0.15 ohms maximum.

Operation

Digital outputs are set to their OFF state following a software or power-on reset. Outputs can optionally be set to user-defined states following a watchdog timeout. Watchdog timeout output control takes precedence over limit alarm control. Alarm control takes precedence over host control.

Output Response Time

4.1ms typical, from receipt of command to gate transition of the output MOSFET.

Communication

Supported Modbus Commands

The command/response protocol for communicating with this module adheres to the Modbus/RTU standard for the following Modbus Functions.

Read Coil
Read Holding Registers
Read Input Registers
Force Single Coil
Preset Single Register
Force Multiple Coils
Preset Multiple Registers
Report Slave ID
Reset Slave

LED Indicators

LEDs indicate power, status, and discrete level/alarm.

Power and Isolation

Power Requirements

10 to 36V DC,
22 to 26V AC.

Supply Current

Supply	Current Draw
10V DC	100mA maximum
24V DC	45mA maximum
24V AC	85mA rms maximum

Isolation

1500V AC for 60 seconds or 250V AC continuous.
4-way isolation between input, network, power and discrete I/O circuits. Inputs are isolated channel-to-channel for common mode voltage to ±5V DC.

Ordering Information

924MB-0900

Thermocouple/millivolt input module

900C-SIP

Configuration Software Interface Package
(includes software CD-ROM for Windows, RS-232/485 converter, and RS-485/three-wire cable)

503A-225

USB-to-RS232 adapter. See page 68 for more info.

TBK-B01

Optional terminal block kit, barrier strip style, 2 pcs.
(Does not include terminal block for input wiring.)

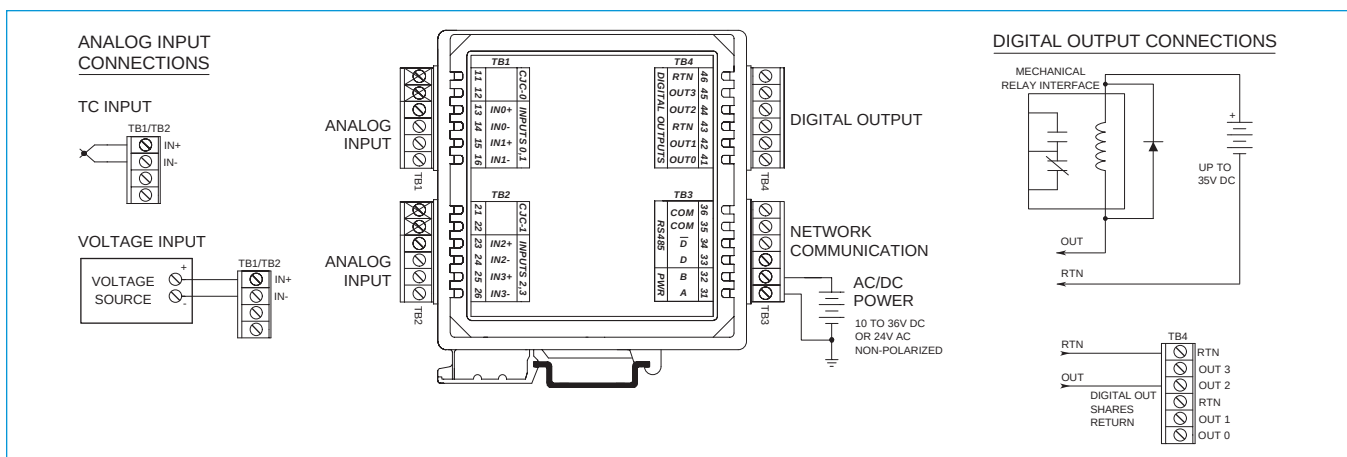
TBK-S02

Optional terminal block kit, spring clamp style, 2 pcs.
(Does not include terminal block for input wiring.)

PS5R-D24

Power supply (24V DC, 2.1A).
See Power Supplies on Page 199.

For more information on software, network hardware, and mounting accessories, please see Pages 69-71.





Modbus/RS-485



932/934MB Multi-Channel Temperature Control Modules

RTD or Resistance Input

Limit Alarms or Discrete Outputs

Models

932MB: 2 input channels, 2 relay outputs

934MB: 4 input channels, 4 relay outputs

Input

RTD (100 ohm Pt, 120 ohm Ni, 10 ohm Cu),
Resistance (0 to 500 ohms)

Output

Solid-state relays, Form A, SPST-NO

Network Communication

Modbus-RTU high-speed RS-485

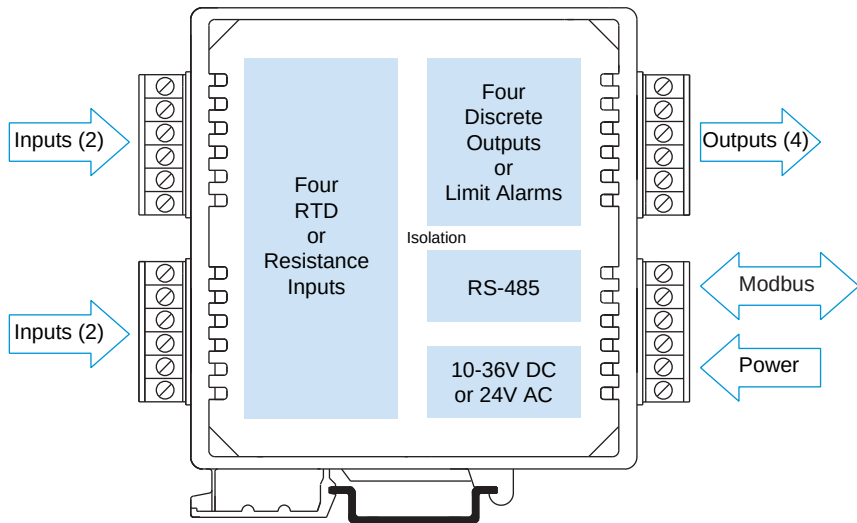
Power Requirement

10 to 36V DC,
24V AC

Approvals

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

RTD/Resistance Input Module



Description

This signal conditioner is a dual or quad-channel analog input module with one discrete/relay output per input channel and a Modbus interface. It filters and linearizes RTD or resistance inputs while providing isolation between input, output, power, and network circuits. Lead wire compensation and upscale/downscale sensor break detection are standard. Low voltage AC and DC power sources are supported with nonpolarized, diode-coupled terminals.

The programmable inputs accommodate four RTD types plus wide-range resistance signals. Flexible discrete outputs operate as alarms or on/off controllers. As limit alarms, each discrete output can be configured with high and/or low setpoints exclusively tied to an analog input channel. Alarm trips function without host communication enabling low-cost stand-alone alarms as well as local backup for the primary control system. Otherwise, on/off control is based on commands issued by the host system.

Combining flexible transmitter functions, mixed signal I/O, alarm support, and a network interface in a single package, makes this instrument extremely powerful. Multi-channel design adds cost-efficiency and allows high-density mounting. Plus, safe, rugged construction makes these modules reliable for use in both control room and distributed field I/O applications. Custom module configurations are also possible (consult factory for details).

Special Features

- Standard Modbus RTU protocol with high-speed RS-485 communication (up to 115K bps)
- 16-bit sigma-delta A/D yields 0.1°C resolution and 0.25°C accuracy (Pt, Ni RTDs)
- RTD linearization and sensor break detection ensure reliable measurements
- Discrete relay outputs enable local temperature limit alarms or host-controlled on/off switching
- Heavy-duty 1A solid-state relays provide dependable on/off control of industrial devices
- Self-calibration lowers maintenance costs by reducing periodic manual calibration checks
- Watchdog timers provide a configurable failsafe output state for use when host I/O communication is lost
- Four-way isolation eliminates potential ground loops between power, input, output and network circuitry
- Self-diagnostics monitor microcontroller activity to detect operational failures (lock-up) and execute a reset to restore communication



Performance

RTD/Resistance Input

Input Ranges

Input type user-configured. Type selected applies to all channels. RTD linearization, lead wire compensation, and open circuit or lead break detection are included.

Input Type	Alpha	Input Range	Accuracy
Pt 100 ohm	1.3850	-200 to 850°C	±0.25°C
Pt 100 ohm	1.3911	-200 to 850°C	±0.25°C
Ni 120 ohm	1.6720	-80 to 320°C	±0.25°C
Cu 10 ohm	1.4272	-200 to 260°C	±1.00°C
Resistance	linear	0 to 500 ohms	±0.05 ohm

Resolution

Input Type	Alpha	Resolution
Pt 100 ohm	1.3850	0.1°C
Pt 100 ohm	1.3911	0.1°C
Ni 120 ohm	1.6720	0.1°C
Cu 10 ohm	1.4272	0.2°C
Resistance	linear	7.8125 milliohms

Ambient Temperature Effect

Better than ±0.005% of input span per °C, or ±1.0uV/°C, whichever is greater.

Noise Rejection

Normal mode: 40dB @ 60Hz, typical.
Common mode: 130dB @ 60Hz, typical.

Input Filter Bandwidth

-3dB at 3Hz, typical.

Input Conversion Rate

300ms per channel typical.

RTD Break Detection

Sensor failure can be configured for either upscale or downscale. Selection applies to all channels.

Excitation Current

1mA DC typical, all types.

Lead-Wire Compensation

Inherent for 3-wire RTD. The maximum lead resistance is 25 ohms per lead (Pt), 20 ohms per lead (Ni), 10 ohms per lead (Cu). All lead wires must be of equal size and length.

Discrete Output

Output Type

Solid-State Relay (SSR), one Form A (SPST-NO) switch per input channel. Outputs share a common return connection at the RTN terminals for low side switching

Output Voltage Range

0 to 48V DC, 1A DC.

Output ON Resistance

0.4 ohms maximum.

Output Response Time

4.1ms typical, from receipt of command to gate transition of the output MOSFET.

Operation

Digital outputs are set to their OFF state following a software or power-on reset. Outputs can be set to user-defined states following a watchdog timeout.

Communication

Supported Modbus Commands

The command/response protocol for communicating with this module adheres to the Modbus/RTU standard for the following Modbus Functions.

Read Holding Registers	Read Coil
Read Input Registers	Reset Slave
Preset Single Register	Report Slave ID
Force Multiple Coils	Force Single Coil
Preset Multiple Register	

LED Indicators

LEDs indicate power, status, and discrete level/alarm.

Power and Isolation

Power Requirements

10 to 36V DC (56mA max. at 24V DC).
22 to 26V AC (94mA rms max. at 24V AC).

Isolation

1500V AC for 60 seconds or 250V AC continuous. 4-way isolation between input, network, power and discrete I/O circuits. Inputs are isolated channel-to-channel for common mode voltage to ±5V DC.

Ordering Information

932MB-0900

Two channel RTD/Resistance input module

934MB-0900

Four channel RTD/Resistance input module

Accessories

900C-SIP

Configuration Software Interface Package (includes software CD-ROM for Windows, RS-232/485 converter, and RS-485/three-wire cable)

5034-225

USB-to-RS232 adapter. See page 68 for more info.

TBK-B02

Optional terminal block kit, barrier strip style, 4 pcs.

TBK-S02

Optional terminal block kit, spring clamp style, 4 pcs.

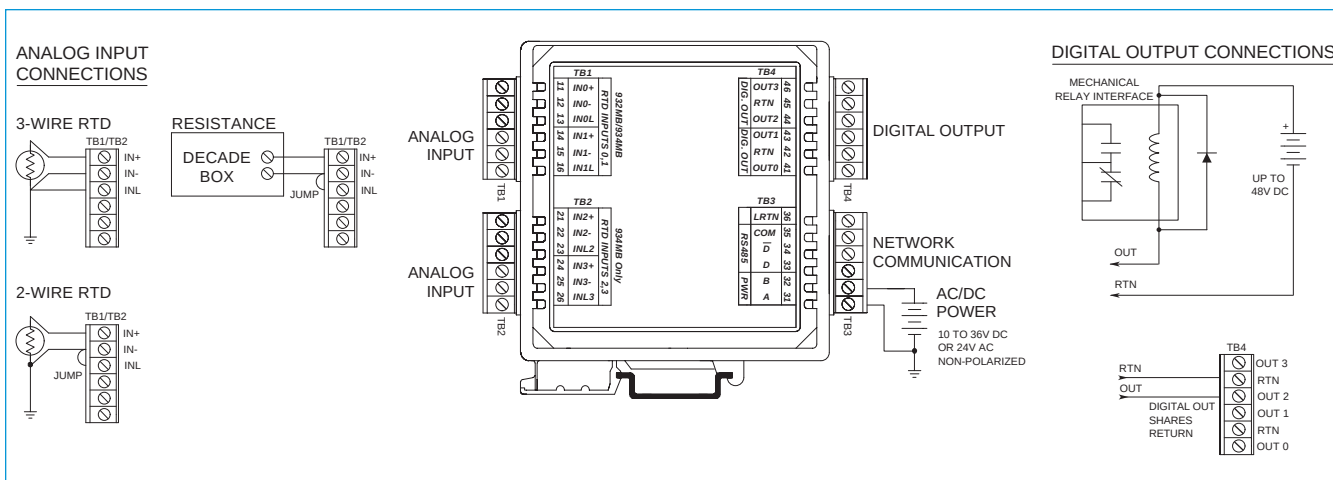
PS5R-D24

Power supply (24V DC, 2.1A).
See Power Supplies on Page 199.

For more information on software, network hardware, and mounting accessories, please see Pages 69-71.



Optional terminal blocks: barrier strip (left) and spring clamp (right). Cage clamp terminal is standard.





Modbus/RS-485



942MB Frequency/ Pulse Counter Modules

Periodic or Pulse Waveform Input

Limit Alarms or Discrete Outputs

Model

942MB: 2 input channels

Input

Two input channels:
0 to 50KHz in three selectable ranges
Amplitudes up to 140V AC or 200V peak
Pulse counter range of 0 to 65535

Output

Two output channels:
Solid-state relays (1A DC loads)
0 to 48V DC

Network Communication

Modbus-RTU high-speed RS-485

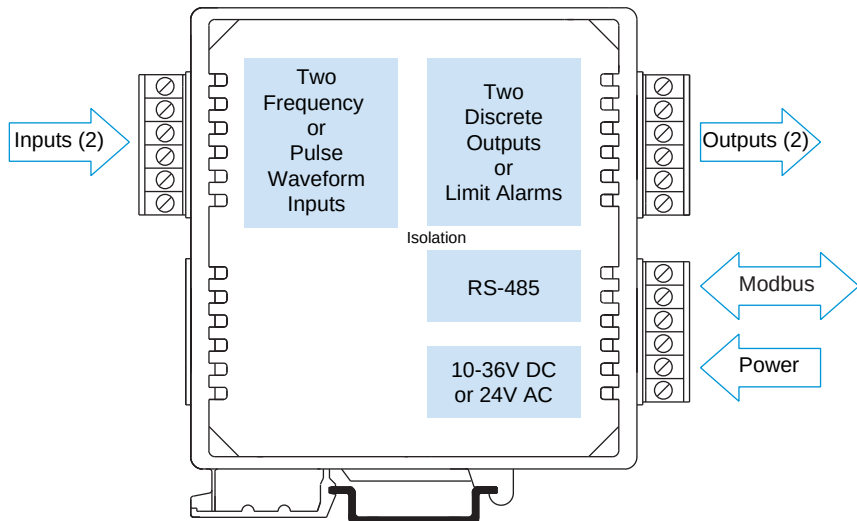
Power Requirement

10 to 36V DC,
24V AC

Approvals

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

Frequency/Counter Module



Description

This signal conditioner is a two-channel analog input module with discrete outputs and Modbus communication. It conditions periodic or pulse waveform inputs and provides solid-state relays for limit alarms or ON/OFF control.

Versatile inputs accommodate many applications using TTL, magnetic pickups, proximity sensors, or a variety of switches (high/low-side transistor, dry contact, open drain, open collector). Bipolar and unipolar waveforms are supported with a selectable input bias that accepts both zero and non-zero crossing signals. Voltage threshold and relative hysteresis are also user selectable.

Inputs may also function as event counters with separate microcontrollers for each channel. The module counts pulses on the positive or negative edge. It can wrap around to zero for continuous counting, latch at a programmed count value (setpoint), or automatically reset itself to zero after reaching a setpoint value. Software controls enable remote resets. A variety of filters help remove noise, jitter, and other mechanical effects to prevent false counts.

The discrete outputs can operate as independent alarms or provide on/off control regulated by the host system. As limit alarms, each output can be set for high and/or low setpoints exclusively tied to an analog input. These low cost modules are ideal for standalone alarms as well as for local backup of the primary control system.

Special Features

- Standard Modbus RTU protocol with high-speed RS-485 communication (up to 115K bps)
- Separate microcontrollers on each channel for pulse counting and period measurement
- Solid-state relay outputs enable local limit alarms or host-controlled on/off switching
- Bipolar and unipolar input signal support
- Programmable pulse counter functions
- Input filtering functions include hysteresis, averaging, debounce, relay time delay, and alarm deadband controls
- 4-way isolation (input, output, power, network)
- Watchdog timers provide a failsafe output
- Self-diagnostics monitor microcontroller activity to detect operational failures (lock-up) and execute a reset to restore communication



Optional terminal blocks: barrier strip (left) and spring clamp (right). Cage clamp terminal is standard.



■ Performance

■ Frequency/Counter Input

Input Ranges

Input type user-configured. Applies to both channels.

Input Range	Accuracy	Accuracy over Temp.
0 to 100Hz	±0.04Hz	±0.06Hz
0 to 1000Hz	±0.4Hz	±0.6Hz
0 to 50,000Hz	±10Hz	±15Hz
0 to 65,535 pulses	±1 pulse	±1 pulse

Unipolar Input Configuration

Amplitude: 0 to 3V minimum range,
0 to 200V peak maximum range.

Threshold: Configurable for 1.5V or 5V, typical.

Hysteresis: Configurable for ±25mV (at 1.5V threshold), or ±83mV (at 5.0V threshold), typical.

Bipolar (Zero-Crossing) Input Configuration

Amplitude (0-20KHz): ±50mV minimum (with ±25mV hysteresis), or ±150mV minimum (with ±83mV hysteresis), to ±200V peak maximum.

Amplitude (Above 20KHz): ±100mV minimum (with ±25mV hysteresis), or ±200mV minimum (with ±83mV hysteresis), to ±200V peak maximum.

Threshold: 0mV nominal, 0.01V typical with ±25mV hysteresis; 0.03V typical with ±83mV hysteresis.

Hysteresis: Configurable for ±25mV or ±83mV, typical.

Resolution

0 to 100Hz input range: 0.01Hz

0 to 1000Hz input range: 0.1Hz

0 to 50,000Hz input range: 1Hz

Pulse counter: 1 pulse

Minimum Input Pulse Width

10µs (frequency input); 5mS (pulse input).

Counting Rate

100Hz maximum counting rate

(5mS ON and 5mS OFF for 10mS period or 100Hz).

Input Impedance

35K ohms, typical.

Input Filter Bandwidth

-3dB at 35kHz, typical.

Input Pullup/Pulldown

Software selectable 2.7K ohm input pullup to +5V and a 1K ohm input pulldown to return. The resistors may also be left floating (none).

Input Debounce

0 to 1.375 seconds, configurable in 5mS increments.

Noise Rejection

Common mode: 80dB @ 60Hz, typical with 100 ohm input unbalance.

■ Discrete Output

Output Type

Solid-State Relay (SSR), one Form A (SPST-NO) switch per input channel. Outputs share a common return connection at the RTN terminals for low-side switching

Output Voltage Range

0 to 48V DC, 1A DC.

Output ON Resistance

0.4 ohms maximum.

Output Response Time

4.1ms typical, from receipt of command to gate transition of the output MOSFET.

Operation

Digital outputs are set to their OFF state following a software or power-on reset. Outputs can be set to user-defined states following a watchdog timeout.

■ Communication

Supported Modbus Commands

The command/response protocol for communicating with this module adheres to the Modbus/RTU standard for the following Modbus Functions.

Read Holding Registers

Read Input Registers

Preset Single Register

Force Multiple Coils

Preset Multiple Registers

Read Coil

Reset Slave

Report Slave ID

Force Single Coil

LED Indicators

LEDs indicate power, status, and discrete level/alarm.

■ Power and Isolation

Power Requirements

10 to 36V DC.

22 to 26V AC.

Isolation

1500V AC for 60 seconds or 250V AC continuous.

4-way isolation between input, network, power and discrete I/O circuits. Inputs are isolated channel-to-channel for common mode voltage to ±5V DC.

■ Ordering Information

942MB-0900

Frequency/counter input module

Accessories

900C-SIP

Configuration Software Interface Package (includes software CD-ROM for Windows, RS-232/485 converter, and RS-485/three-wire cable)

5034-225

USB-to-RS232 adapter. See page 68 for more info.

TBK-B02

Optional terminal block kit, barrier strip style, 4 pcs.

TBK-S02

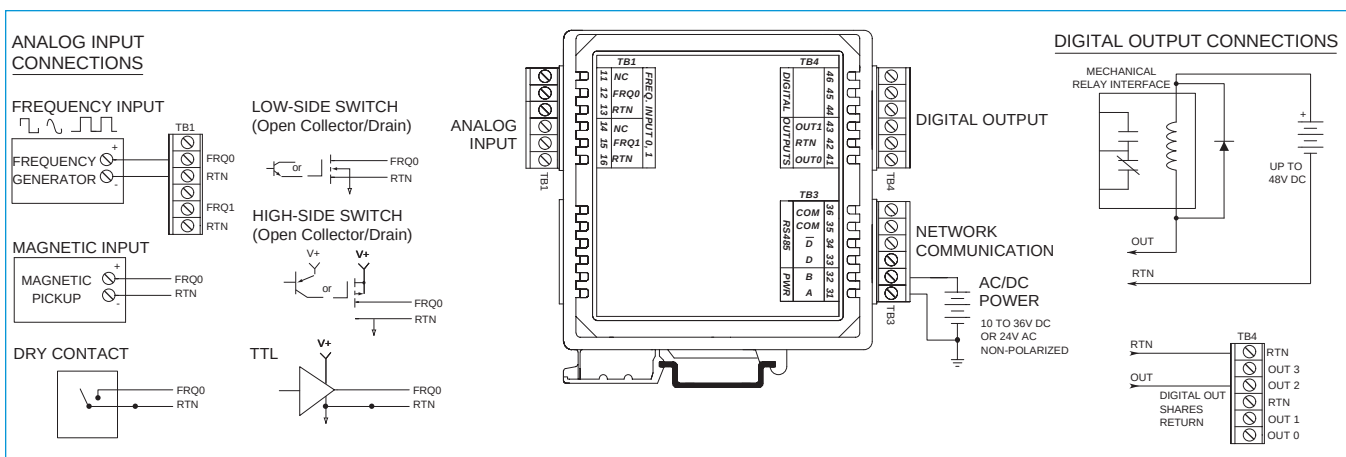
Optional terminal block kit, spring clamp style, 4 pcs.

PS5R-D24

Power supply (24V DC, 2.1A).

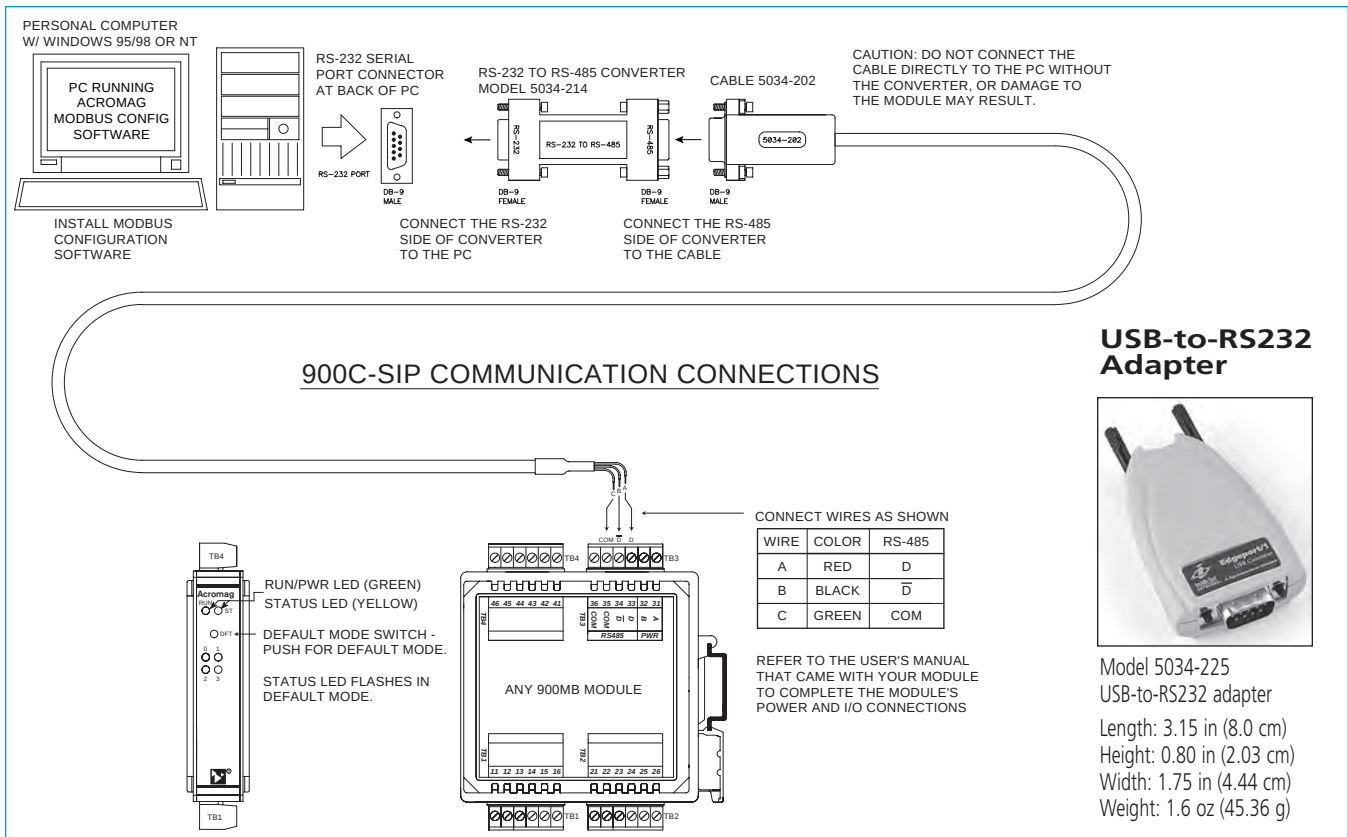
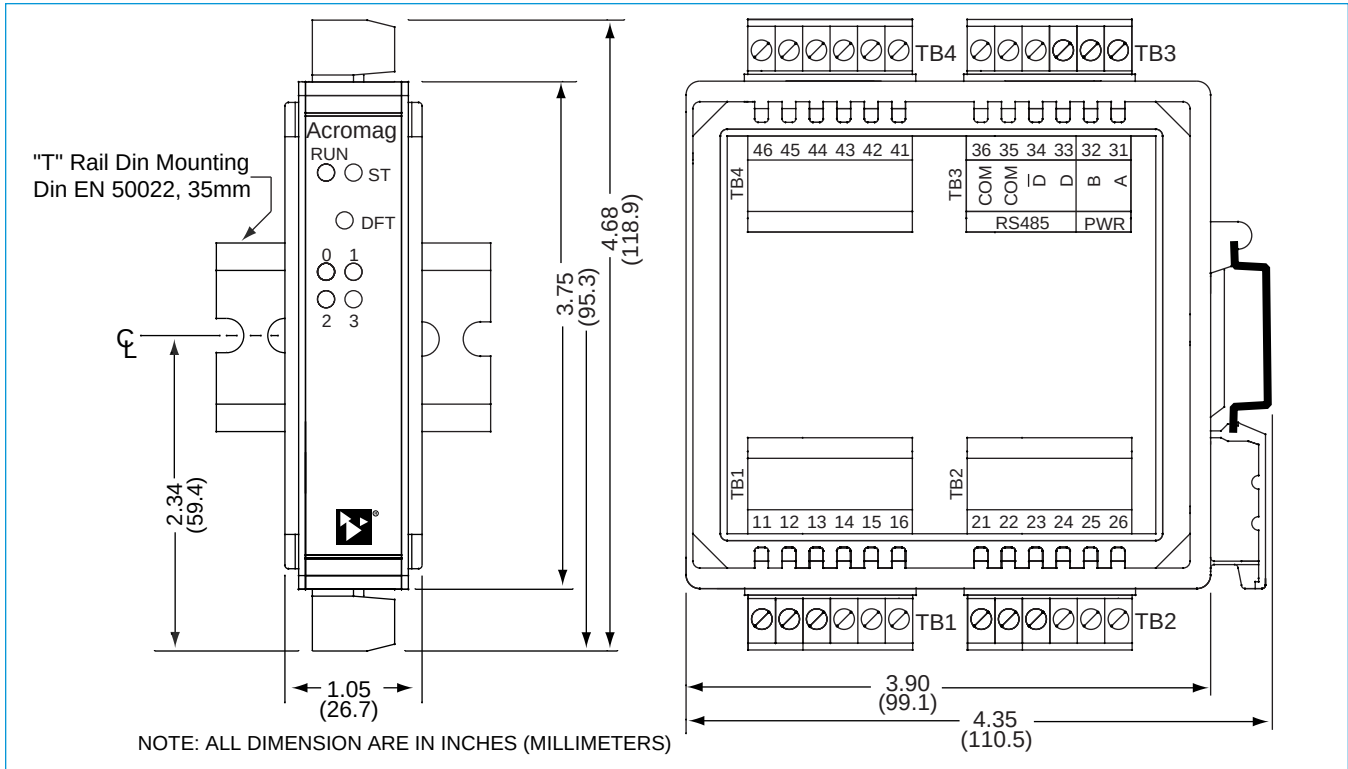
See Power Supplies on Page 199.

For more information on software, network hardware, and mounting accessories, please see Pages 69-71.





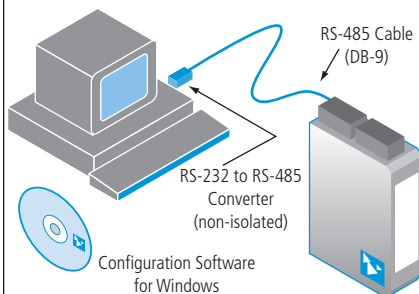
900MB Series Technical Diagrams





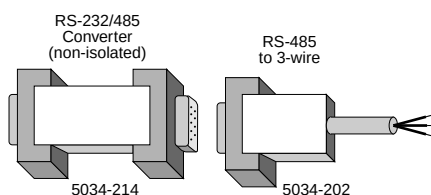
Configuration Kit

Software Interface Package
Model No. 900C-SIP



Software Interface Package

This package includes Windows® Configuration Software, an RS-232-to-485 Serial Port Converter, and an RS-485 Signal Cable. These components provide everything you need to set up a Series 900 I/O module from your desktop PC before installing it on the network.



Ordering Information

- 900C-SIP**
Software Interface Package.
Includes Configuration Software (5034-186), Non-isolated RS-232 to RS-485 Serial Port Converter (5034-214), and RS-485 Cable (5034-202).
Items can also be ordered separately below.
- 5034-186**
Configuration Software for Windows (95/98/2000/ME/NT4/XP) on CD-ROM.
- 5034-214**
Non-isolated RS-232 to RS-485 Serial Port Converter, DB-9F to DB-9F.
- 5034-202**
RS-485 to 3-wire Cable Converter, DB-9M to 3 x 12AWG RS-485 Cable, 8 ft.

Network Power



Universal 50W Power Supply

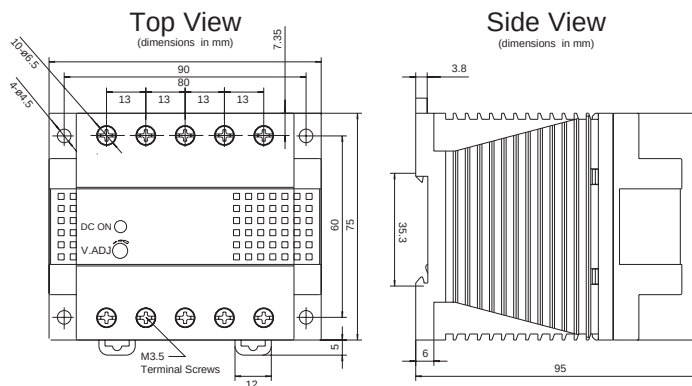
The PS5R-D24 is the ideal power source to drive your network.

Input Power Requirement
Universal power
85 to 264V AC,
105 to 370V DC

Output
24V DC, 2.1A (50W)

Ordering Information

PS5R-D24
Universal Power Supply



Mounting Hardware

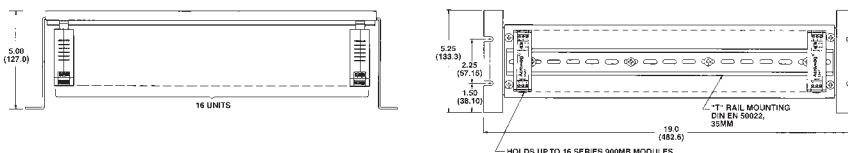


DIN-Rail Mounting

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)



Dimensions in inches (mm).



Notes



Modbus/RS-485



Digital Panel Meters

Display Units

APM765 Page 74

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	APM765
FUNCTIONS	
Isolated signal converter	x
POWER CONFIGURATION	
AC-powered	x
DC-powered	x
INPUTS	
DC voltage input	x
DC current input	x
RTD	x
Thermocouple	x
OUTPUTS	
DC current	x
Modbus, RS-232/422/485	x
Trip relay	x
ISOLATION CONFIGURATION	
3-way (input/output/power)	x



NEMA-4X, IP65



APM765 Panel Meter

Description

The APM765 displays data collected from process current, DC voltage and temperature inputs. Several output options convert the display into a transmitter with proportional 4-20mA output or a serial communication interface. A relay output option adds limit alarm and pump control capabilities.

Process inputs can be scaled with or without applying an input for virtually any engineering units. Temperature inputs can be programmed to display in degrees Fahrenheit or Celsius.

Inputs

4-20mA DC, ± 20 mA DC, ± 10 V DC,
Type J, K, T, E thermocouples,
100 ohm platinum RTDs

Outputs (optional)

4-20mA (sink/source)
Dual SPDT (Form C) 3A relays
RS-232, RS-422/485 serial communication

Power Requirements

Standard unit: 85-265V AC or 90-265V DC
Optional: 12-24V AC or 12-36V DC

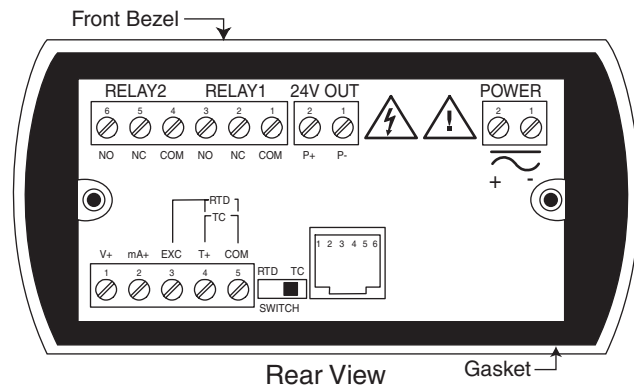
Operating Temperature

0 to 65°C

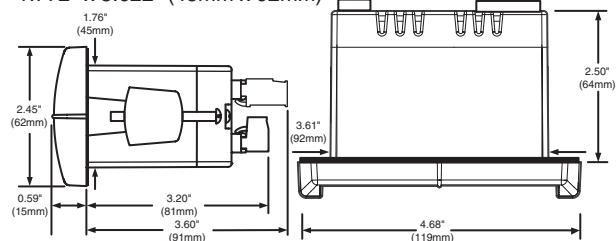
Approvals

CE marked. UL, cUL listed.

Meter with Relays Option



Panel cutout required:
1.772" x 3.622" (45mm x 92mm)



Special Features

- Universal input (TC, RTD, mA, V DC)
- Sunlight-readable display (adjustable intensity)
- Push-button or PC programmable
- Dual relay option for limit alarms or pump control (with alternation)
- Isolated 4-20mA output options (sink/source)
- Single/dual 24V DC isolated power options
- Modbus RTU communication option
- Data acquisition and logging capabilities with MeterView software
- Universal power supply 90-265 VAC/VDC
- Shallow depth package (3.6" behind panel)

Easy Setup

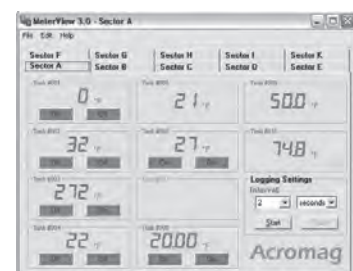
The APM765 is very easy to set up and program using the simple four-button configuration interface. There is only one switch on the entire meter – no jumpers – and never any need to open the case. The meter is also programmable using a PC and the MeterView software. A copy function quickly clones setups from other units.

Applications

- Process & temperature monitoring
- High & low alarms
- Latching or non-latching relays
- Pump alternation control
- Time delay & fail-safe relays
- Minimum & maximum readings

Data Logging

Software provides a convenient way to collect data generated by the APM765's serial output. Users can select the logging time interval and the engineering units for display on the computer screen. Data is written to a file that can be imported into spreadsheets or other applications.





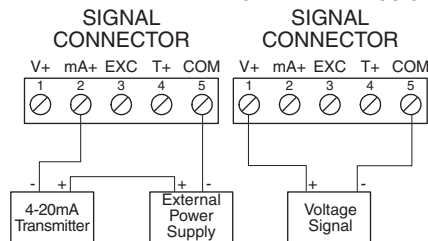
DC Process and Temperature Inputs

The APM765 is factory calibrated to accept 4-20 mA, ± 10 VDC, Type J, K, T, E thermocouples and 100 ohm platinum RTDs. Process inputs can be scaled with or without applying an input for virtually any engineering units. Temperature inputs can be programmed to display in degrees Fahrenheit or Celsius and a type K thermocouple can display up to 2300°F.

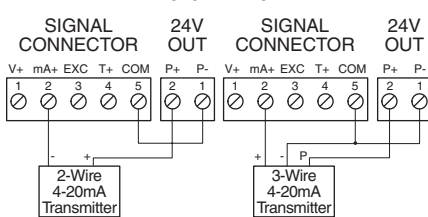
Current/Voltage Input

Setting up the meter to accept a current or voltage input is very easy. All setup steps are performed by pushbuttons or through software so there are no switches or jumpers to adjust.

Transmitter Powered by External Supply



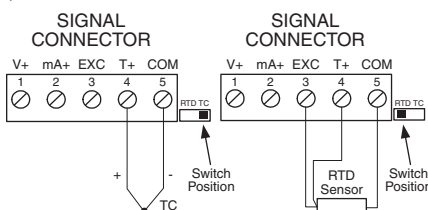
Transmitters Powered by Internal Supply (Optional)



Thermocouple/RTD Input

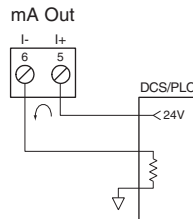
Setting up the APM765 to accept thermocouple or RTD input is simply a matter of setting a switch at the rear of the case and selecting the input type from the menu.

Meters accept J, K, T, or E type thermocouples as well as two, three, or four-wire 100 ohm platinum RTDs.

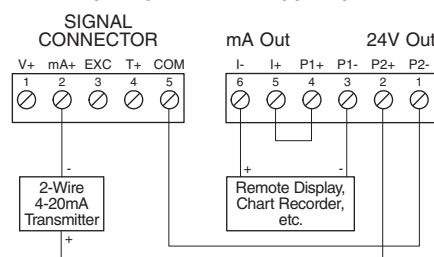


Isolated 4-20mA Output

Standard 4-20 mA Sinking Output (powered externally)

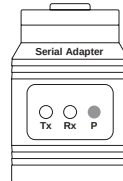


Sourced 4-20 mA Output and Input Signal Powered by Panel Meter (using dual 24V supplies)



Serial or Modbus Output

The APM765 can be used as a data acquisition device, with the added benefit of a digital display, by connecting an optional RS-232 or RS-422/485 serial communication adapter.



Acromag offers MeterView software for simple data acquisition and to program the meter.

Serial Communications

METER ADDRESS

Modbus protocol: 1 - 247 (default 247).

BAUD RATE

300 - 19,200 bps (default 2400).

TRANSMIT TIME DELAY

Programmable between 0 and 199ms or Transmitter always on for RS422 communication (default 10ms).

DATA

8 bit (1 start bit, 1 stop bit).

PARITY

None, even, or odd (default even).

BYTE-TO-BYTE TIMEOUT

0.01 - 2.54 seconds (default 0.01 seconds).

TURN AROUND DELAY

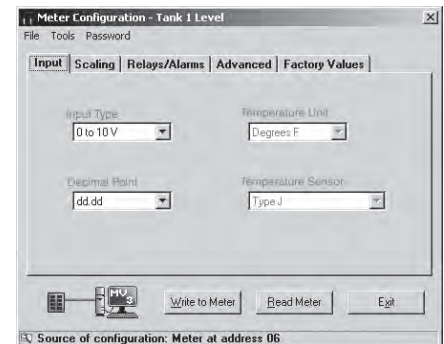
Less than 2ms (fixed).

MeterView Software

MeterView software enables PC programming of the APM765 and sets up data logger operation.

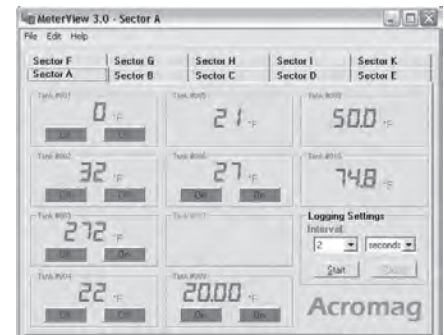
Remote Programming

MeterView software allows all setup parameters to be programmed from a PC and saved to a file for reporting or programming other meters.



Data Acquisition

MeterView software provides a convenient way to collect the data generated from the serial output of up to 100 panel meters. The user can select the logging time interval and the engineering units that will be displayed on the computer screen. Data is written to a file that could then be imported into a spreadsheet or other application.



Sample File Generated by MeterView

PD765 Log File

Name: C:\MV3\Logfile.htm

Created: 2/26/2004 5:34:12 PM

Serial Port:

Connection speed:

Logging rate:

COM 1

2400 Baud

1 update every 10 seconds

Date & Time	Tag Number	Address	Display	Units	Relay 1	Relay 2
2/26/2004 5:34:12 PM	Tank 1 Level	06	17.70	Feet	P1 On	P2 Off
2/26/2004 5:34:12 PM	Tank 2 Level	07	18.18	Feet	P3 Off	P4 Off
2/26/2004 5:34:12 PM	Tank 3 Level	08	20.54	Feet	P5 On	P6 Off
2/26/2004 5:34:12 PM	Tank 1 Temp	09	74	°F	Off	Off
2/26/2004 5:34:12 PM	Tank 2 Temp	10	72	°F	Off	Off
2/26/2004 5:34:12 PM	Tank 3 Temp	11	72	°F	Off	Off
2/26/2004 5:34:22 PM	Tank 1 Level	06	17.58	Feet	P1 On	P2 Off
2/26/2004 5:34:22 PM	Tank 2 Level	07	18.04	Feet	P3 Off	P4 Off
2/26/2004 5:34:22 PM	Tank 3 Level	08	19.79	Feet	P5 Off	P6 Off
2/26/2004 5:34:22 PM	Tank 1 Temp	09	74	°F	Off	Off
2/26/2004 5:34:22 PM	Tank 2 Temp	10	72	°F	Off	Off
2/26/2004 5:34:22 PM	Tank 3 Temp	11	72	°F	Off	Off
2/26/2004 5:34:32 PM	Tank 1 Level	06	16.47	Feet	P1 On	P2 Off
2/26/2004 5:34:32 PM	Tank 2 Level	07	16.87	Feet	P3 Off	P4 Off
2/26/2004 5:34:32 PM	Tank 3 Level	08	17.10	Feet	P5 Off	P6 Off
2/26/2004 5:34:32 PM	Tank 1 Temp	09	74	°F	Off	Off



■ Performance

Specifications apply to operation at 25°C.

■ General

DISPLAY

0.56" (14.2 mm) red LEDs. Four digits (-1999 to 9999).

DISPLAY INTENSITY

Eight user-selectable intensity levels.

FRONT PANEL

NEMA 4X, IP65. Panel gasket provided.

PROGRAMMING METHODS

Four front panel push buttons, PC and MeterView software, or cloning with Copy feature.

NOISE FILTER

Programmable between 2 - 199 (0 will disable filter).

DISPLAY UPDATE RATE

1.8-2.5/sec for TC input or 3.7-5/sec for process/RTD.

OVERRANGE AND UNDERRANGE

Display flashes 9999 (over) or -1999 (under).

MAX/MIN DISPLAY

Stored until reset by user or meter is turned off.

NON-VOLATILE MEMORY

All programmed settings are stored in nonvolatile memory for a minimum of ten years if power is lost.

POWER

AC: 85-265 VAC, 50/60 Hz, 20 VA.

DC: 90-265 VDC, 20 W.

Option: 12-36 VDC or 12-24 VAC.

REQUIRED FUSE

UL Recognized, 5A max, slow blow (up to six meters may share one fuse).

NORMAL MODE REJECTION

64 dB at 50/60 Hz.

ISOLATION

Input or output to power line: 4kV.

Input or output to P1 or P2: 500V.

Input to output: 500V.

P1 to P2: 500V.

ENVIRONMENTAL

Operating range: 0 to 65°C (32 to 149°F).

Storage range: -40 to 85°C (-40 to 185°F).

Relative humidity: 0 to 90% non-condensing.

CONNECTIONS

Power & Signal: removable screw terminal blocks accept 12 to 26 AWG. Serial: RJ11 header, standard on all meters.

ENCLOSURE

1/8 DIN, high impact plastic, 94V-0, color; gray.

WEIGHT

8 oz (2.27 g) (no options).

WARRANTY

3 years parts and labor.

■ Process Inputs

INPUTS

Field selectable: ± 20 mA DC and ± 10 VDC

ACCURACY

$\pm 0.05\%$ of calibrated span ± 1 count, square root: 10-100% F.S.

LOW-FLOW CUTOFF

0 to 9999 (0 disables cutoff function).

DECIMAL POINT

Up to three decimal places: d.ddd, dd.dd, ddd.d, or dddd.

CALIBRATION

Internal or external signal or with PC.

CALIBRATION RANGE

User Programmable over entire range of meter.

INPUT IMPEDANCE

Voltage range: greater than 1M ohms.

Current range: 50-100 ohms.

INPUT OVERLOAD

Protected by automatically resettable fuse.

TEMPERATURE DRIFT

± 50 PPM/°C.

TRANSMITTER SUPPLY

Isolated, one or two transmitter supplies (optional)

P1 (-1 option): 24 VDC $\pm 10\%$ @ 200mA max.

P1/P2 (-2 option)

P1: 24 VDC $\pm 10\%$ @ 200mA.

P2: 24 VDC $\pm 10\%$ @ 40mA.

■ Temperature Inputs

INPUTS

Factory calibrated, field selectable: type J, K, T, or E thermocouples and 100 ohm. platinum RTD (0.00385 or 0.00392 curve).

RESOLUTION

1°; type T, 1° or 0.1°.

ACCURACY

Type	Temperature Range	Accuracy
J	-58 to 1382°F (-50 to 750°C)	$\pm 2^\circ\text{F}$ ($\pm 1^\circ\text{C}$)
K	-58 to 2300°F (-50 to 1260°C)	$\pm 2^\circ\text{F}$ ($\pm 1^\circ\text{C}$)
T	-292 to 700°F (-180 to 371°C)	$\pm 2^\circ\text{F}$ ($\pm 1^\circ\text{C}$)
E	-58 to 1578°F (-50 to 870°C)	$\pm 2^\circ\text{F}$ ($\pm 1^\circ\text{C}$)
RTD	-328 to 1382°F (-200 to 750°C)	$\pm 1^\circ\text{F}$ ($\pm 1^\circ\text{C}$)

COLD JUNCTION REFERENCE

Automatic.

TEMPERATURE DRIFT

$\pm 2^\circ\text{C}$ maximum; 0 to 65°C ambient temperature.

OFFSET ADJUSTMENT

Programmable to $\pm 19.9^\circ$. This allows the user to apply an offset value to the temperature being displayed.

INPUT IMPEDANCE

Greater than 100k ohms.

SENSOR BREAK

All relays and alarm status LEDs go to alarm state.

Analog output may go to pre-programmed state.

Display will flash.

■ Relays

RATING

2 SPDT (form C); rated 3 amps @ 30 VDC or 3 amps @ 250 VAC resistive load; 1/14 HP @ 125/250 VAC for inductive loads.

DEADBAND

0-100% of full scale, user selectable.

HIGH OR LOW ALARM

User may program any alarm for high or low.

RELAY OPERATION

1. Automatic (non-latching).
2. Latching.
3. Pump alternation control.

RELAY RESET

User selectable via front panel buttons or PC.

1. Automatic reset only (non-latching).
2. Automatic + manual reset at any time (non-latching).
3. Manual reset only, at any time (latching).
4. Manual reset only after alarm condition has cleared (latching).

Automatic reset: Resets when input passes reset point.

Manual reset: Front panel ACK button.

TIME DELAY

0 to 199 seconds, on and off delays; programmable.

FAIL-SAFE OPERATION

Programmable, independent for each relay. Relay coils are energized in normal condition. In case of alarm or power failure, relays will go to de-energized state.

AUTO INITIALIZATION

When power is applied to the meter, relays will reflect the state of the input to the meter.

■ Isolated 4-20mA Output

OUTPUT RANGE

1.00 to 23.00mA typical. Scalable for 0.00 to 23.99mA. Factory calibrated for 4-20 mA.

ACCURACY

$\pm 0.1\%$ F.S. ± 0.004 mA.

TEMPERATURE DRIFT

50 PPM/°C from 0 to 65°C ambient.

Note: Analog output drift is separate from input drift.

OUTPUT LOOP RESISTANCE

Power Supply	Minimum	Maximum
24 VDC	10 ohms	700 ohms
35 VDC (external)	100 ohms	1200 ohms

OUTPUT MAXIMUM LOAD

$R_{LOAD} (max) = (V_{SUPPLY} - 10V) / 0.020A$

EXTERNAL POWER RANGE

10-35 VDC.



Ordering Information

Panel Meters

Please select models from the table below.

Model No.	Power: 85-265V AC or 90-265V DC	Power: 12-36V DC or 12-24V AC	24V DC Supply	Dual 24V DC Supplies	Two Relays	4-20mA Output	Modbus Interface
APM765-6R0-00	•						
APM765-6R0-01	•						•
APM765-6R0-10	•		•				
APM765-6R0-11	•		•				•
APM765-6R2-00	•				•		
APM765-6R2-01	•				•		•
APM765-6R2-10	•		•		•		
APM765-6R2-11	•		•		•		•
APM765-6R3-00	•					•	
APM765-6R3-01	•					•	•
APM765-6R3-10	•		•			•	
APM765-6R3-11	•		•			•	•
APM765-6R3-20	•			•		•	
APM765-6R3-21	•			•		•	•
APM765-7R0-00		•					
APM765-7R0-01		•					•
APM765-7R2-00		•			•		
APM765-7R2-01		•			•		•
APM765-7R3-00		•				•	
APM765-7R3-01		•				•	•

Accessories

APMA2801

NEMA 4X plastic enclosure, holds one APM765 meter

APMA6845

Pipe-mount kit (2-inch pipe) for use with APMA2801.

APMA7232

RS-232 serial adapter, APMA7420 included

APMA7420

Standard modular cable, 7ft. (2.1m).

APMA7422

RS-422/485 serial adapter, APM7420 included

APMA7503-1, APMA7503-2, APMA7503-3

MeterView software with 1 meter license (-1 model), 10 meter license (-2), or 100 meter license (-3).

Field Enclosures

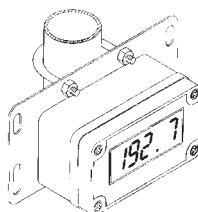
Low-Cost Plastic NEMA 4X Enclosure

The APMA2801 is a low-cost, compact, plastic NEMA 4X enclosure that will house one meter.

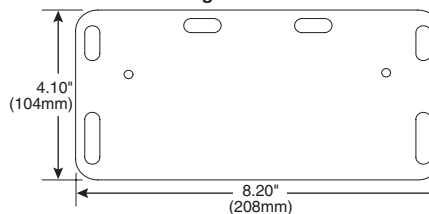


Pipe Mount Kit

The APMA6845 kit mounts a panel meter inside an APMA2801 NEMA 4X enclosure to a 2-inch pipe.



Mounting Plate Hole Pattern



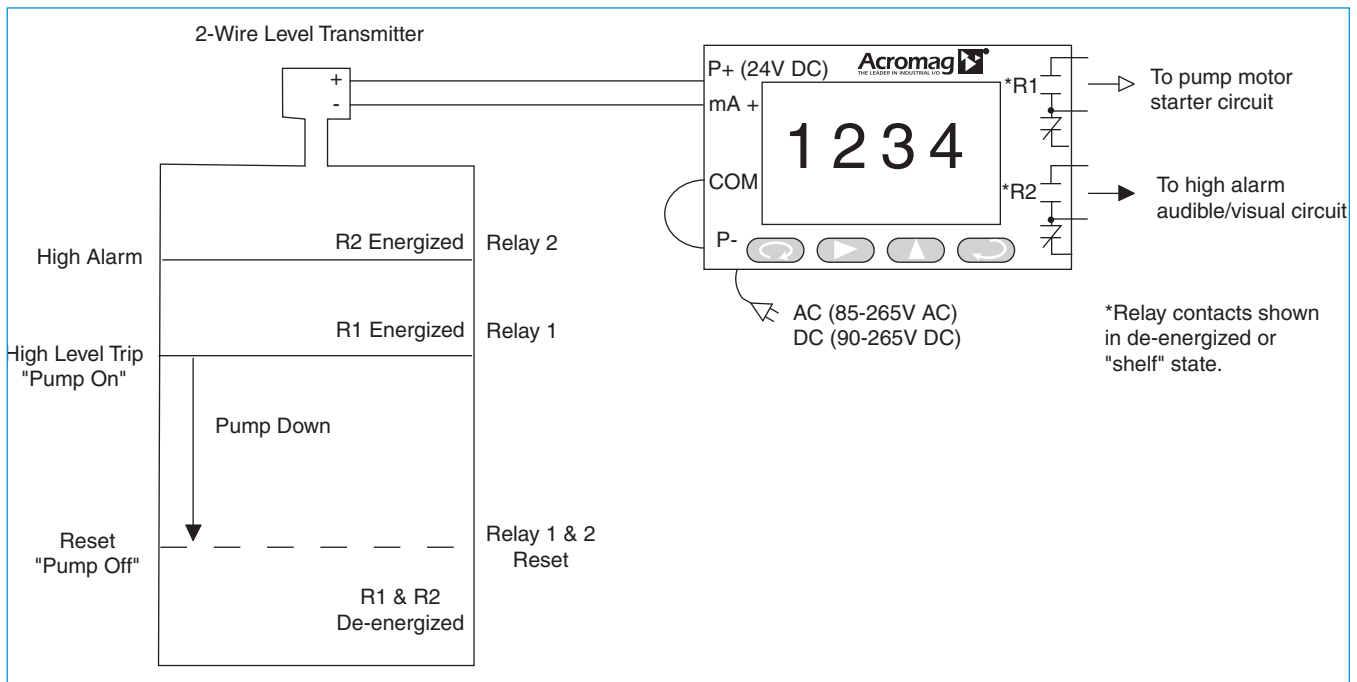


Application #1: Pump down with high alarm

Problem: Need to excite a 2-wire, 4-20mA continuous level sensor, and provide two relay outputs. One relay for pump down and one relay for high alarm with automatic or manual reset.

Solution

Model APM765-6R2-10 panel meter



APM Configuration & Set-up Example

Input: 4-20mA

Dec. Point: As needed (d.ddd, dd.dd, ddd.d, or dddd)

Relay 1 Action: Automatic reset

Relay 1 Setpoint: As needed (e.g.; 16mA)

Relay 1 Reset: As needed (e.g.; 8mA)

Relay 2 Action: Auto-manual reset

Relay 2 Setpoint: As needed (e.g.; 18mA)

Relay 2 Reset: As needed or same as relay 1

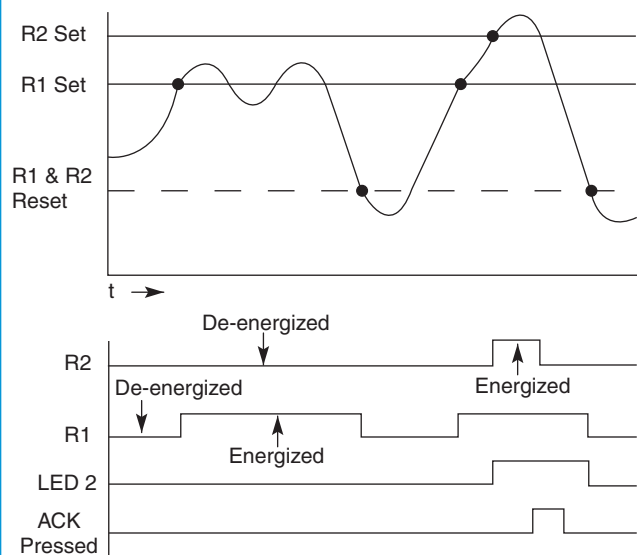
Failsafe Operation: None

Time Delay: None

Display Scale 1: 4mA = 0% (or as needed)

Display Scale 2: 20mA = 100% (or as needed)

Relay Operation Timing Diagrams





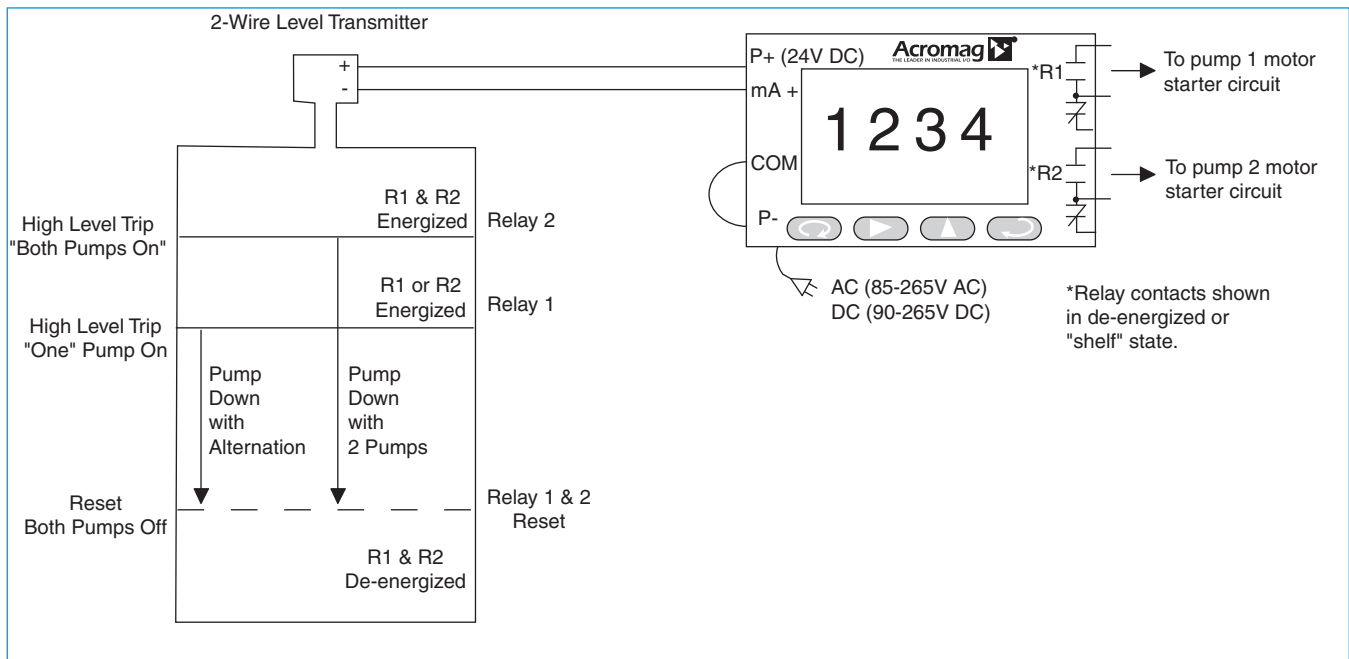
Application #2: Pump down w/duplex pump control

Problem: Need to excite a 2-wire, 4-20mA continuous level sensor, and provide two relay outputs for duplex pump control with alternation. Both pumps must be turned on if one can't handle the duty.

Solution

Model APM765-6R2-10 panel meter

For extra high/low alarm relays with built-in silence circuit (manual reset and acknowledge), use additional APM765-6R2-00 and wire in series with 4-20mA loop.



APM Configuration & Set-up Example

Input: 4-20mA

Dec. Point: As needed (d.ddd, dd.dd, ddd.d, or dddd)

Relay 1 Action: Alternate

Relay 1 Setpoint: As needed (e.g.; 16mA)

Relay 1 Reset: As needed (e.g.; 8mA)

Relay 2 Action: Alternate

Relay 2 Setpoint: Above relay 1 (e.g.; 18mA)

Relay 2 Reset: Same as relay 1

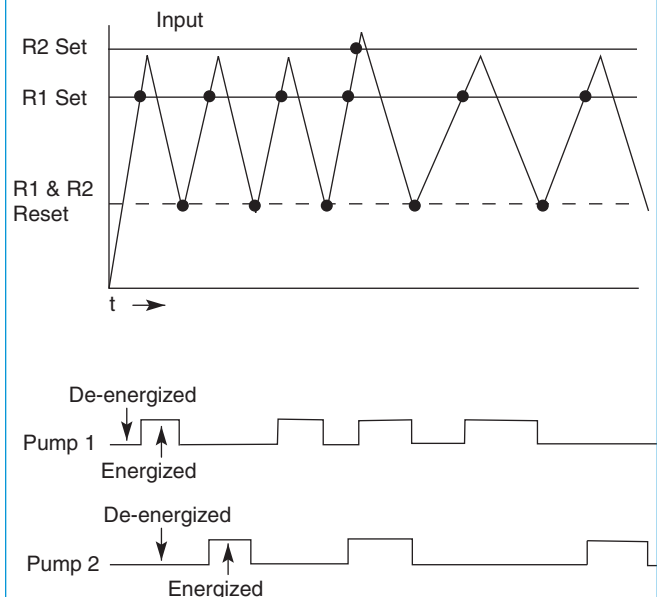
Failsafe Operation: None

Time Delay: None

Display Scale 1: 4mA = 0% (or as needed)

Display Scale 2: 20mA = 100% (or as needed)

Relay Operation Timing Diagrams



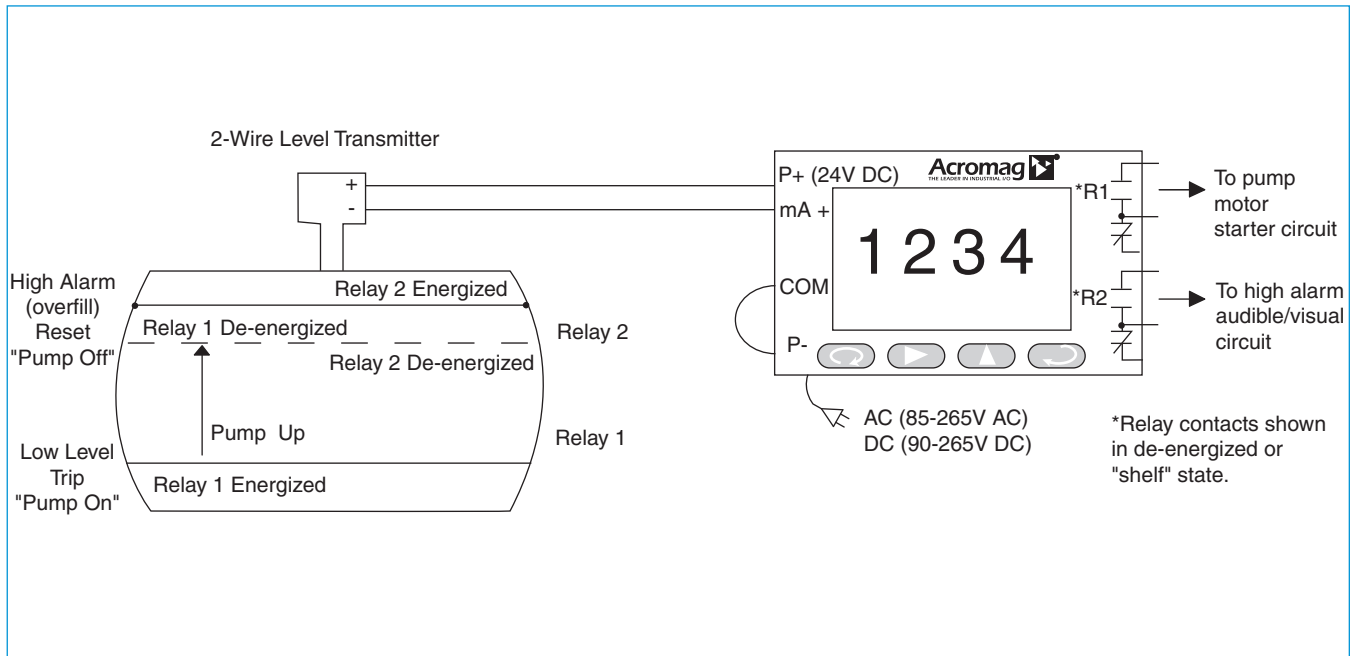


Application #3: Pump Up with overfill alarm

Problem: Need to excite a 2-wire, 4-20mA continuous level sensor, and provide two relay outputs. One relay is for pump control (filling) and the other relay is for high alarm (overfill) with automatic or manual reset.

Solution

Model APM765-6R2-10 panel meter



APM Configuration & Set-up Example

Input: 4-20mA

Dec. Point: As needed (d.ddd, dd.dd, ddd.d, or dddd)

Relay 1 Action: Automatic

Relay 1 Setpoint: As needed (e.g.; 6mA)

Relay 1 Reset: As needed (e.g.; 16mA)

Relay 2 Action: Auto manual

Relay 2 Setpoint: As needed (e.g.; 18mA)

Relay 2 Reset: As needed (e.g.; 16mA)

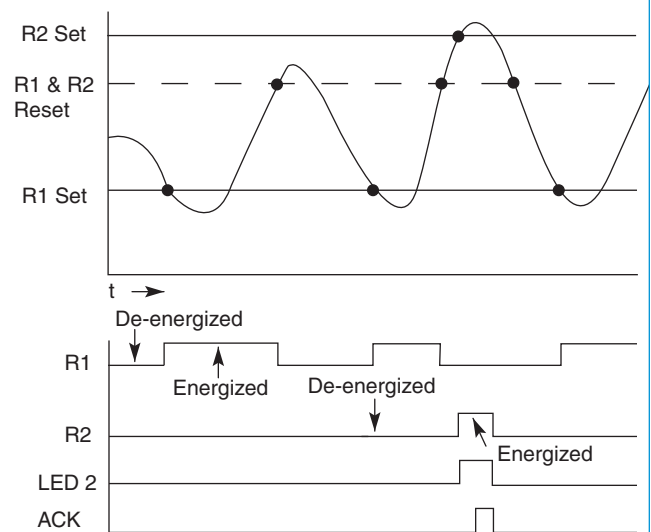
Failsafe Operation: None

Time Delay: None

Display Scale 1: 4mA = 0% (or as needed)

Display Scale 2: 20mA = 100% (or as needed)

Relay Operation Timing Diagrams





Intelligent Transmitters



Intelligent Alarms



Math/Computation



IntelliPack® Series

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	801T	811T	841T	851T	801A	811/812A	822A	832A	892/894M	895/896M
PRIMARY FUNCTIONS										
Isolated transmitter	X	X	X	X					X	X
Single channel alarm	X	X	X	X	X	X				
Dual channel alarm						X	X	X		
Dual channel math/computation									X	X
Quad channel math/computation									X	
POWER CONFIGURATION										
DC-powered	X	X	X	X	X	X	X	X	X	X
INPUTS										
DC voltage/current input		X				X			X	X
DC millivolt input	X			X	X		X			
Thermocouple input	X				X		X			
RTD input	X				X			X		
Resistance input	X				X			X		
Frequency input			X							
AC current input (requires external sensor)		X				X			X	X
Strain gauge/load cell				X						
OUTPUTS										
DC current	X	X	X	X					X	
DC voltage	X	X	X	X					X	
Frequency/pulse/pulse-width modulation										X
SPDT or SPST relay	X	X	X	X	X	X	X	X		X
DPDT relay					X	X				



Signal Conditioning



IntelliPack® Intelligent Transmitters, Alarms, and Math Modules

The IntelliPack series is a high-performance line of multi-function I/O modules. IntelliPack units feature universal input/output ranges and an intelligent microcontroller to provide extreme flexibility and powerful signal conditioning capabilities.

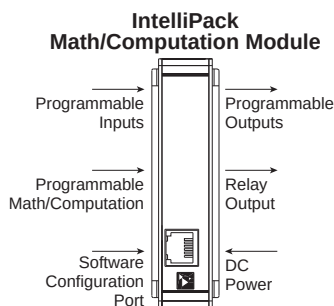
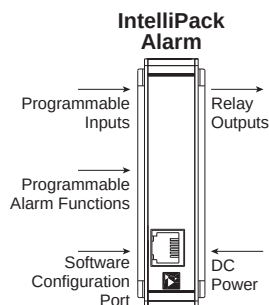
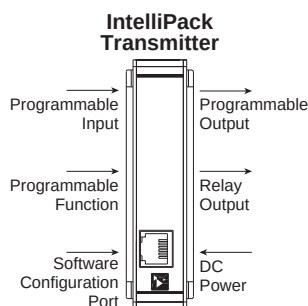
Since each IntelliPack module supports many I/O configurations, you can handle a broad range of applications with only a few models. Now you can reduce your spare inventory stock and still remain covered in an emergency.

Windows® 95/98/2000/ME/NT/XP® software helps you quickly configure IntelliPacks for your application. With just a few mouse clicks, you can select your desired input/output ranges and other operating parameters from a list of available options. And if your operating requirements change, a simple reconfiguration lets you adapt in a hurry with minimal downtime.

Once configured, IntelliPacks are very easy to adjust in the field with standard calibrators (no PC required). Front panel push buttons simplify changes to setpoints, deadbands, and zero/full-scale values. LEDs clearly indicate the status and mode of operation.

Special Features

- **Universal I/O ranges** cover a wide range of applications to reduce stock inventories.
- **Windows 95/98/2000/ME/NT/XP software** configuration simplifies IntelliPack module setup.
- **Push button field calibration** makes routine maintenance easy without a PC.
- **Internal microcontroller** provides intelligent signal processing capabilities.
- **Quick-disconnect terminals** facilitate installation and removal of I/O modules.
- **Field diagnostics** enhanced with software minimize downtime.



Transmitters(Page 86)

IntelliPack transmitter units convert sensor inputs to isolated process current or voltage output signals. Each unit accepts a variety of input and output ranges to support a broad range of applications. An optional relay output enables local alarms. Plus, the internal microcontroller can perform many signal processing and transfer functions.

Input

- Thermocouple/RTD/ohms/DC millivolts
- DC voltage/current
- Frequency/pulse counter
- AC current

Output

- Universal DC voltage/current
- SPDT relay

Functions

All functions are standard

- Signal linearizer
- Square root computation
- Signal average computation
- Pulse counting
- Limit alarm

Alarms(Page 100)

IntelliPack alarm units monitor sensor inputs and provide relay actuation if conditions exceed user-defined limits. An internal microcontroller provides signal processing and logic functions, normally found only in expensive controllers, for a variety of intelligent alarm functions. Dual relay units support two different alarm functions at the same time.

Inputs

- Thermocouple/RTD/ohms/DC millivolts
- DC voltage/current
- AC current

Outputs

- One DPDT relay or two SPDT relays

Functions

All functions are standard on every alarm unit.

- Limit and window (band-pass) alarm
- Deviation alarm
- Rate-of-change alarm
- On/off controller
- Peak/valley signal detection



Math Modules(Page 112)

IntelliPack math modules perform a variety of complex mathematical computations on up to four input signals and provide a DC or frequency output signal that represents the calculated result. Typical applications include calculating sums, deltas, averages, flow rates, volumes, and tracking minimum/maximum values. Equations are entered using a freeform format, the same as in most popular spreadsheet programs.

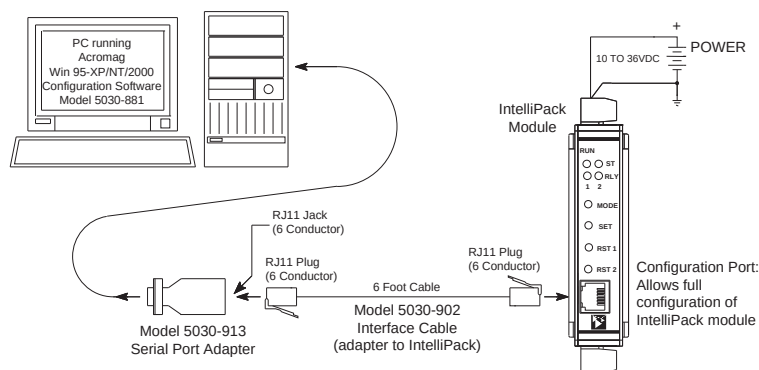
Input and Output Ranges

- Universal DC voltage/current
- Frequency, pulse, PWM outputs

Functions

- Add, subtract, multiply, divide
- Square root, exponential, logarithmic
- Absolute value, minimum/maximum
- High/low selector, track and hold
- Trigonometric (sine, cosine, tangent)
- Conditional arguments (if, then, and, or)

Configuration Diagram



After the initial software configuration, a PC is no longer required. Field calibration is easily handled with the IntelliPack's push-buttons, status LEDs and a standard field calibrator.

Fast Installation

- Step 1** Run configuration software offline to select desired operating parameters.
- Step 2** Print configuration or save to disk.
- Step 3** Connect PC to IntelliPack and download configuration data.
- Step 4** Disconnect PC and install IntelliPack module in the field.
- Step 5** Optional. Calibrate in field using push-buttons on front panel.

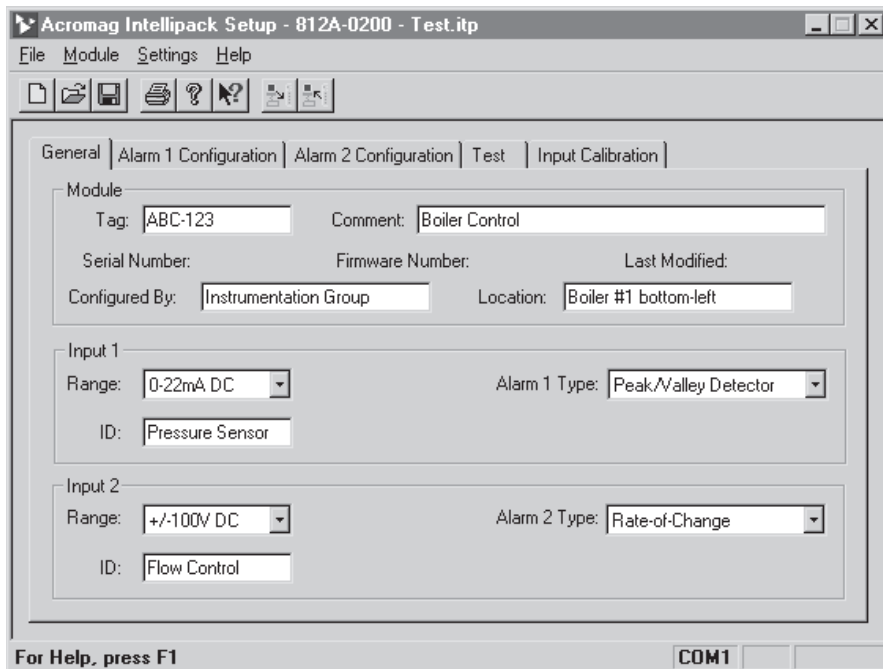
Easy Software Configuration

Acromag's configuration software is the key to the IntelliPack's easy-to-use operation. The software employs the friendly Windows 95/98/2000/ME/NT/XP interface with pull-down selection menus and fill-in-the-blank fields to speed you through a few brief configuration screens. No programming is required.

An adapter plugs into the serial port of your computer. It serves as an isolated interface between the IntelliPack and the PC. A cable with RJ11 phone-style plugs at each end links the adapter to the IntelliPack's serial port. The software, adapter, and cable are sold as a kit (Model 800C-SIP) for easy ordering.

Once connected, the software reads the IntelliPack's non-volatile memory to determine the unit type and loads the appropriate configuration form with several property pages. As you select the input range and alarm function on the general property page, the other pages are dynamically customized to speed you through the procedure. After you select the operating parameters, the configuration is downloaded and stored in the IntelliPack's memory. The configuration is also saved to a file for subsequent downloading to other modules or for quick modifications. This capability saves you valuable downtime and archives your settings.

After you complete the configuration, the software provides a detailed printout to document your application.



Typical software configuration screen. Data is uploaded from the IntelliPack module.

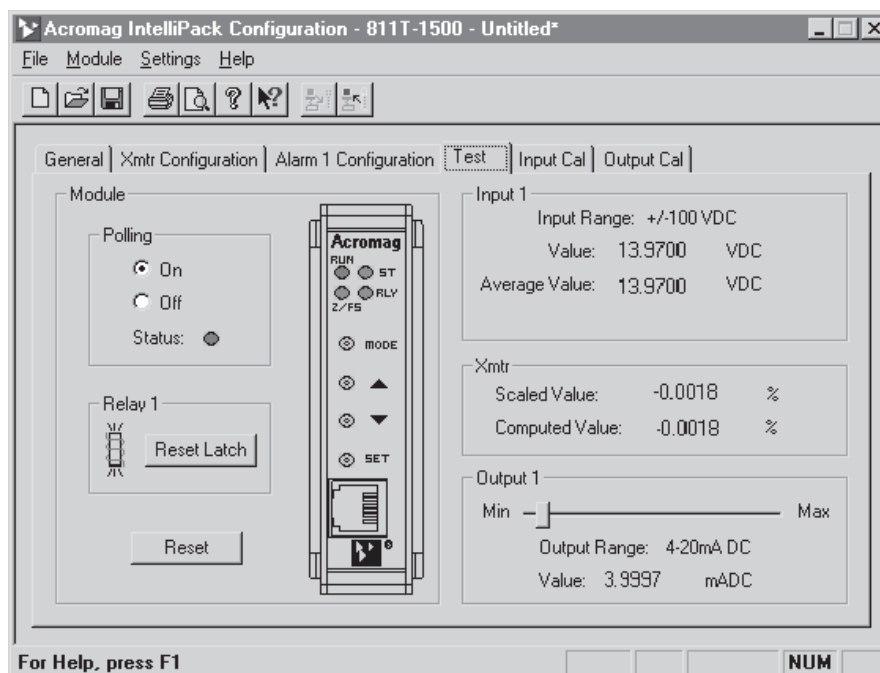


Software Diagnostics

The configuration software also shows you the current status of your IntelliPack module. A test screen (shown at right) indicates the current input signal value and the averaged value. The status of the relay and output signal are also displayed.

You can override the output for 10 seconds to verify the system is responding properly. The screen's IntelliPack diagram has representative LEDs to help you detect any bulb failures and verify proper operation.

On alarm modules, you can reset latched relays in software by clicking the screen's reset button with your mouse.



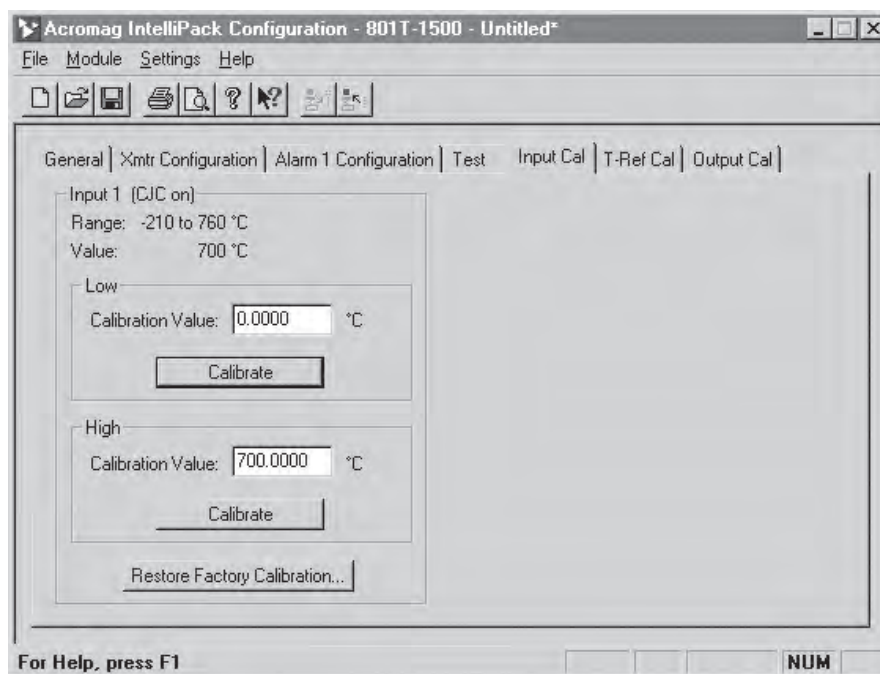
Quickly test or monitor your IntelliPack module with a software screen that displays all current values.

Software Calibration

The IntelliPack's configuration software makes calibrating your transmitters and alarms very easy. You can upload your IntelliPack's current calibration and quickly verify the settings or make changes on the input, output and thermocouple reference junction calibration property sheets.

The output calibration window has a slider control that you can drag with your mouse. This slider allows you to adjust the output current or voltage signal independent of the input signal.

If a unit is miscalibrated or you make a mistake, you can instantly restore the factory calibration settings. The original values are displayed on the screen.



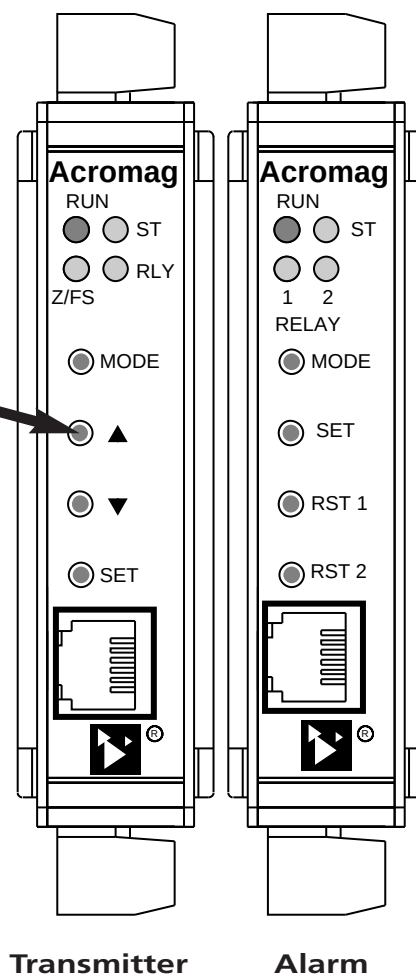
Easily set calibration values by simply typing in the values or restore original factory settings instantly.



Simple Push-Button Field Configuration

After the initial software configuration, key functions may be reprogrammed in the field without a PC. Push-buttons let you adjust the IntelliPack's setpoint, deadband, zero, and full scale signal values with conventional field calibrators. LEDs indicate the mode and guide you through a few short steps. Latched relays may also be reset in the field.

With IntelliPacks, zero and span adjustments are one-step operations. Unlike many potentiometer-based instruments, IntelliPack zero/span adjustments are independent and non-interactive. The internal micro-processor holds the zero setting constant while the span is adjusted for precise calibration in a single iteration.



The following tables describe push-button and LED functions for alarm and transmitter module types.

Push-Buttons (Alarms)

Mode: Push to enter field configuration mode.

Set: Accepts input data during field calibration.

RST 1: Resets a latched alarm for relay 1.

RST 2: Resets a latched alarm for relay 2.

Push-Buttons (Transmitters)

Mode: Push to enter field configuration mode.

Set: Accepts input data during field calibration.

▲: Calibrates (increases) the output signal.

▼: Calibrates (decreases) the output signal.

LED Indicators (Alarms)

Run (Green) - Indicates power applied.

Flashes when performing diagnostics.

ST (Yellow) - Status LED flashes to indicate input is out of range or a sensor break has been detected.

Relay 1 Alarm (Yellow) - Constant ON indicates alarm condition for relay 1.

Relay 2 Alarm (Yellow) - Constant ON indicates alarm condition for relay 2.

LED Indicators (Transmitters)

Run (Green) - Indicates power applied.

Flashes when performing diagnostics.

ST (Yellow) - Status LED flashes to indicate input is out of range or a sensor break has been detected.

Z/FS (Yellow) - Lights or flashes to indicate the input zero or full-scale value is being calibrated.

RLY (Yellow) - Lights to indicate alarm condition or relay setpoint adjustments are being made. Flashes for deadband adjustments.



Series 800 IntelliPack I/O Modules

Model 800C-SIP Configuration Software Interface Package



Configuration Software ♦ USB-to-RS232 Adapter ♦ RS232-to-RJ11 Adapter ♦ Interface Cable

Description

Acromag's configuration software is the key to the IntelliPack's easy-to-use operation. The software employs the friendly Windows® interface with pull-down selection menus and fill-in-the-blank fields to speed you through a few brief configuration screens. No programming is required.

An adapter plugs into the serial or USB port of your computer. It serves as an isolated interface between the IntelliPack and the PC. A cable with RJ11 phone-style plugs at each end links the adapter to the IntelliPack's serial port.

Software Compatibility

Windows 98, 2000, ME, NT, XP, Vista, 7.

Ordering Information

NOTE: For more information, visit www.acromag.com.

Models

800C-SIP

Software interface package includes user manual, CD, serial port adapter (5030-913), RJ11 interface cable (5030-902), and USB adapter (4001-095).

4001-095

USB-to-DB9 serial port (RS232) adapter.

5030-881

Configuration software CD-ROM.

5030-902

Cable. 6 feet long with RJ11 plug at each end.

5030-913

Serial port adapter. DB9S connector to RJ11 jack.

Connection Diagram

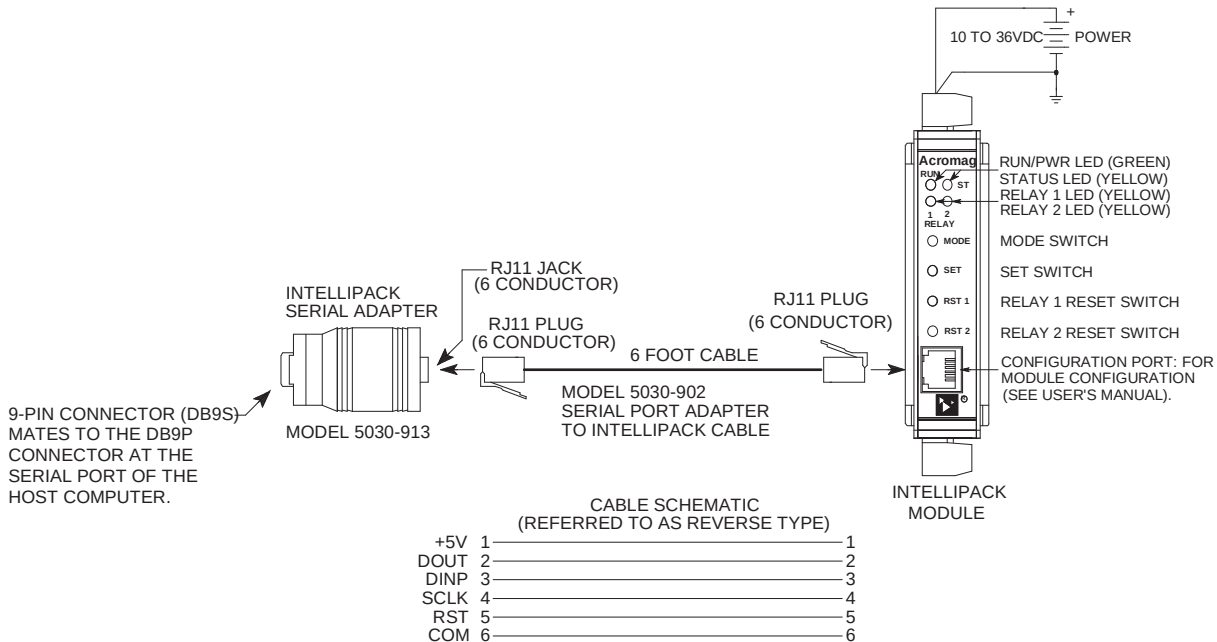
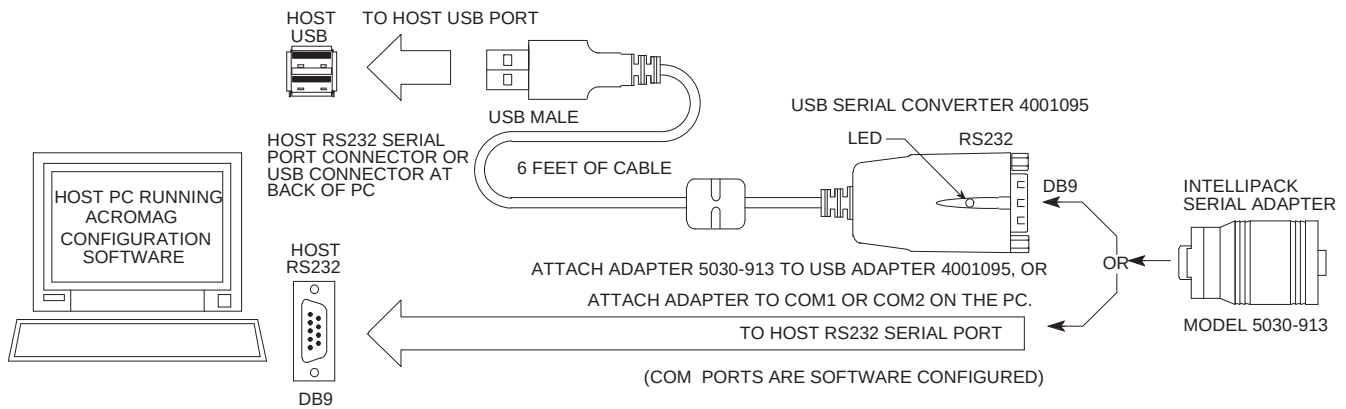
See following page.



Tel: 248-295-0880 ■ Fax: 248-624-9234 ■ sales@acromag.com ■ www.acromag.com ■ 30765 S Wixom Rd, Wixom, MI 48393 USA

Series 800 IntelliPack I/O Modules

INTELLIPACK-TO-COMPUTER CONNECTIONS





Transmitter w/alarm



800T Units

Models

801T: Universal temperature input (thermocouple, RTD, DC mV, and resistance)

811T: DC voltage/current input with optional AC current sensor

841T: Frequency/pulse counter input

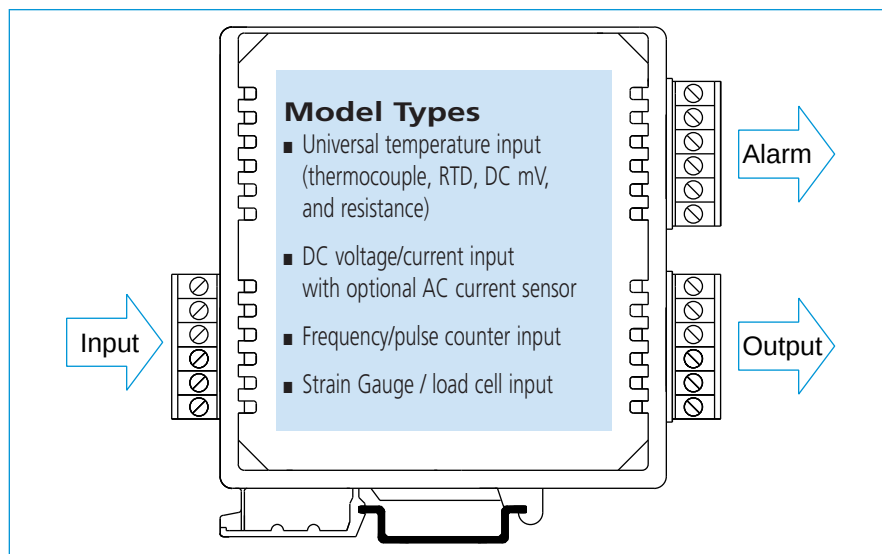
851T: Strain gauge / load cell input

IntelliPack transmitters isolate and convert sensor inputs to noise-free, proportional DC current or voltage output signals. An optional relay output adds a local limit alarm function.

Each unit offers a selection of input and output ranges, as well as several signal conditioning options. This flexibility enables a single IntelliPack to handle a broad range of applications. As your needs change, you can easily reconfigure the unit for different ranges or functions.

The internal microprocessor provides several computation functions. A linearizer function lets you linearize/characterize the input signal with custom break points. The averaging function outputs a signal that is proportional to the average of the previous "n" samples, where n is user-defined. IntelliPacks can also generate an output signal that is proportional to the square root of the input signal. Other functions are possible (consult factory).

Setup is very easy. IntelliPack modules are quickly configured with the user-friendly Windows software program. Field adjustments are simple with the module's front-panel push-buttons and status LEDs. Once configured, IntelliPacks operate independent of any host computer.



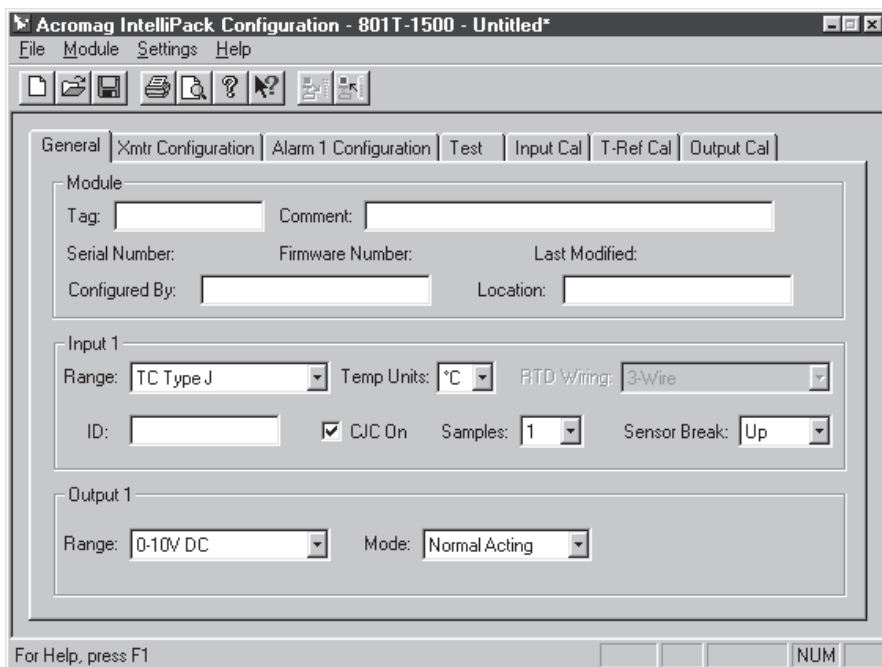
Special Features

General operation

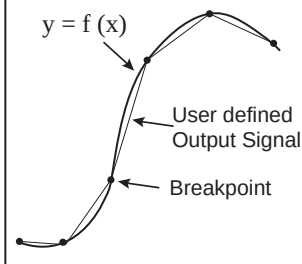
- Advanced microcontroller has integrated, downloadable flash memory and EEPROM for intelligent signal processing.
- Windows 95/98/ME/NT/XP/2000 software configuration speeds setup and replacement.
- Push-button reprogrammability facilitates changes in the field without a host PC.
- Plug-in terminal blocks make module installation and removal easy.
- Built-in self-diagnostic routines operate upon power-up and during operation for easy maintenance and troubleshooting.
- 4-way optical isolation separates input, output, power, and relay contacts from each other.
- EMC compliant. Ruggedized circuitry meets directives to provide increased transient immunity and low emissions.
- Wide ambient temperature range ensures reliable performance from -25 to 70°C.
- Wide DC supply range with diode-coupled reverse polarity protection is useful for redundant supplies and battery backup.

Transmitter Operation

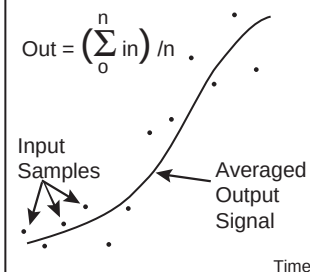
- Multi-purpose inputs accept many signal types to reduce spare stock requirements.
- User-programmable outputs let you select and change ranges to meet your needs (0-1mA, 0-20mA, 4-20mA, 0-5V, 0-10V DC).
- Intelligent signal processing functions perform mathematical computations on the input signal for customized outputs.
 - signal linearization (25 breakpoints)
 - average signal computation
 - square root computation
 - pulse counter (frequency input)
- High-resolution Sigma-Delta A/D converter delivers high accuracy with low noise.
- Relay output option provides local limit alarm capability in addition to the DC current/voltage output signal.
- High-power relays switch voltages up to 230V AC at currents up to 5A.
- User-programmable relay settings let you customize the alarm operation.
 - high or low limit setpoint
 - automatic or latching alarm reset
 - failsafe or non-failsafe operation
 - relay delay to filter transient signals
- Input excitation supply provides power for a two-wire transmitter or a relay input.



Signal Linearizing



Signal Averaging



After the initial software configuration, a PC is no longer required. Field calibration is easily handled with the IntelliPack's push-buttons, status LEDs and a standard field calibrator.

Intelligent Transfer Functions

IntelliPack transmitters support the signal processing functions listed below. The functions are easily selected via the configuration software. The next page shows sample screens for the following applications.

Signal Linearizing

IntelliPacks let you define a transfer function where the output is a function of an equation or a complex curve. The input signal is characterized using straight line approximation with a user-defined table of up to twenty-five breakpoints. Typical applications include linearizing analyzer output, flow rates, transducer non-linearities, tank characterization, and logarithmic equations.

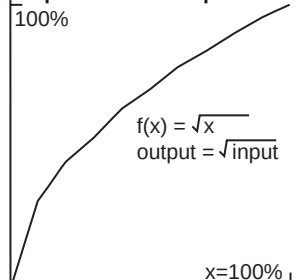
Signal Averaging

This function provides an output signal that is a run-time average of the input signal. Input data samples are taken every 100mS. The output is computed using a user-defined number of the previous "n" samples. Applications include temperature and level measurements subject to electrical transients, air currents, agitation, and vibration.

Square Root Computation

IntelliPacks can also output a signal that is proportional to the square root of the input signal. A common use involves flowmeters where the flow rate equals the square root of the measured differential pressure. In this case, the IntelliPack output is equivalent to a linear flow rate signal that is ideal for interfacing to a standard display device.

Square Root Computation





Software Configuration Examples

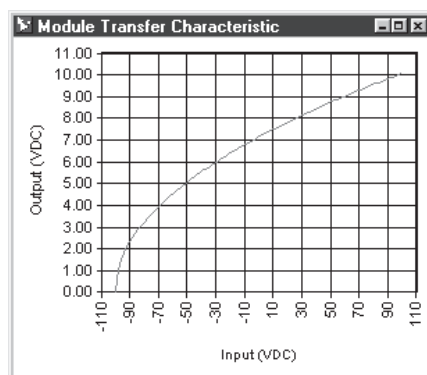
Square Root Computation

Linearizer/Characterizer

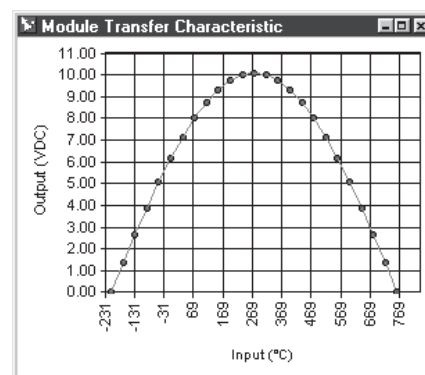
Proportional/Inverse

BP	Input %	Output %
1	0.000	0.000
2	4.167	13.053
3	8.333	25.882
4	12.500	38.267
5	16.667	50.000
6	20.833	60.876
7	25.000	70.711
8	29.167	79.335

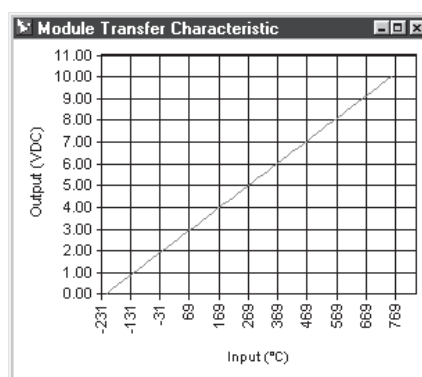
Transmitter configuration property sheet.



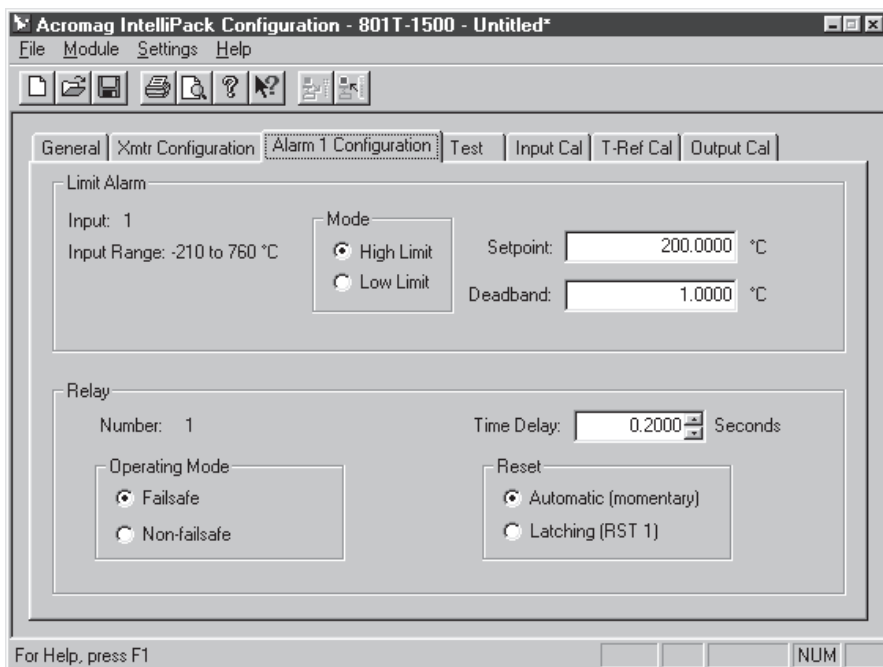
Square root transfer function graph.



Customizable linearizer transfer function graph.

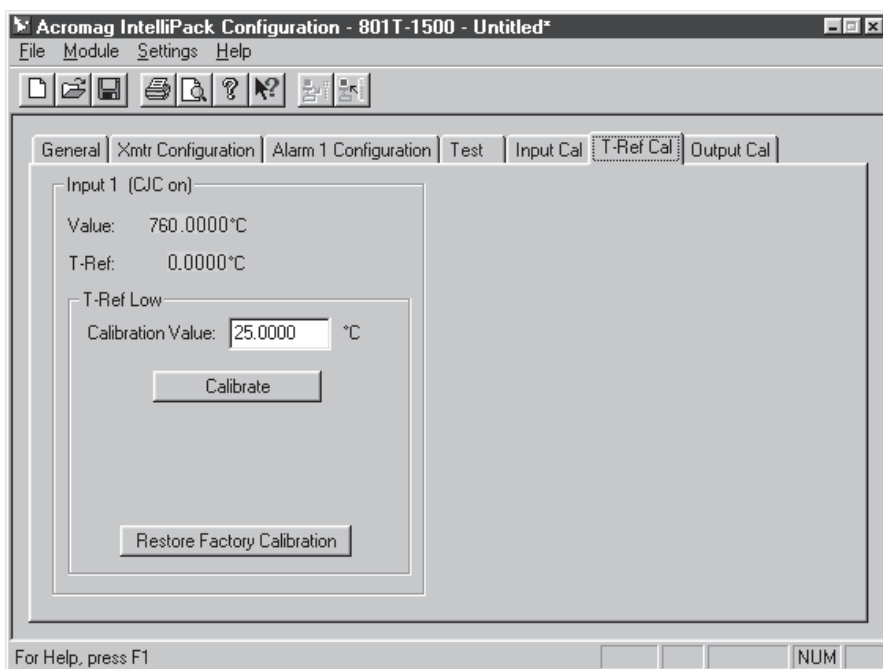


Proportional or inverse output graph.



Relay Output Limit Alarm Configuration

Limit alarm property sheet.

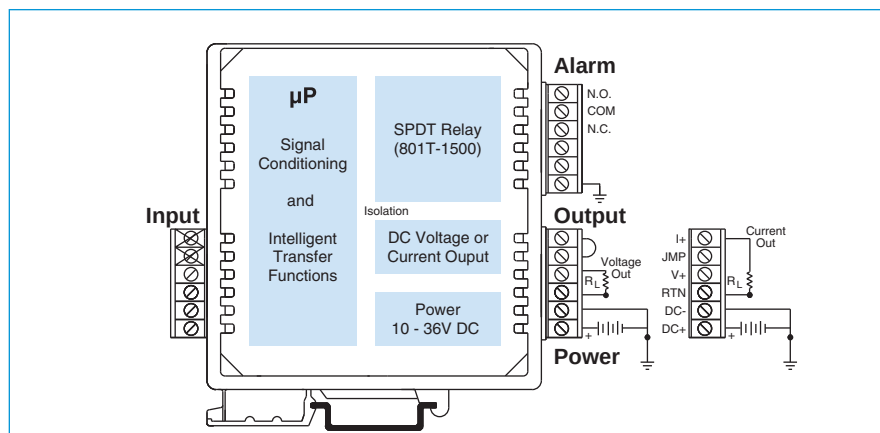


Thermocouple Reference Calibration

Thermocouple reference calibration property sheet.



Transmitter w/alarm



801T Transmitters

Thermocouple, RTD, Millivolt, and Resistance Input

Models

801T-0500: Universal temperature transmitter

801T-1500: Transmitter with limit alarm

Input Ranges

TC types: J, K, T, R, S, E, B, N

Millivolt: $\pm 15.625\text{mV}$ to $\pm 1.0\text{V DC}$

RTD: 100 ohm Pt, 120 ohm Ni, 10 ohm Cu

Resistance: 0 to 500 ohms

Output Ranges

0 to 1mA, 0 to 20mA, 4 to 20mA DC

0 to 5V, 0 to 10V DC

Limit Alarm

SPDT electro-mechanical relay (-1500 unit only)

Power Requirement

10 to 36V DC

Approvals

CE marked. UL, cUL listed.

Description

These transmitters isolate and convert sensor inputs to noise-free, proportional DC current or voltage output signals. An optional relay output adds a local limit alarm function.

Each unit offers a selection of input and output ranges, as well as several signal conditioning options. This flexibility enables a single IntelliPack to handle a broad range of applications. As your needs change, you can easily reconfigure the unit for different ranges or functions.

Setup is very easy. IntelliPack modules are quickly configured with the user-friendly Windows software program. Field adjustments are simple with the module's front-panel push-buttons and status LEDs. Once configured, IntelliPacks operate independent of any host computer.

Special Features

- High-resolution Sigma-Delta A/D converter delivers high accuracy with low noise.
- Advanced microcontroller provides intelligent signal processing power for linearization, averaging, and square root computations.
- Windows 95/98/ME/NT/XP/2000 software configuration speeds setup and replacement.
- Multi-purpose inputs and outputs reduce spare stock requirements.
- Relay output option provides local limit alarm capability.

Performance

General Input

Analog to Digital Converter (ADC)
16-bit $\Sigma\text{-}\Delta$ A/D converter.

Resolution

$\pm 0.005\%$ of span or 0.1°C .

Ambient Temperature Effect

Better than $\pm 0.005\%$ of input span per $^\circ\text{C}$ or $\pm 1\mu\text{V}$, whichever is greater.

Noise Rejection

Normal Mode: Better than 40dB @ 60Hz.

Common Mode: Better than 130dB @ 60Hz.

Input Response Time (for input step change)

Less than 200ms typical
to 98% of final output value.

Input Overvoltage Protection

Bipolar Transient Voltage Suppressors (TVS).

Thermocouple Input

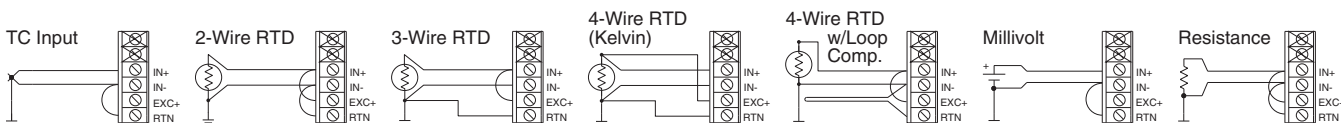
Thermocouple Input Ranges

Thermocouple type user configured. Signal linearization, cold-junction compensation, and open circuit or lead break detection are included.

TC	$^\circ\text{C}$ Range ($^\circ\text{F}$ Range)	Accuracy
J	-210 to 760°C (-346 to 1400°F)	$\pm 0.5^\circ\text{C}$
K	-200 to 1372°C (-328 to 2502°F)	$\pm 0.5^\circ\text{C}$
T	-260 to 400°C (-436 to 752°F)	$\pm 0.5^\circ\text{C}$
R	-50 to 1768°C (-58 to 3214°F)	$\pm 1.0^\circ\text{C}$
S	-50 to 1768°C (-58 to 3214°F)	$\pm 1.0^\circ\text{C}$
E	-200 to 1000°C (-328 to 1832°F)	$\pm 0.5^\circ\text{C}$
B	260 to 1820°C (500 to 3308°F)	$\pm 1.0^\circ\text{C}$
N	-230 to 1300°C (-382 to 2372°F)	$\pm 1.0^\circ\text{C}$

Thermocouple Break Detection

TC sensor failure can be configured for either upscale or downscale.





■ RTD Input

RTD Input Ranges

100 ohm Platinum, 120 ohm Nickel, or 10 ohm Copper; user-configured.

RTD	°C Range (°F Range)	Accuracy
Pt ¹	-200 to 850°C (-328 to 1562°F)	±0.25°C
Pt ²	-200 to 850°C (-328 to 1562°F)	±0.25°C
Ni	-80 to 320°C (-112 to 608°F)	±0.25°C
Cu	-200 to 260°C (-328 to 500°F)	±1.00°C

Alpha: Pt1 (a = 1.3850), Pt2 (a = 1.3911), Ni (a = 1.6720), Cu (a = 1.4272).

2, 3, or 4-wire configurations supported. Module provides sensor excitation, linearization, lead-wire compensation, and sensor break detection.

RTD Excitation Current

1mA DC typical, all types.

RTD Lead-Wire Compensation

25 ohms per lead.

RTD Break Detection

RTD sensor failure can be configured for either upscale or downscale.

■ Millivolt Input

DC Millivolt/Voltage Input Ranges

±1.0V	±125mV	±31.25mV
±500mV	±62.5mV	±15.625mV
±250mV		

Millivolt Accuracy

Better than ±0.05% of input span.

■ Resistance Input

Resistance Input Range

0 to 500 ohms.

Resistance Accuracy

±0.05 ohms.

■ Output (DC V/mA)

D/A Converter

16-bit Σ-Δ.

Current Output

Ranges: 0-1mA, 0-20mA, 4-20mA.

Compliance: 10V minimum (500 ohm load).

Accuracy: 0.025% of span.

Voltage Output

Ranges: 0-5V, 0-10V.

Compliance: 10mA maximum with short circuit protection. 1 ohm output impedance.

Accuracy: 0.025% of span.

Accuracy (overall input to output)

0.075% of span.

■ Output (Relay)

Relay

One SPDT electro-mechanical relay.

Relay Ratings (CSA ratings)

25V DC @ 5A.

120/240V AC @ 5A.

Relay Time Delay

Adjustable alarm delay of up to 25 seconds.

Contact Material

Silver-cadmium oxide (AgCdO).

Expected Mechanical Life

20 million operations.

■ Environmental

Ambient Temperature

Operating: -25 to 70°C (-13 to 158°F).

Storage: -40 to 85°C (-40 to 185°F).

Relative Humidity

5 to 95%.

Power Requirements

10 to 36V DC. 75mA @ 24V. 120mA @ 15V.

Isolation (optical)

4-way (input/output/relay/power).

1500V AC for 60 seconds or 250V AC continuous.

Radiated Field Immunity (RFI)

EN61000-4-3, EN50082-1.

Electromagnetic Field Immunity (EMI)

Less than ±0.25% of output span effect under the influence of electromagnetic fields from switching solenoids, commutator motors, and drill motors.

Electrical Fast Transient (EFT)

EN61000-4-4, EN50082-1.

Surge Withstanding Capability (SWC)

EN61000-4-5, EN50082-1.

Electrostatic Discharge (ESD)

EN61000-4-2, EN50082-1.

Radiated Emissions

EN50081-1 for Class B equipment.

Approvals

CE, UL listed (USA, Canada).

UL3121 - general product safety.

■ Configuration

Software Configuration

Units are fully programmable via the Windows 95/98/ME/2000/NT/XP IntelliPack Configuration Program. Configuration downloads from PC through EIA232 serial port using Acromag 800C-SIP kit.

Field Configuration

Output, zero/full-scale, relay setpoint and deadband are configurable via push-buttons and a standard calibrator.

LED Indicators

LEDs indicate power, status, calibration, and alarm.

■ Physical

Enclosure

Case: Self-extinguishing NYLON type 6.6 polyamide thermoplastic UL94 V-2 NEMA Type 1 enclosure.

Connectors (Removable Terminal Blocks)

Wire Range: AWG #14-22 (AWG #12 stranded only).

Printed Circuit Boards

Military grade FR-4 epoxy glass circuit board.

Dimensions

1.05W x 4.68H x 4.35D inches.

26.7W x 118.9H x 110.5D millimeters.

Shipping Weight

1 pound (0.45 Kg) packed.

■ Ordering Information

IMPORTANT: All IntelliPacks require initial software configuration (order 800C-SIP). See Note 1 below.

801T-0500

IntelliPack transmitter (TC/RTD/mV/resistance input).

801T-1500

Same as above, plus an SPDT relay output.

800C-SIP

Software Interface Package.

Only one kit is required for all IntelliPack models. See diagram on Page 83 for included parts.

5034-225

USB-to-RS232 adapter. See page 121 for more info.

PS5R-D24

Power supply (24V DC, 2.1A).

See Power Supplies on Page 199.

TBK-B01

Optional terminal block kit, barrier strip style, 2 pcs. (Does not include terminal block for input wiring.)

TBK-S01

Optional terminal block kit, spring clamp style, 2 pcs. (Does not include terminal block for input wiring.)

NOTE 1: To order factory configuration, call Acromag for a configuration form which must accompany your order. Also, append "-C" to model number (example: 801T-1500-C). 800C-SIP kit is still recommended.



Optional terminal blocks: barrier strip (left) and spring clamp (right). Cage clamp terminal is standard.



Transmitter w/alarm



811T Transmitters

DC Current, DC Voltage, and AC Current Input

Models

811T-0500: Universal DC input transmitter

811T-1500: Transmitter with limit alarm

Input Ranges

DC Current: 0 to 22mA

DC Voltage: $\pm 100V$ DC

AC Current: 0 to 20A AC (with external sensor)

Output Ranges

0 to 1mA, 0 to 20mA, 4 to 20mA DC

0 to 5V, 0 to 10V DC

Limit Alarm

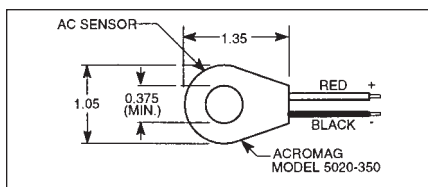
SPDT electro-mechanical relay (-1500 unit only)

Power Requirement

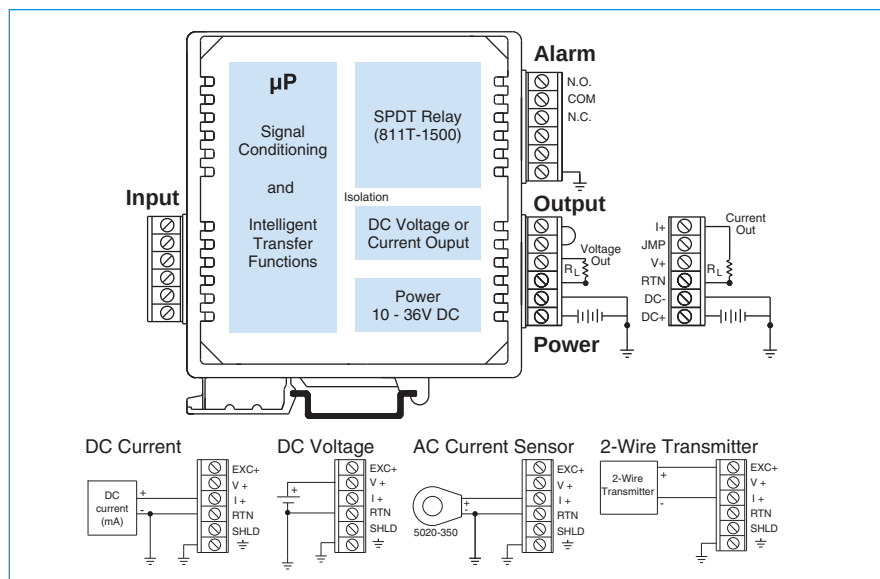
10 to 36V DC

Approvals

CE marked. UL, cUL listed.



AC Current Sensor Model 5020-350 (ordered separately)



Description

These transmitters isolate and convert sensor inputs to noise-free, proportional DC current or voltage output signals. An optional relay output adds a local limit alarm function.

Each unit offers a selection of input and output ranges, as well as several signal conditioning options. This flexibility enables a single IntelliPack to handle a broad range of applications. As your needs change, you can easily reconfigure the unit for different ranges or functions.

Setup is very easy. IntelliPack modules are quickly configured with the user-friendly Windows software program. Field adjustments are simple with the module's front-panel push-buttons and status LEDs. Once configured, IntelliPacks operate independent of any host computer.

Special Features

- High-resolution Sigma-Delta A/D converter delivers high accuracy with low noise.
- Advanced microcontroller provides intelligent signal processing power for linearization, averaging, and square root computations.
- Windows 95/98/ME/NT/XP/2000 software configuration speeds setup and replacement.
- Multi-purpose inputs and outputs reduce spare stock requirements.
- Relay output option provides local limit alarm capability.

Performance

General Input

Analogue to Digital Converter (ADC)
16-bit Σ - Δ A/D converter.

Ambient Temperature Effect

Better than $\pm 0.005\%$ of input span per $^{\circ}C$ or $\pm 1\mu V$, whichever is greater.

Noise Rejection

Normal Mode: Better than 40dB @ 60Hz.
Common Mode: Better than 100dB @ 60Hz.

Input Response Time (for input step change)

Less than 100ms typical
to 98% of final output value.

Input Overvoltage Protection

Bipolar Transient Voltage Suppressors (TVS).

DC Current Input

DC Current Input Range (100% rangeable)

Input Ranges	Resolution
0 to 22mA DC	757nA
0 to 5mA DC	189nA

DC Current Input Impedance

24.9 ohms.

Excitation Supply (for 2-wire instruments)

+15V DC at 24mA maximum.

DC Current Input Accuracy

Better than $\pm 0.05\%$ of input span.

continued on next page



■ DC Voltage Input

DC Voltage Input Ranges (100% rangeable)

Input Ranges	Resolution
±100V DC	3.77mV
±50V DC	1.88mV
±25V DC	942µV
±12V DC	471µV
±6V DC	236µV
±3V DC	118µV

Input impedance

Greater than 500K ohms.

DC Voltage Input Accuracy

Better than ±0.05% of input span.

■ AC Current Input

AC Current Input Range (optional)

An optional external AC current sensor is required to monitor AC current signals (Model 5020-350).

AC Current Range	Primary Turns
0 to 20A AC	1
0 to 10A AC	2
0 to 5A AC	4
0 to 2A AC	10
0 to 1A AC	20

AC Current Input Accuracy

Better than ±0.05% of input span.

■ Output (DC V/mA)

D/A Converter

16-bit Σ-Δ.

Current Output

Ranges: 0-1mA, 0-20mA, 4-20mA.

Compliance: 10V minimum (500Ω load).

Accuracy: 0.025% of span.

Voltage Output

Ranges: 0-5V, 0-10V.

Compliance: 10mA maximum with short circuit protection. 1Ω output impedance.

Accuracy: 0.025% of span.

Accuracy (overall input to output)

0.075% of span.

■ Output (Relay)

Relay

One SPDT electro-mechanical relay.

Relay Ratings (CSA ratings)

25V DC @ 5A.

120/240V AC @ 5A.

Relay Time Delay

Adjustable alarm delay of up to 25 seconds.

Contact Material

Silver-cadmium oxide (AgCdO).

Expected Mechanical Life

20 million operations.

■ Environmental

Ambient Temperature

Operating: -25 to 70°C (-13 to 158°F).

Storage: -40 to 85°C (-40 to 185°F).

Relative Humidity

5 to 95%.

Power Requirements

10 to 36V DC. 110mA @ 24V. 170mA @ 15V.

Isolation (optical)

4-way (input/output/relay/power).

1500V AC for 60 seconds or 250V AC continuous.

Radiated Field Immunity (RFI)

EN61000-4-3, EN50082-1.

Electromagnetic Field Immunity (EMI)

Less than ±0.25% of output span effect under the influence of electromagnetic fields from switching solenoids, commutator motors, and drill motors.

Electrical Fast Transient (EFT)

EN61000-4-4, EN50082-1.

Surge Withstanding Capability (SWC)

EN61000-4-5, EN50082-1.

Electrostatic Discharge (ESD)

EN61000-4-2, EN50082-1.

Radiated Emissions

EN50081-1 for Class B equipment.

Approvals

CE, UL listed (USA, Canada).

UL3121 - general product safety.

■ Configuration

Software Configuration

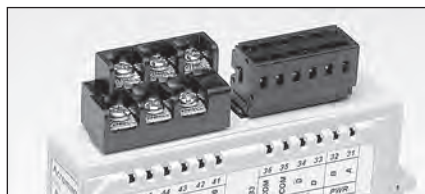
Units are fully programmable via the Windows 95/98/ME/2000/NT/XP IntelliPack Configuration Program. Configuration downloads from PC through EIA232 serial port using Acromag 800C-SIP kit.

Field Configuration

Output, zero/full-scale, relay setpoint and deadband are configurable via push-buttons and a standard calibrator.

LED Indicators

LEDs indicate power, status, calibration, and alarm.



Optional terminal blocks: barrier strip (left) and spring clamp (right). Cage clamp terminal is standard.

■ Physical

Enclosure

Case: Self-extinguishing NYLON type 6.6 polyamide thermoplastic UL94 V-2 NEMA Type 1 enclosure.

Connectors (Removable Terminal Blocks)

Wire Range: AWG #14-22 (AWG #12 stranded only).

Printed Circuit Boards

Military grade FR-4 epoxy glass circuit board.

Dimensions

1.05W x 4.68H x 4.35D inches.

26.7W x 118.9H x 110.5D millimeters.

Shipping Weight

1 pound (0.45 Kg) packed.

■ Ordering Information

IMPORTANT: All IntelliPacks require initial software configuration (order 800C-SIP).

See Note 1 below.

811T-0500

IntelliPack transmitter unit (DC voltage/current input).

811T-1500

Same as above, plus an SPDT relay output.

5020-350

AC current sensor. Required for AC current inputs.

See Page 205 for more information.

800C-SIP

Software Interface Package.

Only one kit is required for all IntelliPack models.

See diagram on Page 83 for included parts.

5034-225

USB-to-RS232 adapter. See page 121 for more info.

PS5R-D24

Power supply (24V DC, 2.1A).

See Power Supplies on Page 199.

TBK-B01

Optional terminal block kit, barrier strip style, 2 pcs. (For use with 811T-0500 model.)

TBK-B02

Optional terminal block kit, barrier strip style, 4 pcs. (For use with 811T-1500 model with alarm.)

TBK-S01

Optional terminal block kit, spring clamp style, 2 pcs. (For use with 811T-0500 model.)

TBK-S02

Optional terminal block kit, spring clamp style, 4 pcs. (For use with 811T-1500 model with alarm.)

NOTE 1: To order factory configuration, call Acromag for a configuration form which must accompany your order. Also, append "-C" to model number (example: 811T-1500-C). 800C-SIP kit is still recommended.



Transmitter w/alarm



841T Transmitters

Frequency, Pulse Counter Input

Models

841T-0500: Frequency input transmitter

841T-1500: Transmitter with limit alarm

Input Ranges

Sensor types: TTL, dry contact, open collector NPN/PNP, NAMUR, magnetic pickups, proximity

Frequency: 0 to 100Hz, 0 to 1KHz, 0 to 50KHz

Pulse: 0 to 65535 pulses

Output Ranges

0 to 1mA, 0 to 20mA, 4 to 20mA DC

0 to 5V, 0 to 10V DC

Limit Alarm

SPDT electro-mechanical relay (-1500 unit only)

Power Requirement

10 to 36V DC

Approvals

CE marked. UL, cUL listed.

Description

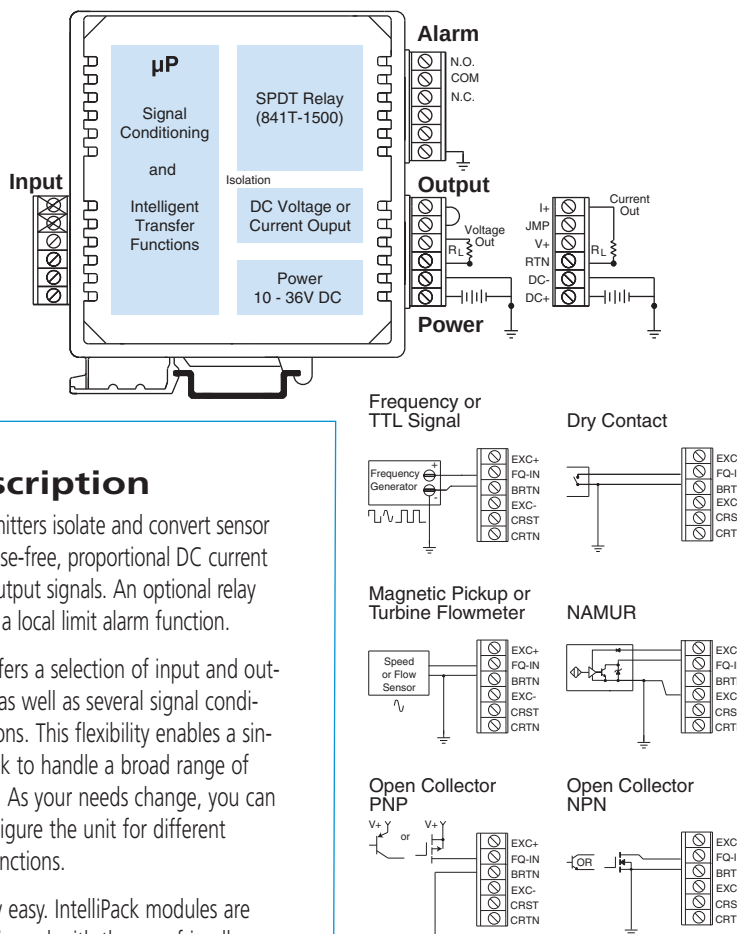
These transmitters isolate and convert sensor inputs to noise-free, proportional DC current or voltage output signals. An optional relay output adds a local limit alarm function.

Each unit offers a selection of input and output ranges, as well as several signal conditioning options. This flexibility enables a single IntelliPack to handle a broad range of applications. As your needs change, you can easily reconfigure the unit for different ranges or functions.

Setup is very easy. IntelliPack modules are quickly configured with the user-friendly Windows software program. Field adjustments are simple with the module's front-panel push-buttons and status LEDs. Once configured, IntelliPacks operate independent of any host computer.

Special Features

- High-resolution Sigma-Delta A/D converter delivers high accuracy with low noise.
- Advanced microcontroller provides intelligent signal processing power for linearization, averaging, and square root computations.
- Windows 95/98/ME/NT/XP/2000 software configuration speeds setup and replacement.
- Multi-purpose inputs and outputs reduce spare stock requirements.
- Relay output option provides local limit alarm capability.



Performance

General Input

Resolution

Input Range	Resolution
0 to 100Hz	0.01Hz
0 to 1000Hz	0.1Hz
0 to 50,000Hz	1Hz
0 to 65,535 pulses	1 pulse

Noise Rejection

Common Mode: Better than 80dB @ 60Hz.

Input Response Time (for input step change)
-3dB @ 35KHz.

Input Overvoltage Protection

Bipolar Transient Voltage Suppressors (TVS).

Continued on next page.



■ Performance

■ Frequency Input

Input Types

TTL, dry contact, open collector NPN/PNP, NAMUR, magnetic pickups, proximity sensors.

Frequency Ranges

0 to 100Hz
0 to 1000Hz
0 to 50,000Hz.

Pulse Counter Input Range

0 to 65535 pulses.

Minimum Input Pulse Width

Frequency inputs: 10µs.
Pulse counting inputs: 5ms.

Voltage Ranges

Unipolar: 0 to 100V DC.
Bipolar: ±50mV to ±100V peak.

Zero/Full Scale Adjustment

Zero and span: 100% full range adjustment.
Pulse counting: Up to 65535 spans within range.

Input Threshold/Hysteresis

Bipolar:
Threshold: 0.01V, typical.
Hysteresis: ±25mV or ±83mV.

Unipolar:

Threshold: 1.5V or 5V.
Hysteresis: ±25mV or ±83mV

Input Debounce (Event Counter)

0 to 1000ms (configurable in 5ms increments).

Frequency Excitation Supply

Selectable, +8.2V or +12V @ 15mA.

Input Impedance

35K ohms, typical.

Accuracy

Input Range	Accuracy
0 to 100Hz	±0.04Hz
0 to 1000Hz	±0.4Hz
0 to 50,000Hz	±10Hz
0 to 65,535 pulses	±1 pulse

■ Output (DC V/mA)

D/A Converter

16-bit Σ-Δ.

Current Output

Ranges: 0-1mA, 0-20mA, 4-20mA.
Compliance: 10V minimum (500Ω load).
Accuracy: 0.025% of span.

Voltage Output

Ranges: 0-5V, 0-10V.
Compliance: 10mA maximum with short circuit protection. 1 ohm output impedance.
Accuracy: 0.025% of span.

Accuracy (overall input to output)

0.075% of span.

■ Output (Relay)

Relay

One SPDT electro-mechanical relay.

Relay Ratings (CSA ratings)

25V DC @ 5A.
120/240V AC @ 5A.

Relay Time Delay

Adjustable alarm delay of up to 25 seconds.

Contact Material

Silver-cadmium oxide (AgCdO).

Expected Mechanical Life

20 million operations.

■ Environmental

Ambient Temperature

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

Relative Humidity

5 to 95%.

Power Requirements

10 to 36V DC. 100mA @ 24V. 160mA @ 15V.

Isolation (optical)

4-way (input/output/relay/power).
1500V AC for 60 seconds or 250V AC continuous.

Radiated Field Immunity (RFI)

EN61000-4-3, EN50082-1.

Electromagnetic Field Immunity (EMI)

Less than ±0.25% of output span effect under the influence of electromagnetic fields from switching solenoids, commutator motors, and drill motors.

Electrical Fast Transient (EFT)

EN61000-4-4, EN50082-1.

Surge Withstanding Capability (SWC)

EN61000-4-5, EN50082-1.

Electrostatic Discharge (ESD)

EN61000-4-2, EN50082-1.

Radiated Emissions

EN50081-1 for Class B equipment.

Approvals

CE, UL listed (USA, Canada).
UL3121 - general product safety.

■ Configuration

Software Configuration

Units are fully programmable via the Windows 95/98/ME/2000/NT/XP IntelliPack Configuration Program. Configuration downloads from PC through EIA232 serial port using Acromag 800C-SIP kit.

Field Configuration

Output, zero/full-scale, relay setpoint and deadband are configurable via push-buttons and a standard calibrator.

LED Indicators

LEDs indicate power, status, calibration, and alarm.

■ Physical

Enclosure

Case: Thermoplastic UL94 V-2 NEMA Type 1 enclosure.

Connectors (Removable Terminal Blocks)

Wire Range: AWG #14-22 (AWG #12 stranded only).

Printed Circuit Boards

Military grade FR-4 epoxy glass circuit board.

Dimensions and Shipping Weight

1.05W x 4.68H x 4.35D in. (26.7 x 118.9 x 110.5 mm)
1 pound (0.45 Kg) packed.

■ Ordering Information

IMPORTANT: All IntelliPacks require initial software configuration (order 800C-SIP).

See Note 1 below.

841T-0500

IntelliPack transmitter unit (freq/pulse counter input).

841T-1500

Same as above, plus an SPDT relay output.

800C-SIP

Software Interface Package.
Only one kit is required for all IntelliPack models.
See diagram on Page 83 for included parts.

5034-225

USB-to-RS232 adapter. See page 121 for more info.

PS5R-D24

Power supply (24V DC, 2.1A).
See Power Supplies on Page 199.

TBK-B01

Optional terminal block kit, barrier strip style, 2 pcs.
(For use with 841T-0500 model.)

TBK-B02

Optional terminal block kit, barrier strip style, 4 pcs.
(For use with 841T-1500 model with alarm.)

TBK-S01

Optional terminal block kit, spring clamp style, 2 pcs.
(For use with 841T-0500 model.)

TBK-S02

Optional terminal block kit, spring clamp style, 4 pcs.
(For use with 841T-1500 model with alarm.)

NOTE 1: To order factory configuration, call Acromag for a configuration form which must accompany your order. Also, append "-C" to model number (example: 841T-1500-C). 800C-SIP kit is still recommended.



Optional terminal blocks: barrier strip (left) and spring clamp (right). Cage clamp terminal is standard.



Bridge Interface



851T Transmitters

Strain Gauge, Load Cell Input

Input

Sensor types

Load cells (4- or 6-wire configurations),
Strain gauges (full-, half-, or quarter-bridge),
Millivolt

Bridge/gauge resistance

Supports 85 ohms or greater with 10V excitation

Input sensitivity

Accepts load cell and strain gauge rated outputs
up to 10mV/V DC

Internal excitation

Adjustable from 4 to 11V DC, 120mA max.

Output

Universal output

0 to 20mA (user-configured ranges),
0 to 10V DC (user-configured ranges),

Relay Output (optional)

5A SPDT dry contact relay

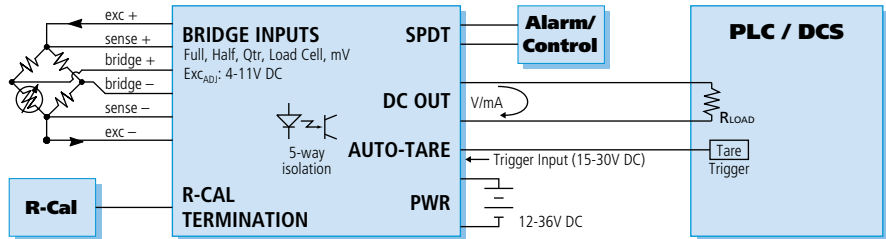
Power Requirement

12 to 36V DC

Approvals

CE marked. UL, cUL listed.

Strain Gauge / Load Cell Transmitter with Alarm



Description

IntelliPack strain gauge and load cell transmitters offer many powerful features beyond the limited capabilities found in typical bridge amplifiers. 851T models accept signals from sensors wired in a Wheatstone bridge configuration. Common uses include measurement of force, weight, level, torque, acceleration, pressure, and vibration.

The transmitter's input circuit allows true 6-wire bridge measurement and includes an adjustable bridge excitation supply (4 to 11V DC) with a remote sense feature. Sense wires ensure the programmed excitation voltage is applied at the sensor and enable lead-wire compensation. The differential input performs true ratiometric conversions for extremely stable measurements that remain accurate over time and temperature. Plus, lead break detection is inherent in the device.

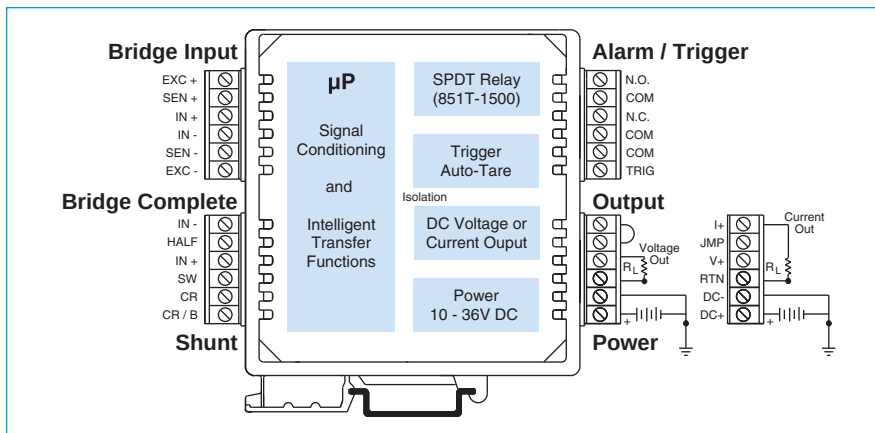
IntelliPack configuration software simplifies setup for use with basic load cells, millivolt inputs, or seven bridge sensor formats. Internal bridge completion resistors are supplied for half and quarter bridges. The software also downloads sensor parameters such as gauge factor and Poisson's ratio into the transmitter for internal calculation of complex equations to determine sensor strain (ϵ). The strain is then converted to a representative process signal output.

Screw terminals enable a remote "auto-tare" function to compensate for non-zero dead weights and other sensor offsets (e.g. container weight or bridge imbalances). Alternatively, these same screw terminals may be used to reset latched relay alarms.

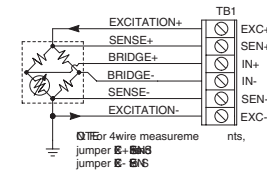
All these powerful features combined with Acromag's user-friendly configuration software, make the 851T a versatile device that's easy to use and maintain. Plus, a rugged, compact design makes it ideal for use out in the field, on the plant floor, or inside a laboratory.

Special Features

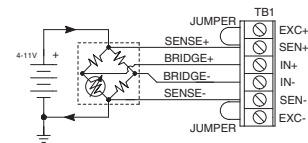
- Intelligent signal processing functions perform math computations for custom output:
 - strain (ϵ) calculations
 - signal linearization (25 breakpoints)
 - average signal computation
- Relay output option provides local limit alarm capability in addition to the DC output
- Adjustable bridge excitation supports a wide variety of sensor types
- An internal bridge completion function (half-to-full and quarter-to-full) accommodates a broad range of applications
- Remote auto-tare function compensates for extraneous loads and corrects for imbalances in the input bridge
- High-resolution Sigma-Delta A/D converter delivers high accuracy with low noise.
- Windows 95/98/ME/NT/XP/2000 software configuration speeds setup and replacement.



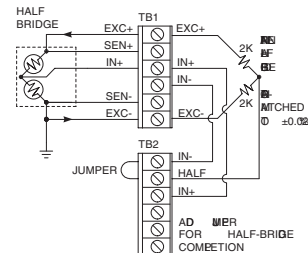
FULL-BRIDGE INPUT (INTERNAL EXCITATION)



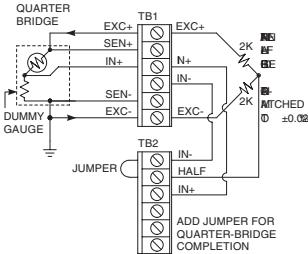
FULL-BRIDGE INPUT (EXTERNAL EXCITATION)



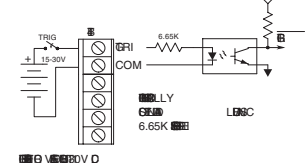
HALF-BRIDGE INPUT



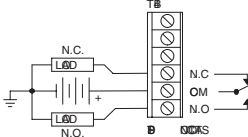
QUARTER-BRIDGE INPUT



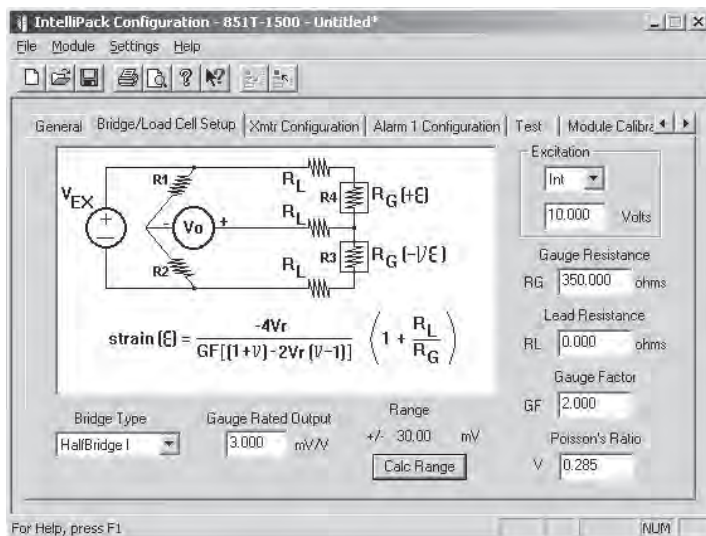
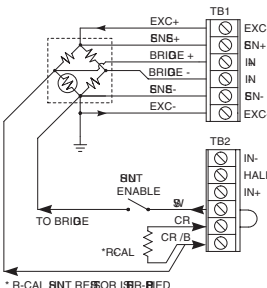
DIGITAL INPUT "TRIGGER" (AUTO-TARE/RELAY RESET)



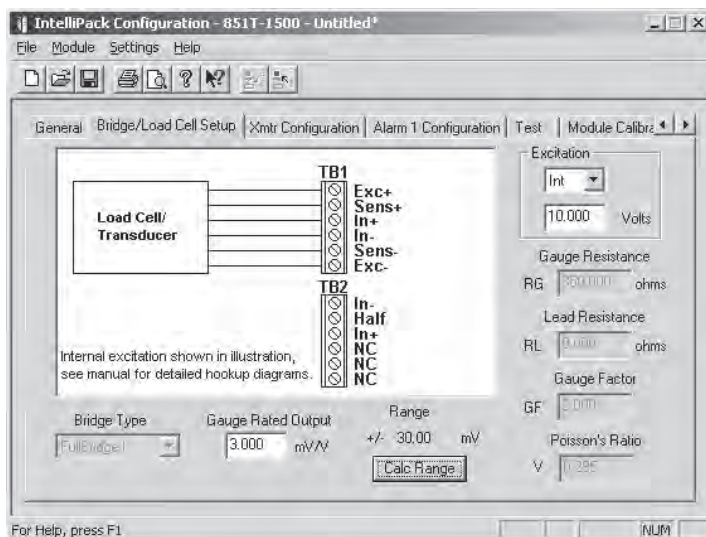
RELAY OUTPUT



SHUNT CALIBRATION (R-CAL)



Complex strain (ϵ) calculations are easily configured and computed for full, half, and quarter-bridge sensors.



The configuration software makes it easy to set up the transmitter for use with basic load cell sensor devices. Common input sources include pressure transducers, torque converters, and vibration sensors.



851T Transmitters

■ Performance

■ General Input

Analog to Digital Converter (ADC)

16-bit Σ - Δ A/D converter.

Resolution

$\pm 0.01\%$ of span.

Input Reference Test Conditions

120 ohm full bridge; Excitation = 10V; Rated Output = 3mV/V; Range = ± 30 mV; Ambient Temperature = 25°C; Power Supply = 24V DC; Alarm Delay = 100ms.

Accuracy (overall input to output)

Better than $\pm 0.1\%$ of span, typical.
This value does not include sensor errors.

Ambient Temperature Effect

Better than $\pm 0.01\%$ of input span per °C (± 100 ppm/°C), or ± 1.0 uV/°C, whichever is greater.

Response Time (for input step change)

250ms to 98% of final output value (into 500 ohms).

Input Overvoltage Protection

Bipolar Transient Voltage Suppressors (TVS).

■ Bridge Input

Input Types

Select from basic load cell, two quarter-bridge options, two half-bridge options, three full-bridge options, or millivolts.

Input Span/Range

Bipolar input range is determined from the $\pm$ product of the gauge's rated output and the nominal excitation selection (2mV/V x 10V = ± 20 mV range).

Input Over-range

The actual input range is $\pm 150\%$ typical of the range obtained via the $\pm$ product of the gauge's rated output and the nominal excitation applied.

Input Sensitivity

Accepts gauge rated outputs up to 10mV/V. The range of your input signal is the product of the excitation voltage and your gauge's rated output.

Input Impedance

± 1 N at 1M ohms min.; ± 5 EN at 29.09K ohms, typical.

Input Lead Resistance

Module has sufficient overdrive to guarantee 10V bridge excitation with 5 ohms/lead and 100mA of internal excitation current. Larger lead resistances may limit the maximum achievable bridge excitation.

Input Lead Break Detection

Sensor failure detection is upscale only.

Input Bridge Excitation (Internal)

Adjustable from 4V to 11V, 120mA maximum. Internal excitation may be turned OFF for external excitation supply connection.

Input Bridge Excitation (External)

4V to 11V. The internal excitation must be turned OFF for connection to an external excitation supply.

■ Digital (Trigger) Input

Input Type

"Active High" input.
15-30V DC (6.65K ohms).
See connection diagram.

Operation (Tare/Alarm Modes)

The trigger function is set for "Auto-Tare" mode by default. This input can also be configured to reset latched alarms via the Configuration Software.

■ Output (DC V/mA)

D/A Converter

16-bit Σ - Δ .

Current Output

Ranges: 0-1mA, 0-20mA, 4-20mA.
Compliance: 10V minimum (500 ohm load).

Voltage Output

Ranges: 0-5V, 0-10V.
Compliance: 10mA maximum with short circuit protection. 1 ohm output impedance.

■ Output (Relay)

Relay

One SPDT, Form C, dry contact relay.

Relay Ratings (CSA ratings)

25V DC @ 5A, resistive load.
120/240V AC @ 5A, resistive load.

Relay Time Delay

Adjustable alarm delay of up to 25 seconds.

Relay Response (No Relay Time Delay)

Relay contacts switch within 580ms typical, for an input step change from 10% of span on one side of an alarm point to 5% of span on the other side of the alarm point.

Initial Dielectric Strength

1000V AC rms between open contacts.

Contact Material

Silver-cadmium oxide (AgCdO).

Expected Mechanical Life

20 million operations.

Performance specifications continued on next page.



■ Environmental

Ambient Temperature

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

Relative Humidity

5 to 95%.

Power Requirements

12 to 36V DC. 11V DC minimum.
175mA @ 24V. 290mA @ 15V.

Isolation (optical)

5-way (input/output/relays/trigger/power).
Input, analog output, trigger, and power circuits are isolated from each other for up to 1500V AC for 60 seconds or 250V AC continuous. Optional relay outputs are isolated from other circuits up to 150V AC, or 150V DC.

Radiated Field Immunity (RFI)

EN61000-4-3, EN50082-1.

Electromagnetic Field Immunity (EMI)

Less than $\pm 0.25\%$ of output span effect under the influence of electromagnetic fields from switching solenoids, commutator motors, and drill motors.

Electrical Fast Transient (EFT)

EN61000-4-4, EN50082-1.

Surge Withstanding Capability (SWC)

EN61000-4-5, EN50082-1.

Electrostatic Discharge (ESD)

EN61000-4-2, EN50082-1.

Radiated Emissions

EN50081-1 for Class B equipment.

Approvals

CE, UL listed (USA, Canada).
UL3121 - general product safety.

■ Configuration

Software Configuration

Units are fully programmable via the Windows 95/98/ME/2000/NT/XP IntelliPack Configuration Program. Configuration downloads from PC through EIA232 serial port using Acromag 800C-SIP kit.

Field Configuration

Output, zero/full-scale, relay setpoint and deadband are configurable via push-buttons and a standard calibrator.

LED Indicators

LEDs indicate power, status, calibration, and alarm.

■ Physical

Enclosure

Case: Self-extinguishing NYLON type 6.6 polyamide thermoplastic UL94 V-2 NEMA Type 1 enclosure.

Connectors (Removable Terminal Blocks)

Wire Range: AWG #14-22 (AWG #12 stranded only).

Printed Circuit Boards

Military grade FR-4 epoxy glass circuit board.

Dimensions

1.05W x 4.68H x 4.35D inches.
26.7W x 118.9H x 110.5D millimeters.

Shipping Weight

1 pound (0.45 Kg) packed.

■ Ordering Information

IMPORTANT: All IntelliPacks require initial software configuration (order 800C-SIP).
See Note 1 below.

851T-0500

IntelliPack transmitter unit, strain gauge input

851T-1500

Same as above, plus an SPDT relay output.

800C-SIP

Software Interface Package.

Only one kit is required for all IntelliPack models.
See diagram on Page 83 for included parts.

5034-225

USB-to-RS232 adapter. See page 121 for more info.

PS5R-D24

Power supply (24V DC, 2.1A).
See Power Supplies on Page 199.

TBK-B02

Optional terminal block kit, barrier strip style, 4 pcs.

TBK-S02

Optional terminal block kit, spring clamp style, 4 pcs.

NOTE 1: To order factory configuration, call Acromag for a configuration form which must accompany your order. Also, append "-C" to model number (example: 851T-1500-C). 800C-SIP kit is still recommended.



Optional terminal blocks: barrier strip (left) and spring clamp (right). Cage clamp terminal is standard.



Intelligent Alarms



800A Units

Single input models

801A: Universal temperature input (thermocouple, RTD, or DC millivolts); One DPDT relay or two SPDT relays

811A: DC voltage/current* input; One DPDT relay or two SPDT relays

Dual input models

812A: DC voltage/current* inputs; Two SPDT relays

822A: Thermocouple inputs; Two SPDT relays

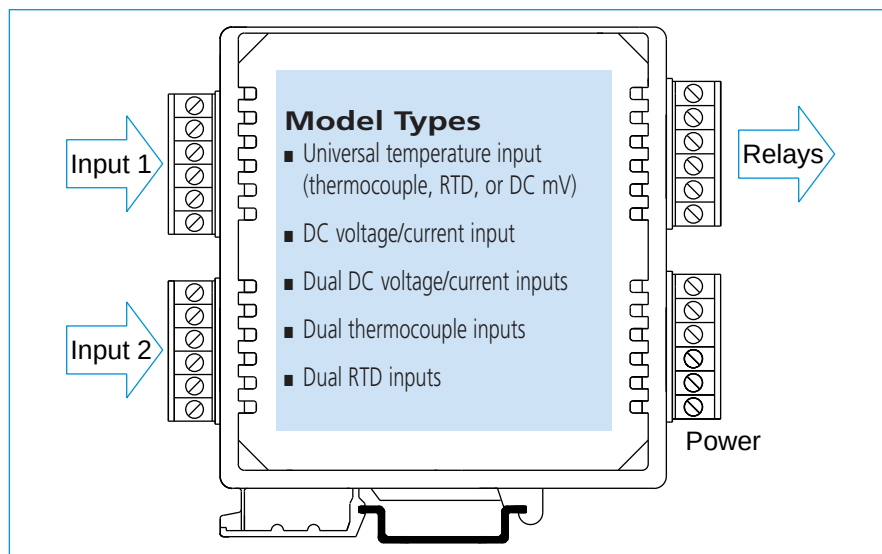
832A: RTD inputs; Two SPDT relays

* AC current sensor option available.

IntelliPack alarms compare inputs against user-defined limit setpoints to control built-in relays.

Each unit offers a selection of input ranges and alarm functions to handle a broad range of applications. As your needs change, you can easily reconfigure the unit for different ranges or functions. Alarm functions available on all models include on/off controller, limit alarm, window alarm, deviation alarm, rate-of-change alarm, and peak/valley detection. Other functions are also possible; please consult the factory.

Setup is very easy. IntelliPack alarms are configured through a user-friendly Windows 95/98/NT program. Field adjustments and recalibration are quickly performed with front-panel push-buttons and status LEDs. Once configured, IntelliPacks operate independent of any host computer.



Special Features

General Operation

- Advanced microcontroller has integrated, downloadable flash memory and EEPROM for intelligent signal processing.
- Windows 95/98/ME/NT/XP/2000 software configuration speeds setup and replacement.
- Push-button reprogrammability facilitates changes in the field without a host PC.
- Plug-in terminal blocks make module installation and removal easy.
- Built-in self-diagnostic routines operate upon power-up and during operation for easy maintenance and troubleshooting.
- 3-way isolation separates inputs, power, and relay contacts from each other.
- EMC compliant. Ruggedized circuitry meets directives to provide increased transient immunity and low emissions.
- Wide ambient temperature range ensures reliable performance from -25 to 70°C.
- Wide DC supply range with diode-coupled reverse polarity protection is useful for redundant supplies and battery backup.

Alarm Operation

- Multi-purpose inputs accept numerous ranges to reduce spare stock requirements.
- User-programmable alarm operation lets you select or change alarm functions (see next page for supported functions).
- Dual alarm operation lets you perform two alarm functions at the same time.
- High-resolution Sigma-Delta A/D converter delivers high accuracy with low noise.
- Input excitation supply on each input provides power for a two-wire transmitter.
- High-power relays switch voltages up to 230V AC at 5A.
- User-programmable deadband (100%) on each setpoint eliminates relay chatter and prolongs contact life.
- User-programmable relay reset enables automatic alarm reset or latching alarm with manual reset.
- Failsafe/non-failsafe operation lets you set the default relay position.
- Relay delay feature lets you set the reaction time to filter transients.
- Thermocouple and RTD signal processing performs linearization, up/downscale break detection, reference-junction compensation and other functions.



Alarm functions

Each IntelliPack alarm unit includes all the alarm functions listed below. Acromag's configuration software helps you quickly define or modify the relay operation for your application. Unique, fill-in-the-blank screens are provided for each alarm type.

Limit Alarm

Limit alarms monitor a single setpoint (high or low) for an alarm condition. The relay enters the alarm state when the input signal exceeds the setpoint for a user-defined time period. This time period helps filter input transients. The relay remains in the alarm state until the input signal retreats past the setpoint and any applied deadband.

Window (Band-Pass) Alarm

Window alarms use two setpoints to monitor for an alarm condition. This allows both a high and low setpoint to be defined for a single input signal. The two setpoints define a minimum/maximum operating range or a window. This function is commonly referred to as a Window, Guard, or Band-Pass alarm.

The relay enters the alarm state when the input level rises or falls outside the window for a user-defined time period (to filter input transients). The relay remains in the alarm state until the input retreats back into the window, plus any applied deadband.

On/Off Controller

An on/off controller uses two setpoints to toggle a relay. No deadband is applied. This alarm type is often used for level control applications, such as filling or emptying a container (pump/valve control).

The relay enters the alarm state when the input exceeds the "on" setpoint for a user-defined time period. The relay remains in the alarm state until the input signal retreats past the "off" setpoint.

Deviation Alarm (Dual Input Models Only)

The deviation alarm generates an alarm condition based on the difference between two input signals. One signal serves as the reference input. The second input signal is monitored for a user-defined deviation value (positive, negative, or absolute) with respect to the reference input. This alarm type is useful for controlling temperature and flow.

The relay enters the alarm state when the deviation exceeds the limit for a user-defined time period. The relay remains in the alarm state until the deviation decreases below the limit, plus any applied deadband.

Peak/Valley Detection Alarm

This function detects when the input signal reaches a maximum (peak) or minimum (valley) value. Peak/valley alarms are useful for torque and pressure testing applications as well as for monitoring temperature and chemical reactions.

The detection function activates only after the input exceeds a user-defined threshold level. Once activated, the alarm unit monitors the input signal for a decrease on a rising signal or an increase on a falling signal. A relay trips when the signal exceeds a user-defined deadband following the peak/valley. The relay remains in alarm state until the signal reaches a user-defined dropout value.

Rate-of-Change

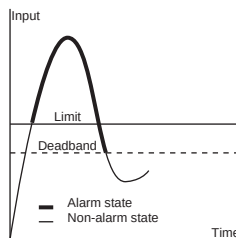
This function monitors an input for a change in value with respect to time. IntelliPacks monitor absolute rate-of-change and can activate for increasing or decreasing rates.

The relay enters alarm state when the input rate-of-change exceeds the user-defined rate limit for a one second time period. The relay remains in the alarm state until the rate-of-change moves past a specified dropout level for a one second time period.

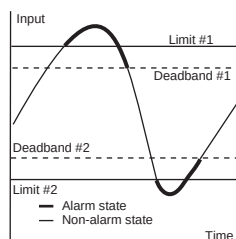
Other Alarm Functions

Internal intelligence and downloadable flash memory allow IntelliPacks to perform many other functions. If your application differs from the standard alarms above, please call the factory regarding the possibility of other functions custom-tailored to your needs.

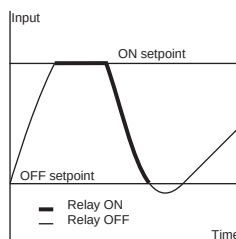
Limit Alarm



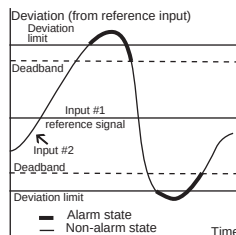
Window Alarm



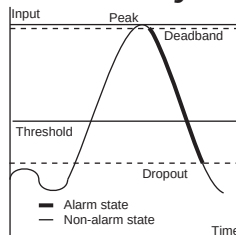
On/Off Controller



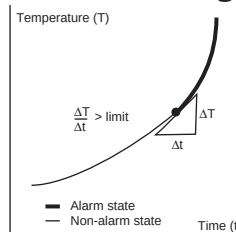
Deviation Alarm



Peak/valley Detector



Rate of Change Alarm





Software Configuration Examples

Limit Alarms, Window Alarms, and On/Off Controllers

The screenshot shows the 'Alarm 1 Configuration' tab for a Window Alarm. The 'Input Range' is set to -210 to 760 °C. The 'High' setpoint is 760.0000 °C with a deadband of 1.0000 °C. The 'Low' setpoint is -210.0000 °C with a deadband of 1.0000 °C. The 'Relay' section shows 'Number: 2', 'Time Delay: 0.2000 Seconds', 'Operating Mode' set to 'Failsafe', and 'Reset' set to 'Automatic (momentary)'.

A property sheet to configure a window alarm. Limit alarms and on/off controllers are similar. Typical applications: pump control, early warning alert, safety shutdown.

Deviation Alarms

The screenshot shows the 'Alarm 1 Configuration' tab for a Deviation Alarm. The 'Input Range' is 0-22mA DC. The 'Deviation Type' is set to 'Positive (Input 1 - Input 2 > Magnitude)' with a 'Magnitude' of 22.0000 mA DC and a 'Deadband' of 0.0000 mA DC. The 'Relay' section shows 'Number: 1', 'Time Delay: 0.1000 Seconds', 'Operating Mode' set to 'Failsafe', and 'Reset' set to 'Automatic (momentary)'.

A property sheet to configure a deviation alarm. Positive, negative, and absolute deviation alarms are supported. Typical applications: speed tracking/monitoring, consistent batch temperature measurement, flow leak detection.



Acromag IntelliPack Configuration - 801A-0200 - Untitled*

File Module Settings Help

General Alarm 1 Configuration **Alarm 2 Configuration** Test Input Calibration T-Ref Calibration

Peak/Valley Detector Alarm

Input: 1
Input Range: -210 to 760 °C

Start Input Value: 760.0000 °C Start Time Delay: 0.0000 Seconds
Deadband: 1.0000 °C Relay Deactivate Value: -210.0000 °C

Detector Type

☒ Peak
☐ Valley

Relay

Number: 2

Operating Mode

☒ Failsafe
☐ Non-failsafe

Reset

☒ Automatic (momentary)
☐ Latching (RST 2)

For Help, press F1

Peak/Valley Alarms

A property sheet to configure a peak/valley alarm.

Typical applications: force measurement, pressure testing, chemical mixing.

Acromag IntelliPack Configuration - 801A-0200 - Untitled*

File Module Settings Help

General **Alarm 1 Configuration** Alarm 2 Configuration Test Input Calibration T-Ref Calibration

Rate-of-Change Alarm

Input: 1
Input Range: -210 to 760 °C Rate-of-Change Value: 760.0000 °C/Second
Dropout Value: 0.0000 °C/Second

Relay

Number: 1

Operating Mode

☒ Failsafe
☐ Non-failsafe

Reset

☒ Automatic (momentary)
☐ Latching (RST 1)

For Help, press F1

Rate-of-Change Alarms

A property sheet to configure a rate-of-change alarm.

Typical applications: injection molding, speed sensing, monitoring chemical reactions



Intelligent Alarms



801A Alarms

Thermocouple, RTD, and Millivolt Input

Models

801A-0100: Alarm with one DPDT relay

801A-0200: Alarm with two SPDT relays

Input Ranges

TC types: J, K, T, R, S, E, B, N

Millivolt: $\pm 15.625\text{mV}$ to $\pm 1.0\text{V DC}$

RTD: 100 ohm Pt, 120 ohm Ni, 10 ohm Cu

Resistance: 0 to 500 ohms

Alarm Outputs

Single DPDT electro-mechanical 5A relay (-0100),

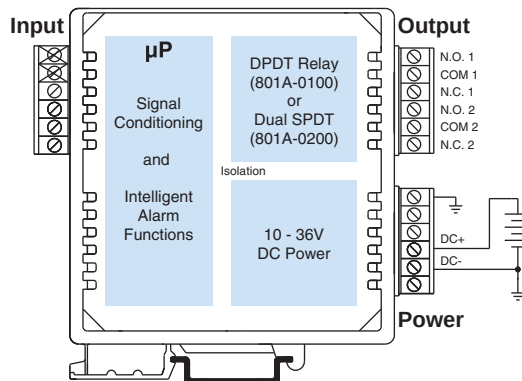
Dual SPDT electro-mechanical 5A relays (-0200)

Power Requirement

10 to 36V DC

Approvals

CE marked. UL, cUL listed.



Description

IntelliPack alarms compare inputs against user-defined limit setpoints to control built-in relays.

Each unit offers a selection of input ranges and alarm functions to handle a broad range of applications. As your needs change, you can easily reconfigure the unit for different ranges or functions. Alarm functions available on all models include on/off controller, limit alarm, window alarm, deviation alarm, rate-of-change alarm, and peak/valley detection.

Setup is very easy. IntelliPack alarms are configured through a user-friendly Windows 95/98/ME/NT/XP/2000 program. Field adjustments and recalibration are quickly performed with front-panel push-buttons and status LEDs. Once configured, IntelliPacks operate independent of any host computer.

Special Features

- Integrated microcontroller performs intelligent signal processing for advanced alarm functions.
- Windows 95/98/ME/NT/XP/2000 software configuration speeds setup and replacement.
- Push-button reprogrammability facilitates changes in the field without a host PC.
- Multi-purpose inputs accept numerous ranges to reduce spare stock requirements.
- High-resolution Sigma-Delta A/D converter delivers high accuracy with low noise.

- Input excitation supply on each input provides power for a two-wire transmitter.

- Dual alarm operation lets you perform two alarm functions at the same time.

Performance

General Input

Analog to Digital (A/D) Converter

16-bit $\Sigma\text{-}\Delta$ A/D converter.

Resolution

$\pm 0.005\%$ of span or $0.1^\circ\text{C}/\text{LSB}$. ADC typically yields resolutions finer than $0.1^\circ\text{C}/\text{LSB}$.

Ambient Temperature Effect

Better than $\pm 0.005\%$ of input span per $^\circ\text{C}$ or $\pm 1\mu\text{V}$, whichever is greater.

Noise Rejection

Normal Mode: Better than 40dB @ 60Hz.

Common Mode: Better than 130dB @ 60Hz.

Input Filter

Normal mode filtering, plus digital filtering optimized and fixed per input range within $\Sigma\text{-}\Delta$ ADC.

Input Response Time

Less than 200mS to 98% of final value for a step change in the input. A software programmable delay can be implemented for filtering transients.

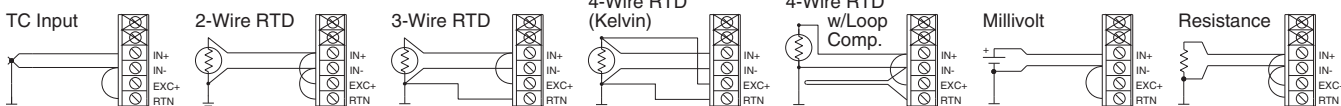
Relay Time Delay

Adjustable alarm delay of up to 25 seconds.

Input Overvoltage Protection

Bipolar Transient Voltage Suppressors (TVS).

Continued on next page.





■ DC Millivolt Input

DC Millivolt/Voltage Input Ranges

±1.0V	±125mV	±31.25mV
±500mV	±62.5mV	±15.625mV
±250mV		

Millivolt Accuracy

Better than ±0.05% of input span.

■ Thermocouple Input

Thermocouple Input Ranges

Thermocouple type user configured. Signal linearization, cold-junction compensation, and open circuit or lead break detection are included.

TC	°C Range (°F Range)	Accuracy
J	-210 to 760°C (-346 to 1400°F)	±0.5°C
K	-200 to 1372°C (-328 to 2502°F)	±0.5°C
T	-260 to 400°C (-436 to 752°F)	±0.5°C
R	-50 to 1768°C (-58 to 3214°F)	±1.0°C
S	-50 to 1768°C (-58 to 3214°F)	±1.0°C
E	-200 to 1000°C (-328 to 1832°F)	±0.5°C
B	260 to 1820°C (500 to 3308°F)	±1.0°C
N	-230 to 1300°C (-382 to 2372°F)	±0.5°C

■ RTD Input

RTD Input Ranges

100Ω Pt, 120Ω Ni, or 10Ω Cu; user-configured.

RTD	°C Range (°F Range)	Accuracy
Pt ¹	-200 to 850°C (-328 to 1562°F)	±0.25°C
Pt ²	-200 to 850°C (-328 to 1562°F)	±0.25°C
Ni	-80 to 320°C (-112 to 608°F)	±0.25°C
Cu	-200 to 260°C (-328 to 500°F)	±1.00°C

Alpha: Pt¹ ($\alpha = 1.3850$), Pt² ($\alpha = 1.3911$), Ni ($\alpha = 1.6720$), Cu ($\alpha = 1.4272$).

2, 3, or 4-wire configurations supported. Module provides sensor excitation, linearization, lead-wire compensation, and sensor break detection.

RTD Excitation Current

1mA DC typical, all types.

RTD Lead-Wire Compensation

25 ohms per lead.

RTD Break Detection

Configurable for either upscale or downscale.

■ Resistance Input

Resistance Input Range

0 to 500 ohms.

Resistance Accuracy

±0.05 ohms.

■ Output

Relay (801A-0100 models)

One DPDT electro-mechanical relay.
Contact material Silver Nickel (AgNi 90/10).

Relays (801A-0200 models)

Two independent SPDT electro-mechanical relays.
Contact material Silver-Cadmium Oxide (AgCdO).

Relay Ratings (CSA ratings)

25V DC @ 5A. 120/240V AC @ 5A.

Expected Mechanical Life

20 million operations.

■ Environmental

Ambient Temperature

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

Relative Humidity

5 to 95%.

Power Requirements

10 to 36V DC. 55mA @ 24V. 75mA @ 15V.

Isolation

3-way (input/output/power).
1500V AC for 60 seconds or 250V AC continuous.

Radiated Field Immunity (RFI)

EN61000-4-3, EN50082-1.

Electromagnetic Field Immunity (EMI)

No relay trips will occur beyond ±0.25% of input span from setpoint under the influence of electromagnetic fields from switching solenoids, commutator motors, and drill motors.

Electrical Fast Transient (EFT)

EN61000-4-4, EN50082-1.

Surge Withstanding Capability (SWC)

EN61000-4-5, EN50082-1.

Electrostatic Discharge (ESD)

EN61000-4-2, EN50082-1.

Radiated Emissions

EN50081-1 for Class B equipment.

Approvals

CE marked, UL, cUL listed (USA, Canada).
UL3121 - general product safety.

■ Configuration

Software Configuration

Units are fully programmable via the Windows 95/98/ME/2000/NT/XP IntelliPack Configuration Program. Configuration downloads from PC through EIA232 serial port using Acromag 800C-SIP kit.

Field Configuration

Setpoint and deadband are configurable via push-buttons and a standard calibrator.

LED Indicators

LEDs indicate power, status, and alarm.

■ Physical

Enclosure

Case: Self-extinguishing NYLON type 6.6 polyamide thermoplastic UL94 V-2, color beige; general purpose NEMA Type 1 enclosure.

Connectors (Removable terminal blocks)

Wire Range: AWG #14-22 (AWG #12 stranded only).

Printed Circuit Boards

Military grade FR-4 epoxy glass circuit board.

Dimensions

1.05W x 4.68H x 4.35D inches.
26.7W x 118.9H x 110.5D millimeters.

Shipping Weight

1 pound (0.45 Kg) packed.

■ Ordering Information

IMPORTANT: All IntelliPacks require initial software configuration (order 800C-SIP). See Note 1 below.

801A-0100

IntelliPack alarm unit.
One TC/RTD/millivolt input, one DPDT relay.

801A-0200

Same as above except two SPDT relays.

800C-SIP

Software Interface Package.
Only one kit is required for all IntelliPack models. See diagram on Page 83 for included parts.

5034-225

USB-to-RS232 adapter. See page 121 for more info.

PS5R-D24

Power supply (24V DC, 2.1A).
See Power Supplies on Page 199.

TBK-B01

Optional terminal block kit, barrier strip style, 2 pcs. (Does not include terminal block for input wiring.)

TBK-S01

Optional terminal block kit, spring clamp style, 2 pcs. (Does not include terminal block for input wiring.)

NOTE 1: To order factory configuration, call Acromag for a configuration form which must accompany your order. Also, append "-C" to model number (example: 801A-0200-C). 800C-SIP kit is still recommended.



Optional terminal blocks: barrier strip (left) and spring clamp (right). Cage clamp terminal is standard.



Intelligent Alarms



811A Alarm, 812A Dual Alarm

DC Current, DC Voltage, and AC Current Input

Models

- 811A-0100: Alarm with one DPDT relay
- 811A-0200: Alarm with two SPDT relays
- 812A-0200: Dual alarm with two SPDT relays

Input Ranges

- DC Current: 0 to 22mA
- DC Voltage: $\pm 100V$ DC
- AC Current: 0 to 20A AC (with AC current sensor)

Alarm Outputs

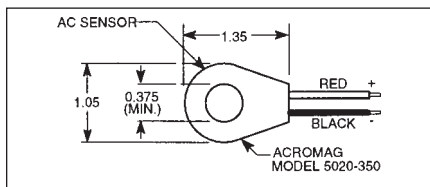
- Single DPDT electro-mechanical 5A relay (-0100),
- Dual SPDT electro-mechanical 5A relays (-0200)

Power Requirement

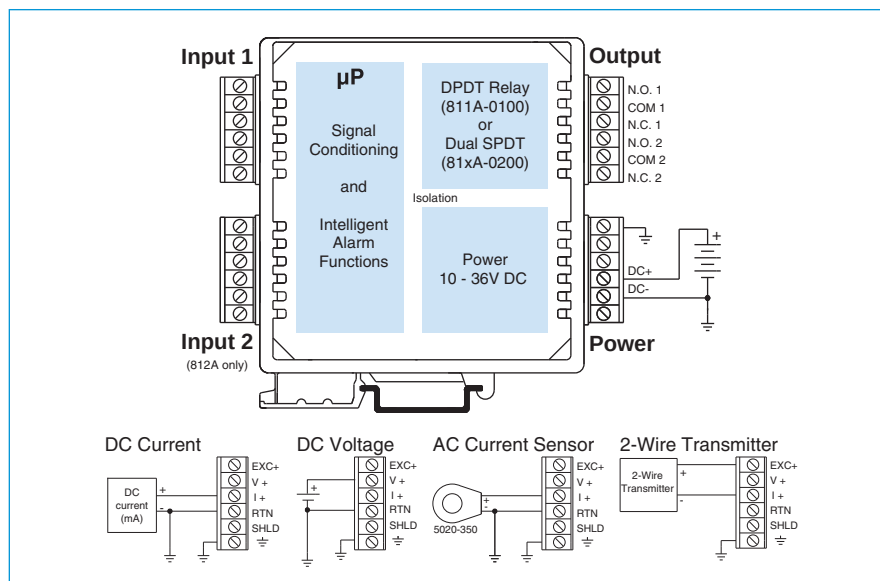
10 to 36V DC

Approvals

CE marked. UL, cUL listed.



AC Current Sensor Model 5020-350
(ordered separately)



Description

IntelliPack alarms compare inputs against user-defined limit setpoints to control built-in relays.

Each unit offers a selection of input ranges and alarm functions to handle a broad range of applications. As your needs change, you can easily reconfigure the unit for different ranges or functions. Alarm functions available on all models include on/off controller, limit alarm, window alarm, deviation alarm, rate-of-change alarm, and peak/valley detection.

Setup is very easy. IntelliPack alarms are configured through a user-friendly Windows 95/98/ME/NT/XP/2000 program. Field adjustments and recalibration are quickly performed with front-panel push-buttons and status LEDs. Once configured, IntelliPacks operate independent of any host computer.

Special Features

- Integrated microcontroller performs intelligent signal processing for advanced alarm functions.
- Windows 95/98/ME/NT/XP/2000 software configuration speeds setup and replacement.
- Push-button reprogrammability facilitates changes in the field without a host PC.
- Multi-purpose inputs accept numerous ranges to reduce spare stock requirements.
- High-resolution Sigma-Delta A/D converter delivers high accuracy with low noise.

- Input excitation supply on each input provides power for a two-wire transmitter.

- Dual alarm operation lets you perform two alarm functions at the same time.

Performance

General Input

Analog to Digital (A/D) Converter
16-bit $\Sigma-\Delta$ A/D converter.

Ambient Temperature Effect

Better than $\pm 0.005\%$ of input span per $^{\circ}C$ or $\pm 1\mu V$, whichever is greater.

Noise Rejection

Normal Mode: Better than 40dB @ 60Hz.

Common Mode: Better than 100dB @ 60Hz.

Input Filter

Normal mode filtering, plus digital filtering optimized and fixed per input range within $\Sigma-\Delta$ ADC.

Input Response Time

Less than 100ms to 98% of final value for a step change in the input. A software programmable delay can be implemented for filtering transients.

Relay Time Delay

Adjustable alarm delay of up to 25 seconds.

Input Overvoltage Protection

Bipolar Transient Voltage Suppressors (TVS).

Accuracy (DC Voltage/Current Inputs)

Better than $\pm 0.05\%$ of input span.

Continued on next page.



■ DC Current Input

DC Current Input Range

Input Ranges	Resolution
0 to 5mA DC	189nA/LSB
0 to 22mA DC	757nA/LSB

DC Current Input Impedance

24.9 ohms.

Excitation Supply (for 2-wire instruments)

+15V DC, 24mA maximum.

■ DC voltage Input

DC Voltage Input Ranges

Input Ranges	Resolution
±100V DC	3.77mV
±50V DC	1.88mV
±25V DC	942µV
±12V DC	471µV
±6V DC	236µV
±3V DC	118µV

Input impedance

Greater than 500K ohms.

■ AC Current Input

AC Current Input Range (optional)

An optional external AC current sensor is required to monitor AC current signals (Model 5020-350).

AC Current Range	Primary Turns
0 to 20A AC	1
0 to 10A AC	2
0 to 5A AC	4
0 to 2A AC	10
0 to 1A AC	20

■ Output

Relay (811A-0100 model)

One DPDT electro-mechanical relay.
Contact material Silver Nickel (AgNi 90/10).

Relays (811A-0200, 812A-0200 models)

Two independent SPDT electro-mechanical relays.
Contact material Silver-Cadmium Oxide (AgCdO).

Relay Ratings (CSA ratings)

25V DC @ 5A.
120/240V AC @ 5A.

Expected Mechanical Life

20 million operations.

■ Environmental

Ambient Temperature

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

Relative Humidity

5 to 95%.

Power Requirements

811A:
10 to 36V DC. 70mA @ 24V. 110mA @ 15V.
812A:
10 to 36V DC. 110mA @ 24V. 155mA @ 15V.

Isolation

3-way (input/output/power).
1500V AC for 60 seconds or 250V AC continuous.
Inputs share a common on 812A Model.

Radiated Field Immunity (RFI)

EN61000-4-3, EN50082-1.

Electromagnetic Field Immunity (EMI)

No relay trips will occur beyond ±0.25% of input span from setpoint under the influence of electromagnetic fields from switching solenoids, commutator motors, and drill motors.

Electrical Fast Transient (EFT)

EN61000-4-4, EN50082-1.

Surge Withstanding Capability (SWC)

EN61000-4-5, EN50082-1.

Electrostatic Discharge (ESD)

EN61000-4-2, EN50082-1.

Radiated Emissions

EN50081-1 for Class B equipment.

Approvals

CE marked, UL, cUL listed (USA, Canada).
UL3121 - general product safety.

■ Configuration

Software Configuration

Units are fully programmable via the Windows 95/98/ME/2000/NT/XP IntelliPack Configuration Program. Configuration downloads from PC through EIA232 serial port using Acromag 800C-SIP kit.

Field Configuration

Setpoint and deadband are configurable via push-buttons and a standard calibrator.

LED Indicators

LEDs indicate power, status, and alarm.

■ Physical

Enclosure

Case: Self-extinguishing NYLON type 6.6 polyamide thermoplastic UL94 V-2, color beige; general purpose NEMA Type 1 enclosure.

Connectors (Removable terminal blocks)

Wire Range: AWG #14-22 (AWG #12 stranded only).

Printed Circuit Boards

Military grade FR-4 epoxy glass circuit board.

Dimensions

1.05W x 4.68H x 4.35D inches.
26.7W x 118.9H x 110.5D millimeters.

Shipping Weight

1 pound (0.45 Kg) packed.

■ Ordering Information

IMPORTANT: All IntelliPacks require initial software configuration (order 800C-SIP). See Note 1 below.

811A-0100

IntelliPack alarm unit.
One DC voltage/current input, one DPDT relay.

811A-0200

Same as above except two SPDT relays.

812A-0200

IntelliPack alarm unit.
Two DC voltage/current inputs, two SPDT relays.

5020-350

AC current sensor. Required for AC current inputs. See page 205 for more information.

800C-SIP

Software Interface Package.
Only one kit is required for all IntelliPack models. See diagram on Page 83 for included parts.

5034-225

USB-to-RS232 adapter. See page 121 for more info.

PS5R-D24

Power supply (24V DC, 2.1A).
See Power Supplies on Page 199.

TBK-B02

Optional terminal block kit, barrier strip style, 4 pcs.

TBK-S02

Optional terminal block kit, spring clamp style, 4 pcs.

NOTE 1: To order factory configuration, call Acromag for a configuration form which must accompany your order. Also, append "-C" to model number (example: 811A-0200-C). 800C-SIP kit is still recommended.



Optional terminal blocks: barrier strip (left) and spring clamp (right). Cage clamp terminal is standard.



Intelligent Alarms



822A Dual Alarm

Thermocouple and Millivolt Input

Models

822A-0200:
Dual input alarm with two SPDT relays

Input Ranges

TC types: J, K, T, R, S, E, B, N
Millivolt: $\pm 15.625\text{mV}$ to $\pm 1.0\text{V DC}$

Alarm Outputs

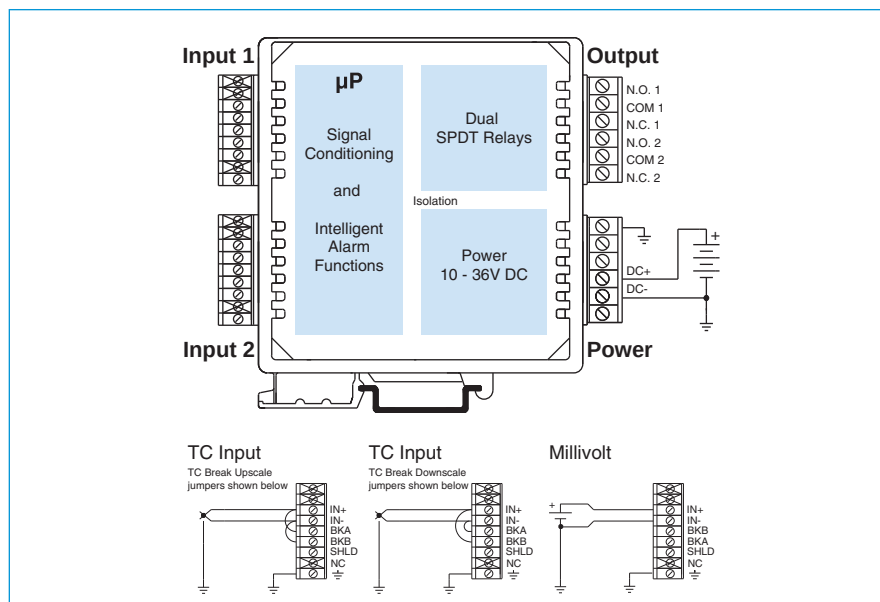
Dual SPDT electro-mechanical 5A relays

Power Requirement

10 to 36V DC

Approvals

CE marked. UL, cUL listed.



Description

IntelliPack alarms compare inputs against user-defined limit setpoints to control built-in relays.

Each unit offers a selection of input ranges and alarm functions to handle a broad range of applications. As your needs change, you can easily reconfigure the unit for different ranges or functions. Alarm functions available on all models include on/off controller, limit alarm, window alarm, deviation alarm, rate-of-change alarm, and peak/valley detection.

Setup is very easy. IntelliPack alarms are configured through a user-friendly Windows 95/98/ME/NT/XP/2000 program. Field adjustments and recalibration are quickly performed with front-panel push-buttons and status LEDs. Once configured, IntelliPacks operate independent of any host computer.

Special Features

- Integrated microcontroller performs intelligent signal processing for advanced alarm functions.
- Windows 95/98/ME/NT/XP/2000 software configuration speeds setup and replacement.
- Push-button reprogrammability facilitates changes in the field without a host PC.
- Multi-purpose inputs accept numerous ranges to reduce spare stock requirements.
- High-resolution Sigma-Delta A/D converter delivers high accuracy with low noise.
- Input excitation supply on each input provides power for a two-wire transmitter.
- Dual alarm operation lets you perform two alarm functions at the same time.



■ Performance

■ General Input

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

Resolution
 $\pm 0.005\%$ of span or $0.1^\circ\text{C}/\text{LSB}$. ADC typically yields resolutions finer than $0.1^\circ\text{C}/\text{LSB}$.

Ambient Temperature Effect
Better than $\pm 0.005\%$ of input span per $^\circ\text{C}$ or $\pm 1\mu\text{V}$, whichever is greater.

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

Input Filter
Normal mode filtering, plus digital filtering optimized and fixed per input range within Σ - Δ ADC.

Input Response Time
Less than 500mS to 98% of final value for a step change in the input. A software programmable delay can be implemented for filtering transients.

Relay Time Delay
Adjustable alarm delay of up to 25 seconds.

Input Overvoltage Protection
Bipolar Transient Voltage Suppressors (TVS).

■ Thermocouple Input

Thermocouple Input Ranges
Thermocouple type user configured. Signal linearization, cold-junction compensation, and open circuit or lead break detection are included.

TC	$^\circ\text{C}$ Range ($^\circ\text{F}$ Range)	Accuracy
J	-210 to 760°C (-346 to 1400°F)	$\pm 0.5^\circ\text{C}$
K	-200 to 1372°C (-328 to 2502°F)	$\pm 0.5^\circ\text{C}$
T	-260 to 400°C (-436 to 752°F)	$\pm 0.5^\circ\text{C}$
R	-50 to 1768°C (-58 to 3214°F)	$\pm 1.0^\circ\text{C}$
S	-50 to 1768°C (-58 to 3214°F)	$\pm 1.0^\circ\text{C}$
E	-200 to 1000°C (-328 to 1832°F)	$\pm 0.5^\circ\text{C}$
B	260 to 1820°C (500 to 3308°F)	$\pm 1.0^\circ\text{C}$
N	-230 to 1300°C (-382 to 2372°F)	$\pm 0.5^\circ\text{C}$

Thermocouple Break Detection
Upscale or downscale.

■ DC Millivolt Input

DC Millivolt/Voltage Input Ranges		
$\pm 1.0\text{V}$	$\pm 125\text{mV}$	$\pm 31.25\text{mV}$
$\pm 500\text{mV}$	$\pm 62.5\text{mV}$	$\pm 15.625\text{mV}$
$\pm 250\text{mV}$		

Millivolt Accuracy
Better than $\pm 0.05\%$ of input span.

■ Output

Relays
Two independent SPDT electro-mechanical relays.
Contact material Silver-Cadmium Oxide (AgCdO).

Relay Ratings (CSA ratings)
25V DC @ 5A.
120/240V AC @ 5A.

Expected Mechanical Life
20 million operations.

■ Environmental

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

Relative Humidity
5 to 95%.

Power Requirements
10 to 36V DC. 60mA @ 24V. 90mA @ 15V.

Isolation
3-way (input/output/power).
1500V AC for 60 seconds or 250V AC continuous.
Inputs are isolated (up to 48V) from each other.

Radiated Field Immunity (RFI)
EN61000-4-3, EN50082-1.

Electromagnetic Field Immunity (EMI)
No relay trips will occur beyond $\pm 0.25\%$ of input span from setpoint under the influence of electromagnetic fields from switching solenoids, commutator motors, and drill motors.

Electrical Fast Transient (EFT)
EN61000-4-4, EN50082-1.

Surge Withstanding Capability (SWC)
EN61000-4-5, EN50082-1.

Electrostatic Discharge (ESD)
EN61000-4-2, EN50082-1.

Radiated Emissions
EN50081-1 for Class B equipment.

Approvals
CE marked, UL, cUL listed (USA, Canada).
UL3121 - general product safety.

■ Configuration

Software Configuration
Units are fully programmable via the Windows 95/98/ME/2000/NT/XP IntelliPack Configuration Program. Configuration downloads from PC through EIA232 serial port using Acromag 800C-SIP kit.

Field Configuration
Setpoint and deadband are configurable via push-buttons and a standard calibrator.

LED Indicators
LEDs indicate power, status, and alarm.

■ Physical

Enclosure
Case: Self-extinguishing NYLON type 6.6 polyamide thermoplastic UL94 V-2, color beige; general purpose NEMA Type 1 enclosure.

Connectors (Removable terminal blocks)
Wire Range: AWG #14-22 (AWG #12 stranded only).

Printed Circuit Boards
Military grade FR-4 epoxy glass circuit board.

Dimensions
1.05W x 4.68H x 4.35D inches.
26.7W x 118.9H x 110.5D millimeters.

Shipping Weight
1 pound (0.45 Kg) packed.

■ Ordering Information

IMPORTANT: All IntelliPacks require initial software configuration (order 800C-SIP). See Note 1 below.

822A-0200
IntelliPack alarm unit.
Two thermocouple/millivolt inputs, two SPDT relays.

800C-SIP
Software Interface Package.
Only one kit is required for all IntelliPack models.
See diagram on Page 83 for included parts.

5034-225
USB-to-RS232 adapter. See page 121 for more info.

P55R-D24
Power supply (24V DC, 2.1A).
See Power Supplies on Page 199.

TBK-B01
Optional terminal block kit, barrier strip style, 2 pcs.
(Does not include terminal block for input wiring.)

TBK-S01
Optional terminal block kit, spring clamp style, 2 pcs.
(Does not include terminal block for input wiring.)

NOTE 1: To order factory configuration, call Acromag for a configuration form which must accompany your order. Also, append "-C" to model number (example: 822A-0200-C). 800C-SIP kit is still recommended.



Optional terminal blocks: barrier strip (left) and spring clamp (right). Cage clamp terminal is standard.



Intelligent Alarms



832A Dual Alarm

RTD and Resistance Input

Models

832A-0200:

Dual input alarm with two SPDT relays

Input Ranges

RTD: 100 ohm Pt, 120 ohm Ni, 10 ohm Cu

Resistance: 0 to 500 ohms

Alarm Outputs

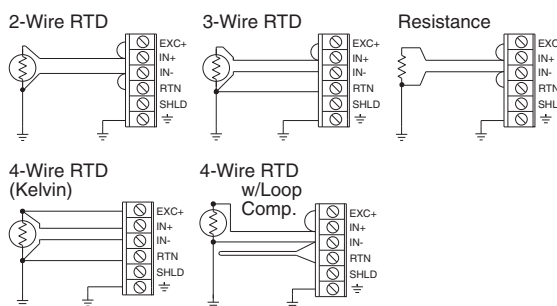
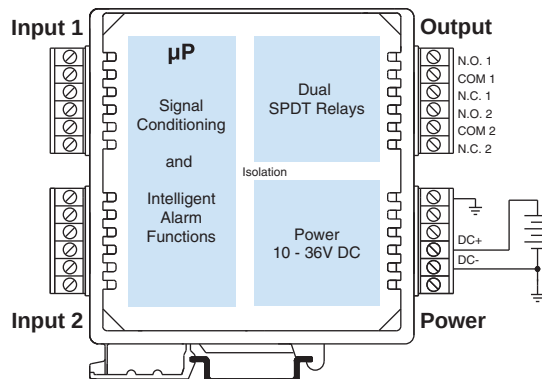
Dual SPDT electro-mechanical 5A relays

Power Requirement

10 to 36V DC

Approvals

CE marked. UL, cUL listed.



Description

IntelliPack alarms compare inputs against user-defined limit setpoints to control built-in relays.

Each unit offers a selection of input ranges and alarm functions to handle a broad range of applications. As your needs change, you can easily reconfigure the unit for different ranges or functions. Alarm functions available on all models include on/off controller, limit alarm, window alarm, deviation alarm, rate-of-change alarm, and peak/valley detection.

Setup is very easy. IntelliPack alarms are configured through a user-friendly Windows 95/98/ME/NT/XP/2000 program. Field adjustments and recalibration are quickly performed with front-panel push-buttons and status LEDs. Once configured, IntelliPacks operate independent of any host computer.

Special Features

- Integrated microcontroller performs intelligent signal processing for advanced alarm functions.
- Windows 95/98/ME/NT/XP/2000 software configuration speeds setup and replacement.
- Push-button reprogrammability facilitates changes in the field without a host PC.
- Multi-purpose inputs accept numerous ranges to reduce spare stock requirements.
- High-resolution Sigma-Delta A/D converter delivers high accuracy with low noise.
- Input excitation supply on each input provides power for a two-wire transmitter.
- Dual alarm operation lets you perform two alarm functions at the same time.



■ Performance

■ General Input

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

Resolution
0.1°C/LSB. ADC typically yields resolutions finer than 0.1°C/LSB.

Ambient Temperature Effect
Better than $\pm 0.005\%$ of input span per °C or $\pm 1\mu\text{V}$, whichever is greater.

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

Input Filter
Normal mode filtering, plus digital filtering optimized and fixed per input range within Σ - Δ ADC.

Input Response Time
Less than 300mS to 98% of final value for a step change in the input. A software programmable delay can be implemented for filtering transients.

Relay Time Delay
Adjustable alarm delay of up to 25 seconds.

Input Overvoltage Protection
Bipolar Transient Voltage Suppressors (TVS).

■ Resistance Input

Resistance Input Range
0 to 500 ohms.

Resistance Accuracy
 ± 0.05 ohms.

■ RTD Input

RTD Input Ranges
100 ohm Platinum, 120 ohm Nickel, or 10 ohm Copper; user-configured.

RTD	°C Range (°F Range)	Accuracy
Pt ¹	-200 to 850°C (-328 to 1562°F)	$\pm 0.25^\circ\text{C}$
Pt ²	-200 to 850°C (-328 to 1562°F)	$\pm 0.25^\circ\text{C}$
Ni	-80 to 320°C (-112 to 608°F)	$\pm 0.25^\circ\text{C}$
Cu	-200 to 260°C (-328 to 500°F)	$\pm 1.00^\circ\text{C}$

Alpha: Pt¹ ($\alpha = 1.3850$), Pt² ($\alpha = 1.3911$), Ni ($\alpha = 1.6720$), Cu ($\alpha = 1.4272$).

2, 3, or 4-wire configurations supported. Module provides sensor excitation, linearization, lead-wire compensation, and sensor break detection.

RTD Excitation Current
1mA DC typical, all types.

RTD Lead-Wire Compensation
25 ohms per lead.

RTD Break Detection
RTD sensor failure can be configured for either upscale or downscale.

■ Output

Relays
Two independent SPDT electro-mechanical relays.
Contact material Silver-Cadmium Oxide (AgCdO).

Relay Ratings (CSA ratings)
25V DC @ 5A.
120/240V AC @ 5A.

Expected Mechanical Life
20 million operations.

■ Environmental

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

Relative Humidity
5 to 95%.

Power Requirements
10 to 36V DC. 55mA @ 24V. 80mA @ 15V.

Isolation
3-way (input/output/power).
1500V AC for 60 seconds or 250V AC continuous.
Inputs share a common.

Radiated Field Immunity (RFI)
EN61000-4-3, EN50082-1.

Electromagnetic Field Immunity (EMI)
No relay trips will occur beyond $\pm 0.25\%$ of input span from setpoint under the influence of electromagnetic fields from switching solenoids, commutator motors, and drill motors.

Electrical Fast Transient (EFT)
EN61000-4-4, EN50082-1.

Surge Withstanding Capability (SWC)
EN61000-4-5, EN50082-1.

Electrostatic Discharge (ESD)
EN61000-4-2, EN50082-1.

Radiated Emissions
EN50081-1 for Class B equipment.

Approvals
CE marked, UL, cUL listed (USA, Canada).
UL3121 - general product safety.

■ Configuration

Software Configuration
Units are fully programmable via the Windows 95/98/ME/2000/NT/XP IntelliPack Configuration Program. Configuration downloads from PC through EIA232 serial port using Acromag 800C-SIP kit.

Field Configuration
Setpoint and deadband are configurable via push-buttons and a standard calibrator.

LED Indicators
LEDs indicate power, status, and alarm.

■ Physical

Enclosure
Case: Self-extinguishing NYLON type 6.6 polyamide thermoplastic UL94 V-2, color beige; general purpose NEMA Type 1 enclosure.

Connectors (Removable terminal blocks)
Wire Range: AWG #14-22 (AWG #12 stranded only).

Printed Circuit Boards
Military grade FR-4 epoxy glass circuit board.

Dimensions
1.05W x 4.68H x 4.35D inches.
26.7W x 118.9H x 110.5D millimeters.

Shipping Weight
1 pound (0.45 Kg) packed.

■ Ordering Information

IMPORTANT: All IntelliPacks require initial software configuration (order 800C-SIP). See Note 1 below.

832A-0200
IntelliPack alarm unit.
Two RTD/resistance inputs, two SPDT relays.

800C-SIP
Software Interface Package.
Only one kit is required for all IntelliPack models.
See diagram on Page 83 for included parts.

503A-225
USB-to-RS232 adapter. See page 121 for more info.

P55R-D24
Power supply (24V DC, 2.1A).
See Power Supplies on Page 199.

TBK-B02
Optional terminal block kit, barrier strip style, 4 pcs.

TBK-S02
Optional terminal block kit, spring clamp style, 4 pcs.

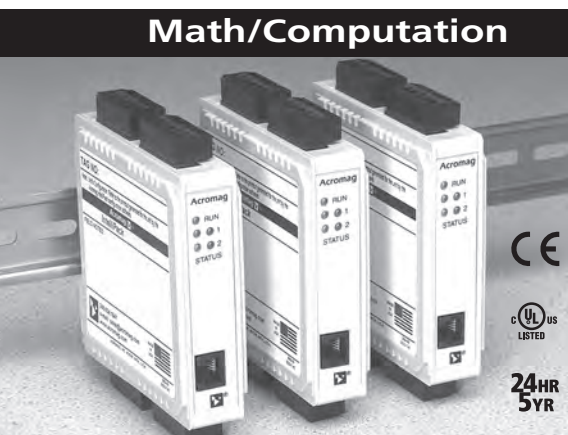
NOTE 1: To order factory configuration, call Acromag for a configuration form which must accompany your order. Also, append "-C" to model number (example: 832A-0200-C). 800C-SIP kit is still recommended.



Optional terminal blocks: barrier strip (left) and spring clamp (right). Cage clamp terminal is standard.



Math/Computation



890M Units

Model Types

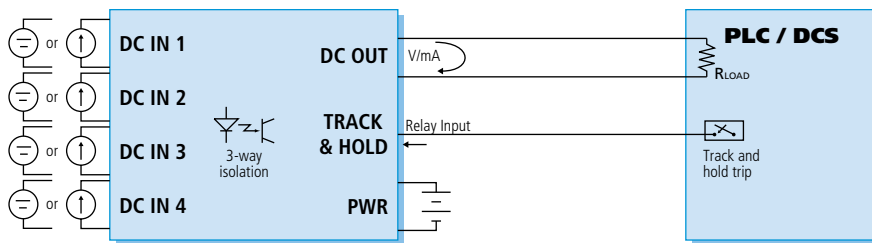
- **892M:** Dual DC voltage/current input with universal DC voltage/current output
- **894M:** Quad DC voltage/current input with universal DC voltage/current output
- **895M:** Single DC voltage/current input with frequency/pulse output
- **896M:** Dual DC voltage/current input with frequency/pulse output

Functions

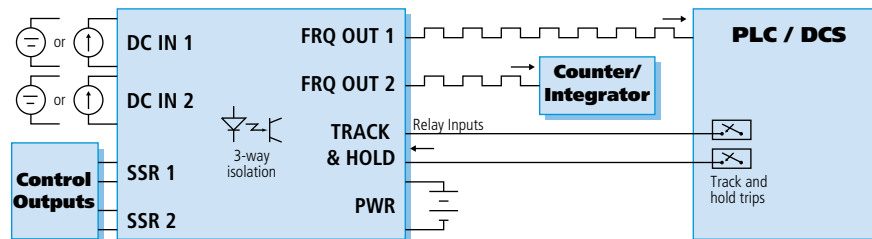
32-bit floating point math processing ensures precise computing for highly accurate output.

- Add, subtract, multiply, divide
- Square root
- Exponential (e^n) and power (X^n)
- Logarithmic (natural and base 10)
- Sine, cosine, tangent, and inverse
- Absolute value
- Minimum/maximum
- Conditional arguments (if, then, else, and, or, >, <, <>, =, <=, >=)
- Input scaling
- High/low signal selector or discriminator
- Track and hold

DC to DC Conversion: 892/894M Math Modules



DC to Frequency Conversion: 895/896M Math Modules



Description

IntelliPack math modules perform complex mathematical computations and convert DC input signals to scaled DC or frequency outputs. They are ideal for isolating and interfacing analog signals to a PLC or controller as a voltage, current, or a pulsed input. Typical applications include calculating a sum, delta's, average, flow rate, volume, weight, power, and other scaled or computed variables.

Math modules are available with either DC voltage/current output or frequency/pulse-width modulated output. The frequency output models also provide two solid-state relays for control or alarm functions. Each output (DC, frequency, and relay channels) is controlled by a unique, user-defined equation. On relay output channels, zero/nonzero equation results and true/false conditions control the on/off state.

Frequency output models are ideal for integrator/totalizer applications. They support ultra-low frequency pulses as slow as 10 cph. And, adjustable zero dropout levels apply a minimum input threshold to filter noise and unwanted pulses.

The math/computation equations are entered into the IntelliPack configuration software in a freeform format, the same as in most popular spreadsheet programs. A simulator screen provides instant feedback to test equations and see the output response before actual installation.

Special Features

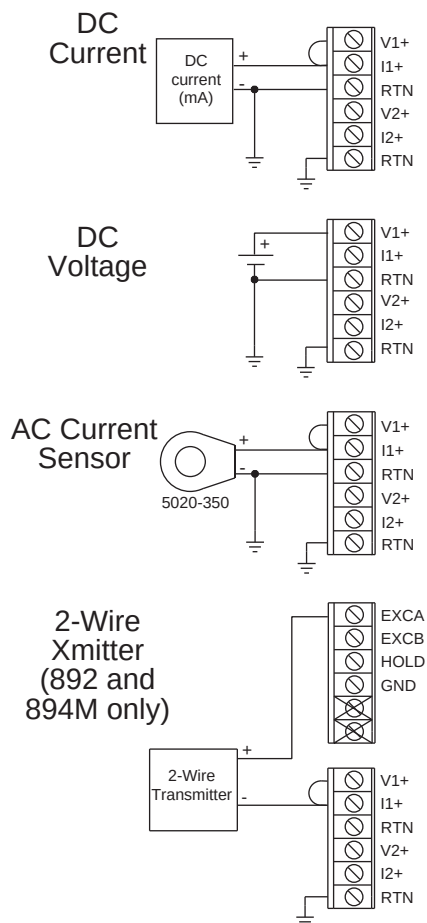
- Universal DC analog I/O ranges provide flexibility for changing application requirements.
- Individual channel input/output scaling displays signal values in engineering units.
- Track and hold function enables easy identification of critical events and their corresponding signal values.
- 200-character equation fields (50-char. max. on 895/896M) support complex transfer functions.
- Software simulation feature allows off-line testing of equations to quickly check output signal response for a variety of conditions.
- Excitation supply for two 2-wire transmitters provides 15V DC @ 48mA to eliminate need for additional power supplies. 892/894M only.
- Diagnostic LEDs provide quick, visual indication of an out-of-range input value.

Frequency output models (895/896M) only

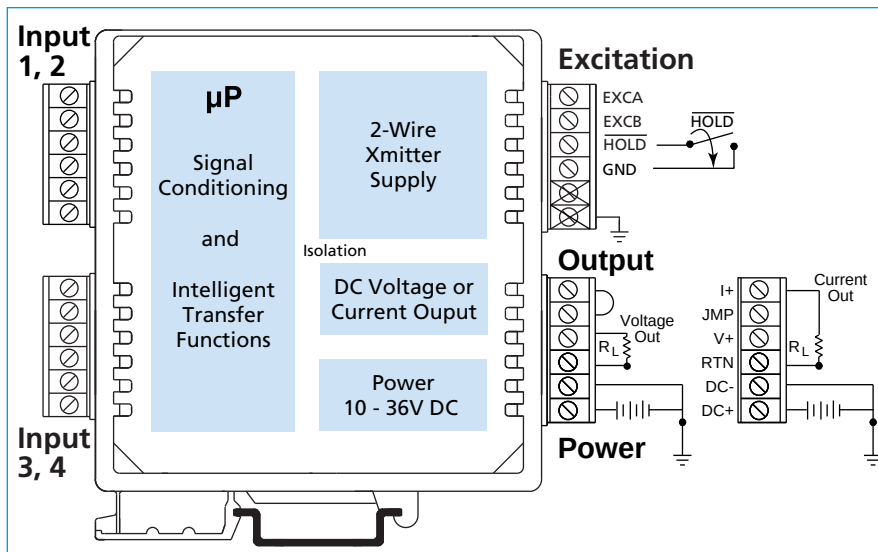
- Pulse output supports integrator and totalizer applications using an external counter to calculate flow, volume, weight, power, etc.
- Pulse-width modulation capability allows the user to vary the output signal's pulse width on a user-defined carrier frequency.
- Solid-state relays provide on/off control or local alarms with failsafe/ nonfailsafe capability.



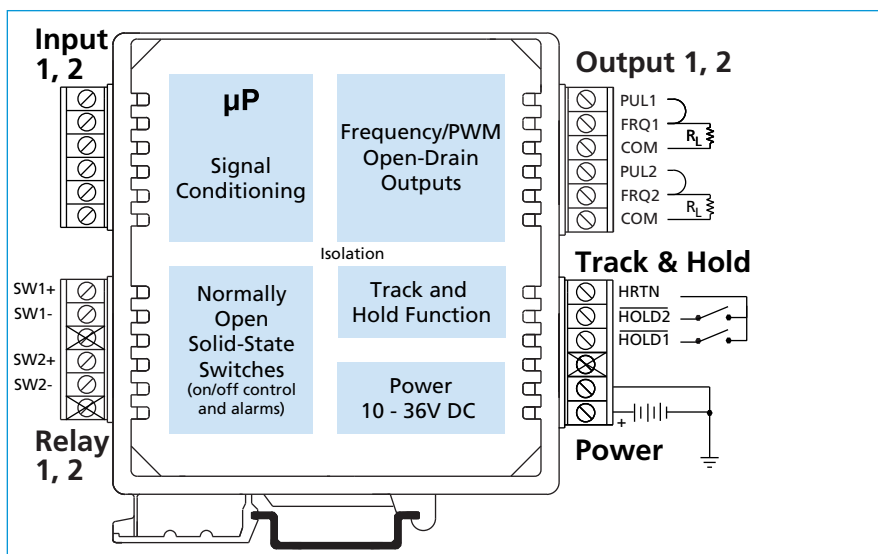
Input Connections



892/894M DC Output Math Module



895/896M Frequency Output Math Module



IntelliPack Features

- Advanced microcontroller has integrated, downloadable flash memory and EEPROM for intelligent signal processing.
- Windows 95/98/ME/NT/XP/2000 software configuration speeds setup and replacement.
- Plug-in terminal blocks make module installation and removal easy.
- Built-in self-diagnostic routines operate upon power-up and during operation for easy maintenance and troubleshooting.
- 3-way optical isolation separates inputs, outputs, and power from each other.
- EMC compliant. Ruggedized circuitry meets directives to provide increased transient immunity and low emissions.
- Wide ambient temperature range ensures reliable performance from -25 to 70°C.
- Wide DC supply range has diode-coupled reverse polarity protection.



892/894M DC Output Math Modules

Application Example

A typical application involves calculating the composite flow rate of several flows. The 894M easily sums up to four inputs and provides the total as an output scaled in engineering units.

Configuration Procedures

- 1) Enter optional tag identifiers and other desired application information.
- 2) Select your input ranges from the pull-down menus and identify the sources.
- 3) Select the output range and either normal or reverse acting (proportional/inverse) mode.

IntelliPack Configuration - 894M-0500 - Untitled*

File Module Settings Help

General Xmtr Configuration Test Input 1-2 Calibration Input 3-4 Calibration Output Calibration

Module

Tag: Tank #2A Comment: Flow into Tank #2A

Serial Number: Firmware Number: 9300-016A Last Modified: 10/12/98 3:31 PM

Configured By: RMG Location: Building #2

Input 1 Range: 4-20mA DC ID: H2O

Input 2 Range: 4-20mA DC ID: HCL

Input 3-4 Range: 4-20mA DC ID (3): NaOH ID (4): CO2

Output 1 Range: 0-10V DC Mode: Normal Acting

IntelliPack Configuration - 894M-0500 - Untitled*

File Module Settings Help

General Xmtr Configuration Test Input 1-2 Calibration Input 3-4 Calibration Output Calibration

Scaling:

I/O	Equation Symbol	Zero Signal Value	Zero Engr. Units Value	Full Scale Signal Value	Full Scale Engr. Units Value	Engr. Units
Input 1	A	4.0 mADC	0	20.0 mADC	1000	GPM
Input 2	B	4.0 mADC	0	20.0 mADC	500	GPM
Input 3	C	4.0 mADC	0	20.0 mADC	250	GPM
Input 4	D	4.0 mADC	0	20.0 mADC	100	GPM
Output 1		0.0 VDC	0	10.0 VDC	1850	GPM

Equation: Output 1 = A+B+C+D

Show Simulator

IntelliPack Configuration Software makes it very easy to set up your input and output ranges and other operational parameters.

- 4) Enter the zero/full scale values in engineering units for input variables A, B, C and D.
- 5) Enter the output scaling parameters, also in engineering units.
- 6) Enter your equation (up to 200-characters) in the equation field to define the output.
- 7) Use the I/O equation simulator (shown below) to verify the expected results for various field conditions.

The IntelliPack math module's configuration property sheet simplifies the entry of equations.

Simulator

Simulated Inputs

Min Max

I/O	Signal Value	Engr. Units Value
Input 1 (A)	12.0000 mADC	500 GPM
Input 2 (B)	12.0000 mADC	250 GPM
Input 3 (C)	12.0000 mADC	125 GPM
Input 4 (D)	12.0000 mADC	50 GPM
Output 1	5.0000 VDC	925 GPM

The pop-up simulator sheet helps you test equations in software with slider bars to simulate input conditions.



895/896M Frequency Output Math Modules

Application Example

Both models are designed for integrator/totalizer applications. The 896M is ideal for demand metering applications. With one high speed pulse output and one low speed output to a pulse counter, you can measure the sum, flow, rate, and total volume.

Configuration Procedures

- 1) Enter optional tag identifiers and application information.
- 2) Select input ranges and zero dropout values from pull-down lists and identify the device.
- 3) Select output ranges from the pull-down menu and set the duty cycle (on-time).

IntelliPack Configuration Software makes it very easy to set up your input and output ranges and other operational parameters.

I/O	Eqn Sym	Zero Signal Value	Zero Engr Units Value	Full Scale Signal Value	Full Scale Engr Units Value	Initial EU Value	Engr Units
Input 1	A	4.0 mADC	0	20.0 mADC	100		gpm
Output 1	B	0.0 Hz	0	1100.0 Hz	1100	0	gpm
Cont 1	C	Open	0	Closed	<>0	0	
Input 2	D	4.0 mADC	0	20.0 mADC	1000		gpm
Output 2	E	0.0 CPH	0	660.0 CPH	1100	0	gpm
Cont 2	F	Open	0	Closed	<>0	0	

Equation:
 Output 1 (B) = A+D
 Cont 1 (C) = IF(A<0) THEN(0) ELSE(1)
 Output 2 (E) = A+D
 Cont 2 (F) = IF(D<0) THEN(0) ELSE(1)

The IntelliPack math module's configuration property sheet simplifies the entry of equations.

- 4) Enter the scaling parameters in engineering units for input variables A and D.
- 5) Enter the frequency scaling parameters for outputs B and E.
- 6) Enter the initial start-up conditions for outputs B, C, E, and F in engineering units.
- 7) Enter up to four 50-character equations in the scroll-down fields to define each output.
- 8) Use the I/O equation simulator (shown below) to verify the expected results for various field conditions.

I/O	Eqn Sym	Signal Value	Engr. Units Value
Input 1	A	12.0000 mADC	50.000 gpm
Output 1	B	550.00 Hz	550.00 gpm
Cont 1	C	Closed	1.0000
Input 2	D	12.0000 mADC	500.00 gpm
Output 2	E	330.00 CPH	550.00 gpm
Cont 2	F	Closed	1.0000

The pop-up simulator sheet helps you test equations in software with slider bars to simulate input conditions.



Real Time Monitoring

892/894M DC Output Math Modules

Models

892M-0500: Two input channels

894M-0500: Four input channels

Input Ranges

0 to 1mA, 0 to 20mA, or 4 to 20mA DC

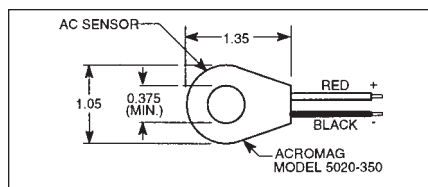
0 to 5V or 0 to 10V DC

0 to 20A AC (with AC current sensor)

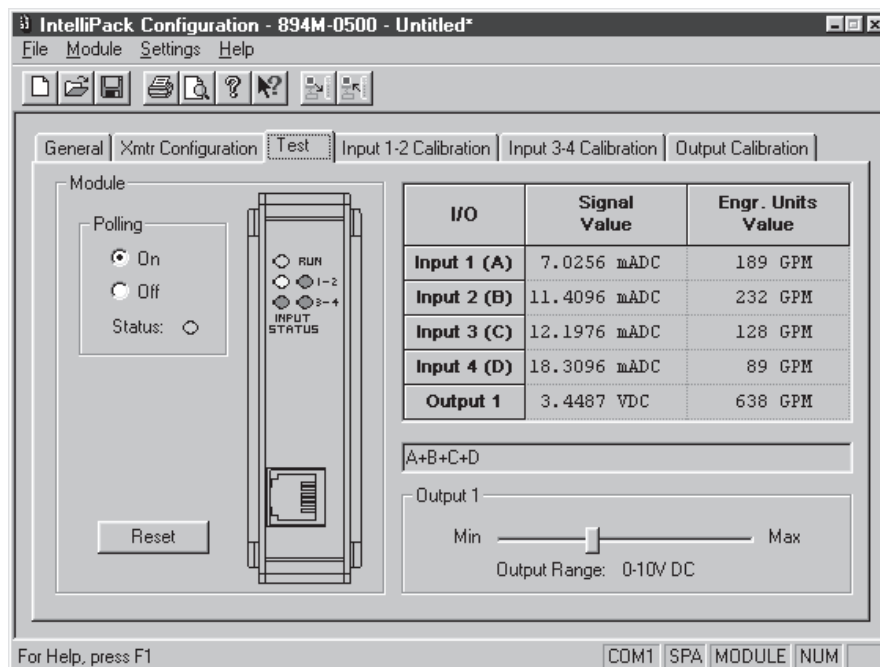
Output Ranges

0 to 1mA, 0 to 20mA, or 4 to 20mA DC,

0 to 5V or 0 to 10V DC



AC Current Sensor Model 5020-350
(ordered separately)



The test property sheet displays run-time input/output values for easy troubleshooting and diagnostics.

Arithmetic Functions

Function	Equation
Addition	$A+B+C+D$
Subtraction	$A - B+C - D$
Multiplication	$4*A - 2*B+3*C - 6*D$
Division	$(A/4+B/2 - 3*C)/8$
Square Root	$\text{SQRT}(A - B+C - D)$
Absolute Value	$\text{ABS}(A - B+C - D)$
Exponential	$\text{EXP}(2*A) = e^{2A}$
Power	$\text{POWER}(A, B) = A^B$
Natural Log	$\text{LN}(A+B)$
Log Base 10	$\text{LOG}_{10}(A/B)$
SIN, COS, TAN, ASIN, ACOS, ATAN	$\text{SIN}(A - B)$ $\text{ACOS}(A*B)$
Minimum	$\text{MIN}(A/2, B/4, 3*C, D)$
Maximum	$\text{MAX}((A - B)/4, C+D)$

Conditional

Function	Equation
If, Then, Else,	$\text{IF } (A>B) \text{ THEN } (2*C)$
And, Or	
>, <, <=	$\text{IF } (\text{OR } (A=B, B>=C) \text{ THEN } (D))$
=, >=, <=	

Track & Hold Function

A digital input on the math module accepts a logic level signal from PLCs and other devices to hold the output constant at the last known value.



Real Time Monitoring

895/896M Frequency Output Math Modules

Models

895M-0800: Single I/O channel

896M-0800: Dual I/O channels

Input Ranges

0 to 1mA, 0 to 20mA, or 4 to 20mA DC

0 to 5V or 0 to 10V DC

0 to 20A AC (with AC current sensor)

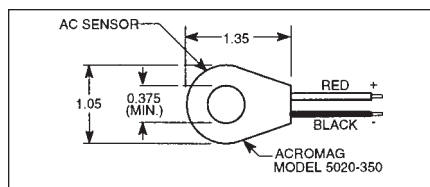
Output Ranges

0 to 36,000 pulse counts per hour,

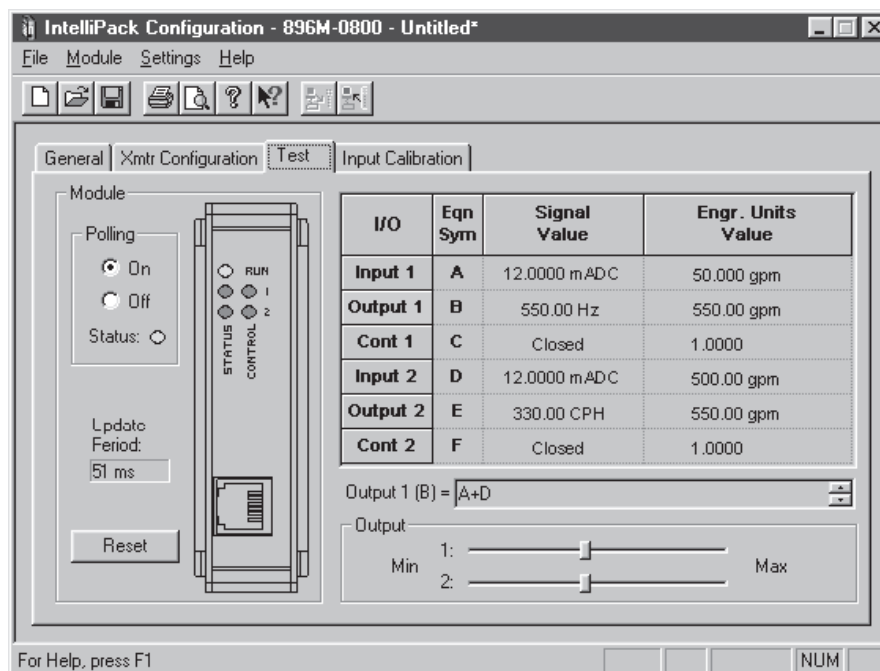
0 to 10KHz Open-drain MOSFETs (60V DC @ 1A),

Solid-state relays (60V DC @ 500mA)

High-voltage open-drain outputs interface to a variety of discrete level devices and to TTL level systems with the use of internal 5V pull-ups.



AC Current Sensor Model 5020-350 (ordered separately)



The test property sheet continuously displays polled information and input/output signal values for easy troubleshooting and diagnostic checkout.

Arithmetic Functions

Function

Addition

Subtraction

Multiplication

Division

Square Root

Absolute Value

Exponential

Power

Natural Log

Log Base 10

SIN, COS, TAN,
ASIN, ACOS, ATAN

Minimum

Maximum

Equation

$A + D$

$A - D$

$4 * A - 6 * D$

$(A/4 + D/2) / 8$

$SQRT(A + D)$

$ABS(A - D)$

$EXP(2 * A) = e^{2A}$

$POWER(A, D) = A^D$

$LN(A + D)$

$LOG10(A/D)$

$SIN(A - D)$
 $ACOS(A * D)$

$MIN(A/2, 3 * D)$

$MAX((A - D)/4, A + D)$

Conditional

Function

If, Then, Else,
And, Or

>, <, <=,
=, >=, <=

Equation

$IF(A > D) THEN (2 * B)$

$IF(OR(A = D, D <= 4 * A) THEN (E/2)$

Track & Hold Function

Discrete inputs on the math module accept logic level signals from PLCs and other devices to hold the associated output constant at the last known value. This function is helpful in determining conditions at the time of a critical event.



■ 892/894M Performance Specs

■ General

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

Ambient Temperature Effect

Better than $\pm 0.005\%$ of input span per $^{\circ}\text{C}$ or $\pm 1\mu\text{V}$, whichever is greater.

Noise Rejection

Normal Mode: 40dB @ 60Hz, 100 ohm unbalance.
Common Mode: 100dB @ 60Hz, 100 ohm unbalance.
(49.9 ohm unbalance for process current inputs).

Response Time (for input step change)

800mS typical to 98% of final output value.

Input Overvoltage Protection

Bipolar Transient Voltage Suppressors (TVS).

■ DC Current Input

DC Current Input Ranges

Input Ranges	Resolution
0 to 1mA DC	0.0370%
0 to 20mA DC	0.0025%
4 to 20mA DC	0.0025%

DC Current Input Impedance

49.9 ohms.

DC Current Input Accuracy

Better than 0.05% of input span, typical.
Better than 0.3% of input span typ. for 0-1mA range.

■ DC Voltage Input

DC Voltage Input Ranges

Input Ranges	Resolution
0 to 5V DC	0.0030%
0 to 10V DC	0.0025%

Input impedance

Greater than 500K ohms.

DC Voltage Input Accuracy

Better than 0.05% of input span, typical.

■ Output (DC V/mA)

D/A Converter

16-bit Σ - Δ .

Current Output

Ranges: 0-1mA, 0-20mA, 4-20mA.
Compliance: 10V minimum (500 Ω load).
Accuracy: 0.025% of span (0-1mA: 0.3% of span).

Voltage Output

Ranges: 0-5V, 0-10V.
Compliance: 10mA maximum with short circuit protection. 1 ohm output impedance.
Accuracy: 0.025% of span.

Accuracy (overall input to output)

Better than 0.075% of span, typical.
Better than 0.5% of span for 0-1mA, typical

■ Environmental

Ambient Temperature

Operating: -25 to 70 $^{\circ}\text{C}$ (-13 to 158 $^{\circ}\text{F}$).
Storage: -40 to 85 $^{\circ}\text{C}$ (-40 to 185 $^{\circ}\text{F}$).

Relative Humidity

5 to 95%.

Power Requirements

10 to 36V DC. 120mA @ 24V. 200mA @ 15V.

Isolation (optical)

3-way (input/output/power).
Input circuits share a common.
1500V AC peak or 250V AC (354V DC) continuous.

Radiated Field Immunity (RFI)

EN61000-4-3, EN50082-1.

Electromagnetic Field Immunity (EMI)

Less than $\pm 0.25\%$ of output span effect under the influence of electromagnetic fields from switching solenoids, commutator motors, and drill motors.

Electrical Fast Transient (EFT)

EN61000-4-4, EN50082-1.

Surge Withstanding Capability (SWC)

EN61000-4-5, EN50082-1.

Electrostatic Discharge (ESD)

EN61000-4-2, EN50082-1.

Radiated Emissions

EN50081-1 for Class B equipment.

Approvals

CE marked.
UL listed (UL508 and UL1604)
cUL listed (C22.2, 142-M1987 and 213-M1987).
Hazardous Loc.: Class I; Division 2; Groups A, B, C, D.

■ Configuration

Software Configuration

Units are fully programmable via the Windows 95/98/ME/2000/NT/XP IntelliPack Configuration Program. Configuration downloads from PC through EIA232 serial port using Acromag 800C-SIP kit.

LED Indicators

LEDs indicate power and status.

■ Physical

Enclosure

Case: Self-extinguishing NYLON type 6.6 polyamide thermoplastic UL94 V-2 NEMA Type 1 enclosure.

Connectors (Removable Terminal Blocks)

Wire Range: AWG #14-22 (AWG #12 stranded only).

Printed Circuit Boards

Military grade FR-4 epoxy glass circuit board.

Dimensions

1.05W x 4.68H x 4.35D inches.
26.7W x 118.9H x 110.5D millimeters.

Shipping Weight

1 pound (0.45 Kg) packed.

■ Ordering Information

IMPORTANT: All IntelliPack units require initial software configuration (order 800C-SIP). See Note 1 below.

892M-0500

Dual input computation module with single output.

894M-0500

Quad input computation module with single output.

5020-350

AC current sensor. Required for AC inputs.. See Page 205 for more information.

800C-SIP

Software Interface Package.
Only one kit is required for all IntelliPack models. See diagram on Page 83 for included parts.

5034-225

USB-to-RS232 adapter. See page 121 for more info.

PS5R-D24

Power supply (24V DC, 2.1A). See Power Supplies on Page 199.

TBK-B02

Optional terminal block kit, barrier strip style, 4 pcs.

TBK-S02

Optional terminal block kit, spring clamp style, 4 pcs.

NOTE 1: To order factory configuration, call Acromag for a configuration form which must accompany your order. Also, append "-C" to model number (example: 892M-0500-C). 800C-SIP kit is still recommended.



Optional terminal blocks: barrier strip (left) and spring clamp (right). Cage clamp terminal is standard.



■ 895/896M Performance Specs

■ General

Analog to Digital Converter (ADC)

16-bit Σ - Δ A/D converter.

Input Accuracy

Better than $\pm 0.05\%$ of input span.

Input Zero Dropout Threshold

0 to 10% of input span, user-defined.

Ambient Temperature Effect

Better than $\pm 0.005\%$ of input span per $^{\circ}\text{C}$ or $\pm 1\mu\text{V}$, whichever is greater.

Noise Rejection

Normal Mode: Better than 40dB @ 60Hz.

Common Mode: Better than 100dB @ 60Hz.

Input Overvoltage Protection

Bipolar Transient Voltage Suppressors (TVS).

Input Scaling

Input signal endpoints are scaled using IntelliPack Configuration Software.

Response Time (for input step change)

70ms typical to 98% of final output value.

■ DC Current Inputs

DC Current Input Ranges

0 to 1mA, 0 to 20mA, 4 to 20mA DC.

DC Current Input Impedance

49.9 ohms.

■ DC Voltage Inputs

DC Voltage Input Ranges

0 to 5V, 0 to 10V DC.

DC Voltage Input impedance

Greater than 500K ohms.

■ Frequency Output

Output Type

Open-drain MOSFETs, 60V DC @ 1A DC.

On resistance: 0.2 ohms.

Frequency Range

0 to 10KHz (100% scalable) or

0 to 36,000 counts per hour (CPH).

Output Scaling

Output signal endpoints are scaled using IntelliPack Configuration Software. Output frequency is limited from a minimum span of 0-10Hz to a maximum span of 0-10KHz or from 0-10CPH to 0-36000 CPH.

Output Pullups

470 ohms to 5V via pullup terminals.

60V DC with external pullup resistor.

Output Duty Cycle

User-defined on-time from 0 to 100% of frequency range.

■ Relay Control Outputs

Solid-State Relay

Form A normally-open switch.

Maximum current: 500mA DC.

Maximum off-state voltage: 60V DC.

Maximum on-state resistance: 0.7 ohms.

■ Environmental

Ambient Temperature

Operating: -25 to 70°C (-13 to 158°F).

Storage: -40 to 85°C (-40 to 185°F).

Relative Humidity

5 to 95%.

Power Requirements

10 to 36V DC. 55mA @ 24V.

Isolation (optical)

4-way (input/output/relays/power).

Input circuits share a common.

1500V AC peak or 250V AC (354V DC) continuous.

Radiated Field Immunity (RFI)

EN61000-4-3, EN50082-1.

Electromagnetic Field Immunity (EMI)

Less than $\pm 0.25\%$ of output span effect under the influence of electromagnetic fields from switching solenoids, commutator motors, and drill motors.

Electrical Fast Transient (EFT)

EN61000-4-4, EN50082-1.

Surge Withstanding Capability (SWC)

EN61000-4-5, EN50082-1.

Electrostatic Discharge (ESD)

EN61000-4-2, EN50082-1.

Radiated Emissions

EN50081-1 for Class B equipment.

Approvals

CE, UL listed (USA, Canada).

UL3121 - general product safety.

■ Configuration

Software Configuration

Units are fully programmable via the Windows 95/98/ME/2000/NT/XP IntelliPack Configuration Program. Configuration downloads from PC through EIA232 serial port using Acromag 800C-SIP kit.

LED Indicators

LEDs indicate power, status, and relay.

■ Physical

Enclosure

Case: Self-extinguishing NYLON type 6.6 polyamide thermoplastic UL94 V-2 NEMA Type 1 enclosure.

Connectors (Removable Terminal Blocks)

Wire Range: AWG #14-24.

Printed Circuit Boards

Military grade FR-4 epoxy glass circuit board.

Dimensions

1.05W x 4.68H x 4.35D inches.

26.7W x 118.9H x 110.5D millimeters.

Shipping Weight

1 pound (0.45 Kg) packed.

■ Ordering Information

IMPORTANT: All IntelliPack units require initial software configuration (order 800C-SIP). See Note 1 below.

895M-0800

Single channel math module with one frequency output and one control/relay output.

896M-0800

Dual channel math module with two frequency outputs and two control/relay outputs.

5020-350

AC current sensor. Required for AC inputs.. See Page 205 for more information.

800C-SIP

Software Interface Package.

Only one kit is required for all IntelliPack models.

See diagram on Page 83 for included parts.

5034-225

USB-to-RS232 adapter. See page 121 for more info.

PS5R-D24

Power supply (24V DC, 2.1A).

See Power Supplies on Page 199.

TBK-B02

Optional terminal block kit, barrier strip style, 4 pcs.

TBK-S02

Optional terminal block kit, spring clamp style, 4 pcs.

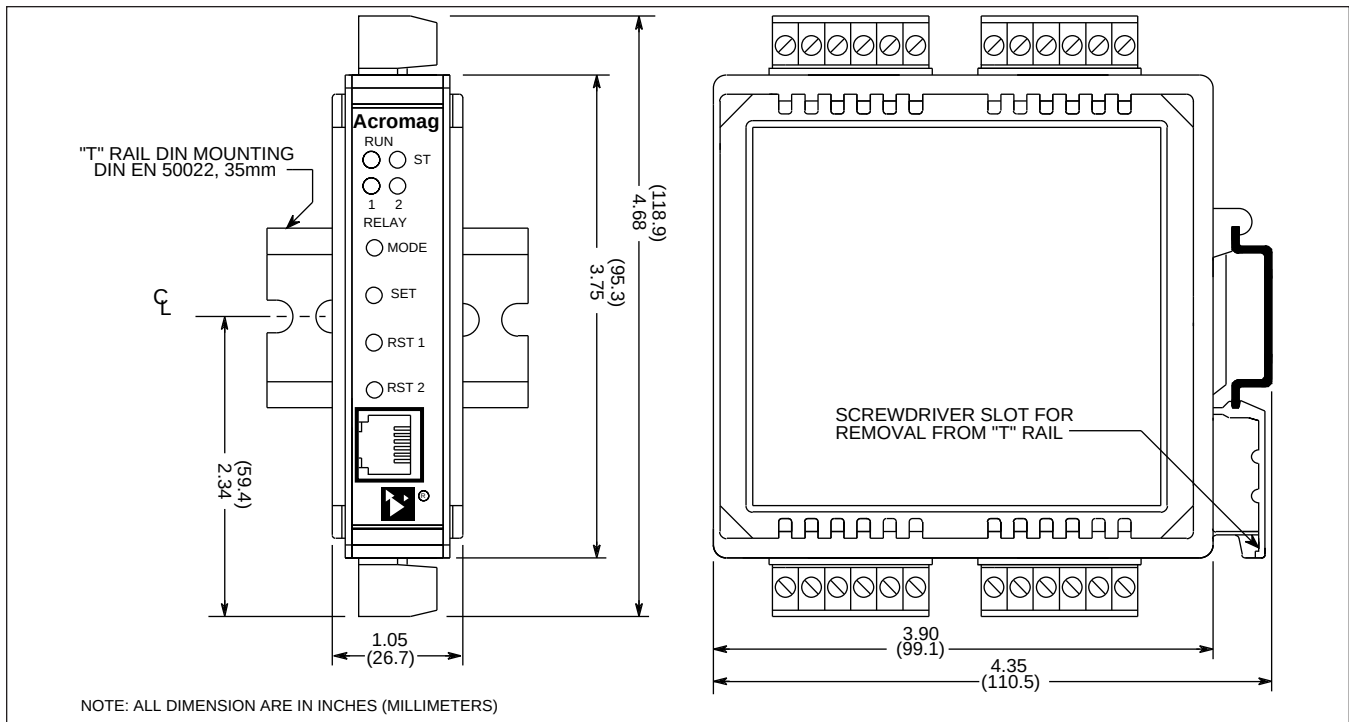
NOTE 1: To order factory configuration, call Acromag for a configuration form which must accompany your order. Also, append "-C" to model number (example: 892M-0500-C). 800C-SIP kit is still recommended.



Optional terminal blocks: barrier strip (left) and spring clamp (right). Cage clamp terminal is standard.



Dimensions





Accessories

Terminal Blocks

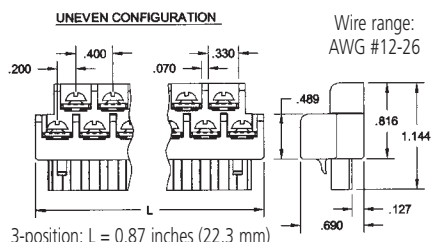
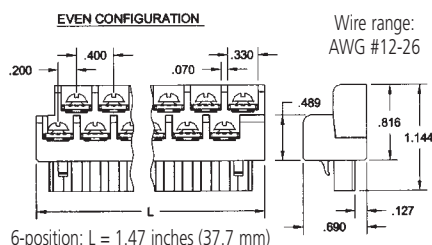


Barrier strip (left) and spring clamp (right).

Ordering Information

See individual I/O modules for compatibility.

Barrier Strip Terminal Blocks

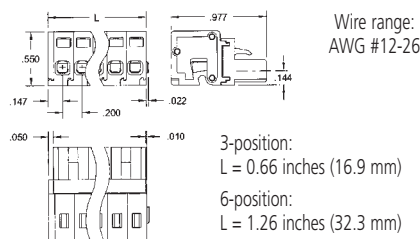


TBK-B01
Terminal block kit,
two 6-position pieces

TBK-B02
Terminal block kit,
four 6-position pieces

TBK-B03
Terminal block kit,
one 3-position and
three 6-position pieces

Spring Clamp Terminal Blocks



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



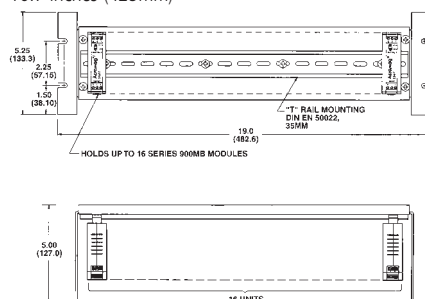
DIN-Rail Mounting

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.

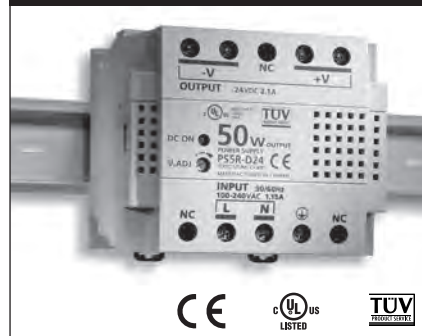
Ordering Information

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)



Power Supplies



50W Supply

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

Output
24V DC, 2.1A (50W)

Ordering Information

P55R-D24
Universal 50W power supply

See Power Supplies on Page 199 for other models and more information.

USB / RS232 Adapter

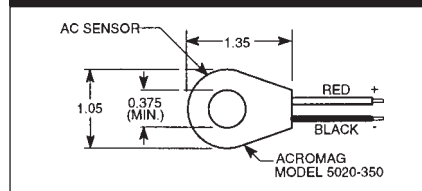


Length: 3.15 in (8.0 cm)
Height: 0.80 in (2.03 cm)
Width: 1.75 in (4.44 cm)
Weight: 1.6 oz (45.36 g)

Ordering Information

5034-225
USB-to-RS232 adapter

AC Current Sensor



Ordering Information

5020-350
AC current sensor (See page 205)

Isolated Transmitters: 600T Series



600T Series Models by Function Guide



◆ 610T Units (4-wire)



Multi-channel, DC-powered isolated transmitters. Designed For high-density panel installations.

◆ 630T Units (4-wire)



Multi-channel AC/DC powered isolators. Provides excitation supply for 2-wire transmitters.

◆ 650T Units (2-wire)



Multi-channel, output loop-powered transmitters with input isolation. Designed to front-end PLC inputs.

◆ 670T Units (2-wire)



Multi-channel, input loop-powered transmitters with output isolation. Designed to isolate PLC outputs to field devices.

	610T	630T	650T	670T
Functions				
4-20mA isolator			X	X
Isolated signal converter/transmitter	X	X		
Signal splitter		X	X	
Channel Configurations				
Single channel units	X	X	X	X
Dual channel units	X	X	X	X
Quad channel units				X
Splitter (one input, two outputs)		X	X	
Power Configurations				
Input loop-powered				X
Output loop-powered (2-wire transmitter)			X	
AC-powered		X		
DC-powered	X	X		
Inputs				
DC voltage input	X		X	
DC current input	X	X	X	X
Thermocouple/millivolt input			X	
RTD/resistance input			X	
AC current input	X			
Outputs				
DC current	X	X	X	X
DC voltage	X			
Isolation Configurations				
Input from output/power	X		X	
Output from input/power	X			X
3-way (input/output/power)	X	X		

600T Series

Isolated Transmitters

611T, 612T	Page 2
631T, 632T, 633T	4
651T, 652T, 653T	6
654T	8
655T, 656T, 653T	10
657T, 658T	12
670T	14

Technical Documentation

Dimensions diagrams	see individual units
Application notes	Page 16
Accessories	21





Isolated Transmitters: 600T Series

611T, 612T Multi-Channel, Universal DC I/O

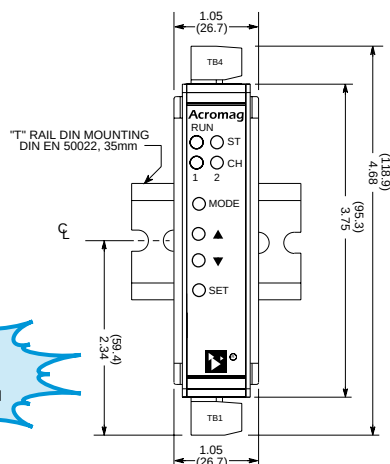


24 HR
STOCK ITEM

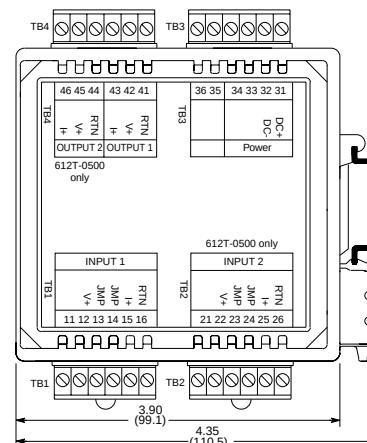
7 YEAR
WARRANTY



**AUTO-CONFIG
SELF-RANGING**



NOTE: ALL DIMENSIONS ARE IN INCHES (MILLIMETERS)



DC current or voltage input ♦ Single/dual-channel DC-powered transmitters

Description

Models

611T: Single I/O channel

612T: Dual I/O channel

These units receive DC current or voltage input signals, provide isolation, and output proportional DC current or voltage signals. With support for universal DC I/O ranges, 610T series transmitters provide a solution for a wide variety of isolation and signal conversion tasks. The single-channel 611T and dual-channel 612T are ideal for panel shops and end-users who require a high-density signal conditioner that can accommodate a broad range of instrumentation applications.

Installation is fast and simple with Acromag's built-in auto-configuration feature. Using your standard calibrator, the 610T's internal microcontroller automatically senses the input source type (voltage or current) and selects the optimum performance range for your zero and full-scale input values. To adjust your output values, simply push the up or down buttons on the front panel until you read the desired output signal on your meter.

Both models provide high-voltage isolation between the input, output and power (3-way). On dual channel units, each channel operates independently, with inputs isolated from each other, to prevent interaction between channels.

For easy troubleshooting, each channel has diagnostic LEDs to identify input over/under range conditions. An additional status LED indicates the unit is operating properly or that the front panel pushbutton lockout feature has been invoked.

Input Ranges

Universal input with automatic configuration

±100mA (self-ranging),
±100V DC (self-ranging),
0 to 20 amps AC (with optional sensor)

Output Ranges

Universal output (user-configured ranges)

0 to 20mA (full range capability),
0 to 10V DC (full range capability)

Power Requirement

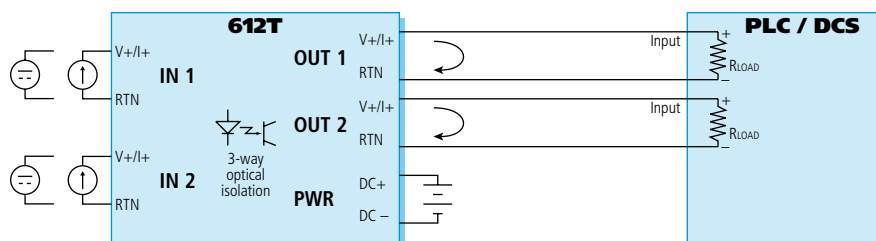
10 to 36V DC

Approvals

CE marked. UL, cUL listed.

Key Features & Benefits

- Universal DC input and output ranges offer flexibility to fit many applications.
- Auto-configuration and self-ranging technologies speed installation without pots, switches, jumpers, or software.
- Optical isolation eliminates ground loops, reduces noise, and blocks transient signals.
- Push-button calibration simplifies field adjustments for faster and easier maintenance.
- Configuration lockout safety feature prevents tampering and accidental changes.
- Reverse-acting output capability enables inverse proportional control signals.
- Each input channel can drive two outputs (a voltage and a current output signal).
- Dual channel model saves space and reduces equipment costs.
- High-resolution Σ - Δ A/D converters deliver superior accuracy for reliable measurements.



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Tel: 248-295-0880 ■ Fax: 248-624-9234 ■ sales@acromag.com ■ www.acromag.com ■ 30765 S Wixom Rd, Wixom, MI 48393 USA

Isolated Transmitters: 600T Series



Performance Specifications

◆ General Input

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

Noise Rejection

Normal Mode: Better than 40dB @ 60Hz.
Common Mode: Better than 100dB @ 60Hz.

Input Overvoltage Protection

Bipolar Transient Voltage Suppressors (TVS).

◆ DC Current Input

DC Current Input Range

$\pm 100\text{mA}$ DC with full range capability.
Minimum recommended span is $\pm 4\text{mA}$.

DC Current Input Impedance

10 ohms.

DC Current Input Accuracy

Better than $\pm 0.1\%$ of output span.

◆ DC Voltage Input

DC Voltage Input Range

$\pm 100\text{V}$ DC with full range capability.
Minimum recommended span is $\pm 40\text{mV}$.

Input impedance

$\pm 1\text{V}$ to $\pm 100\text{V}$ input: greater than 100K ohms.
 $\pm 40\text{mV}$ to $\pm 1\text{V}$ input: 1K ohm

DC Voltage Input Accuracy

Better than $\pm 0.1\%$ of output span.

◆ AC Current Input

AC Current Input Range (optional)

An optional external AC current sensor is required to monitor AC current signals (Model 5020-350).

AC Current Range	Primary Turns
0 to 20A AC	1
0 to 10A AC	2
0 to 5A AC	4
0 to 2A AC	10
0 to 1A AC	20

AC Current Input Accuracy

Better than $\pm 0.5\%$ of output span.



Optional terminal blocks: barrier strip (left) and spring clamp (right). Cage clamp terminal is standard.

◆ Output (DC V/mA)

Current Output

Range: 0 to 20mA maximum (user-configured range).
Compliance: 11V DC typical.
Load resistance range: 0 to 550 ohms.

Voltage Output

Ranges: 0 to 10V maximum (user-configured range).
Compliance: 10mA max. with short circuit protection.
Output impedance: 1 ohms.

Accuracy (overall input to output)

Better than $\pm 0.1\%$ of span for nominal output ranges of 0 to 10V or 0 to 20mA.

Ambient Temperature Effect

Better than $\pm 0.018\%$ of output span per $^{\circ}\text{C}$ or $\pm 1\mu\text{V}$, whichever is greater.

Output Response Time (for input step change)

800mS typical to 98% of final output value.

◆ Environmental

Ambient Temperature

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

Relative Humidity

5 to 95%, noncondensing.

Power Requirements

611T: 10 to 36V DC. 24V DC @ 55mA.
612T: 10 to 36V DC. 24V DC @ 75mA.

Isolation

3-way (input/output/power). 1500V AC for 60 seconds or 250V AC continuous. Dual channel model includes input-to-input isolation and outputs share a common.

Radiated Field Immunity (RFI)

Complies with EN61000-4-3 Level 3 and EN50082-1.

Electromagnetic Field Immunity (EMI)

Less than $\pm 0.25\%$ of output span effect.

Electrical Fast Transient (EFT)

Complies with EN61000-4-4 Level 3 and EN50082-1.

Surge Withstanding Capability (SWC)

Complies with EN61000-4-5 Level 3 and EN50082-1.

Electrostatic Discharge (ESD)

Complies with EN61000-4-2 Level 3 and EN50082-1.

Radiated Emissions

Meets or exceeds EN50081-1 for Class B equipment.

Approvals

CE marked, UL, cUL listed (USA, Canada).
UL3121 general product safety.

◆ Physical

Enclosure

Case: Self-extinguishing NYLON type 6.6 polyamide thermoplastic UL94 V-2 NEMA Type 1 enclosure.

Connectors (Removable Terminal Blocks)

Wire Range: AWG #12-24.

Printed Circuit Boards

Military grade FR-4 epoxy glass circuit board.

Dimensions

1.05W x 4.68H x 4.35D inches.
26.7W x 118.9H x 110.5D millimeters.

Shipping Weight

1 pound (0.45 Kg) packed.

Ordering Information

◆ Models

611T-0500

Single channel isolated transmitter

612T-0500

Dual channel isolated transmitter
Add "-C" suffix for optional factory configuration.

◆ Accessories (see Page 21)

5020-350

AC current sensor. See Page 20 for details.

PS5R-SD24

Power supply (24V DC, 2.5A).

TBK-B02

Optional terminal block kit, barrier strip style, 4 pcs.

TBK-S02

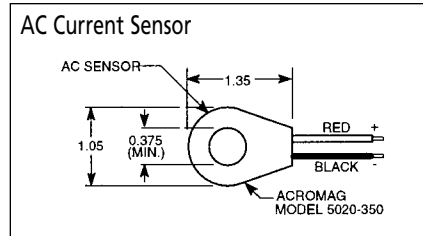
Optional terminal block kit, spring clamp style, 4 pcs.

DIN RAIL 3.0 or DIN RAIL 16.7

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

20RM-16-DIN

19" rack-mount kit with DIN rail.
Holds sixteen 610T series transmitters.



Acromag 
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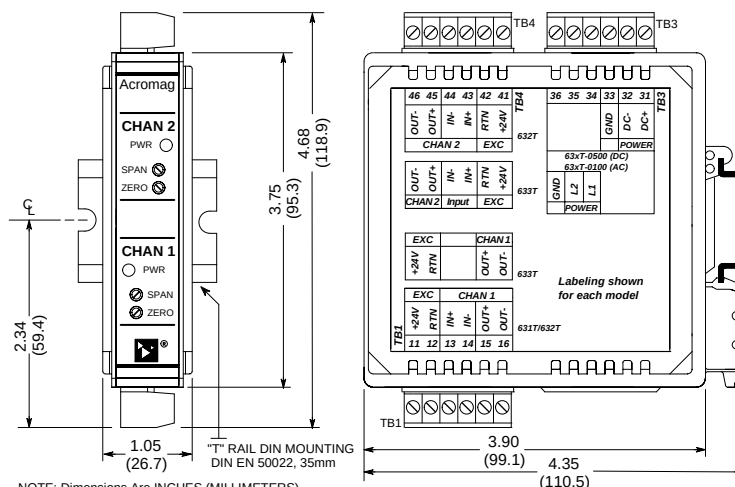
Isolated Transmitters: 600T Series

631T, 632T, 633T Multi-Channel 4-Wire Isolators



24 HR
STOCK ITEM

7 YEAR
WARRANTY



DC current input ♦ Single/dual-channel AC/DC-powered isolators ♦ Signal splitter

Description

Models

631T: Single I/O channel

632T: Dual I/O channel

633T: Single input, dual output (splitter)

These units receive 4-20mA process current inputs and provide isolated 4-20mA output signals. Each channel operates independently and is isolated from the others to prevent interaction between channels. Galvanic isolation eliminates ground loops, reduces noise, and blocks transient signals.

Units are shipped with factory calibration for quick installation. These isolators also automatically compensate for load resistance variations, so re-calibration is rarely necessary. However, adjustable zero and span trim pots are provided to ensure precise calibration for maintenance requirements and long term serviceability.

These isolators generate a 24V input excitation supply suitable for powering one or two 2-wire transmitters. The supply is current limited at each output to prevent any excitation short from pulling down the internal power supply. The internal DC supply improves system performance by isolating loops on a single or dual channel basis. It saves space, complexity, and the expense of installing additional supplies to power your field loops.

Input / Output Ranges

4 to 20mA DC input
4 to 20mA DC output

Power Requirement

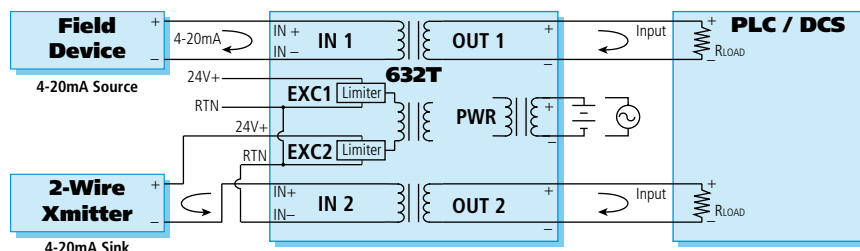
15-36V DC
90-250V AC (125V DC $\pm 10\%$)
Four-wire isolated transmitter

Approvals

CE marked. UL, cUL listed.
Class I, Division 2, Groups A, B, C, D.

Key Features & Benefits

- Two channels in a single unit saves space and reduces costs.
- Signal splitter model (633T) provides two identical isolated outputs from one input signal.
- Built-in isolated excitation supply with short circuit protection can drive up to two field 2-wire process loops.
- Full isolation safely separates each input channel, each output channel, the excitation supply, and power.
- Excellent accuracy and stability ensure reliable operation in hostile environments.
- Low input burden keeps voltage drop to less than 1.5V for full-scale current.
- Supports wide 0 to 1000 ohm load range and no trimming is required if the load varies.
- Current limiting safely limits output to 27mA.
- Pluggable terminals, zero/span trim pots and power LEDs make installation, maintenance, and long term service easy.



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Isolated Transmitters: 600T Series



Performance Specifications

Reference Test Conditions

Input/output current 4 to 20mA; Output load 250 ohms; Power 24V DC or 115V AC; 77°F (25°C).

Input Range

4 to 20mA input (each channel).

Input Burden

Voltage drop (631T, 632T):
Less than 1.5V (75 ohms) at full scale.
Voltage drop (633T):
Less than 3.0V (150 ohms) at full scale.

Input Overvoltage Protection

Bipolar Transient Voltage Suppressors (TVS).

Input Excitation

24V DC $\pm 10\%$, 22mA maximum each. Fully isolated.
Includes independent current limiting at EXC1 and EXC2 near 23mA, each.

Output Range

4-20mA DC output (each channel).

Output Trim Range

Zero and full-scale adjustment to $\pm 4\%$.

Output Limiting

Outputs are limited to 27mA.

Output Load

0 to 1000 ohms (631T).
0 to 950 ohms (632T, 633T).

Output Load Resistance Effect

Less than $\pm 0.01\%$ of output span effect for a ± 100 ohm change in load resistance.

Output Response Time (for input step change)

25mS typical to 98% of final output value.

Accuracy

$\pm 0.05\%$ of output span. Error includes the combined effects of isolator repeatability, hysteresis, terminal point linearity and adjustment resolution.

Temperature Drift

Better than $\pm 50\text{ppm}/^\circ\text{C}$ ($\pm 0.005\%/^\circ\text{C}$) over the ambient temperature range. This specification includes the combined effects of zero and span over temperature.

Calibration

Two 15-turn potentiometers (zero and span) per output channel, accessible from front of the unit.

Bandwidth

-3dB at 50Hz, typical with a 500 ohm load.

Noise Rejection

Common mode: Better than 100dB at 60Hz, typical.
Normal mode: -6dB at 60Hz, typical, 500 ohm load.

LED Indicators

Green, one LED per output channel.
Constant ON indicates power applied.

◆ Environmental

Ambient Temperature

Operating: -25 to 75°C (-13 to 167°F),
[if excitation supplies are used on 632T or 633T
-25 to 60°C (-13 to 140°F)]
Storage: -40 to 85°C (-40 to 185°F)

Relative Humidity

5 to 95%.

Power Requirement

DC-powered units: 15-36V DC SELV.
AC-powered units: 90-250V AC (125V DC $\pm 10\%$)
631T: 1.5 watts without excitation, 2.4 watts with excitation.
632T, 633T: 3.0 watts without excitation, 4.8 watts with excitation.

Isolation

Inputs, outputs, individual channels, power, and excitation supplies are isolated from each other for common-mode voltages up to 250V AC, or 354V DC off ground, on a continuous basis (will withstand 1500V AC dielectric strength test for one minute without breakdown).

Electromagnetic Field Immunity (EMI)

Less than $\pm 0.25\%$ of output span effect under the influence of electromagnetic fields from switching solenoids, commutator motors, and drill motors.

Meets Immunity Standards Per EN50082-1

Electrostatic Discharge (ESD) Immunity
4KV direct contact and 8KV air-discharge to the enclosure port per EN61000-4-2.

Radiated Field Immunity (RFI)

10V/M, 80 to 1000MHz AM and 900MHz keyed carrier, per EN61000-4-3 and ENV50204.

Electrical Fast Transient Immunity (EFT)

2KV to power and 1KV to signal I/O per EN61000-4-4.

Conducted RF Immunity (CRFI)

10Vrms, 150KHz to 80MHz, per EN61000-4-6.

Surge Immunity

0.5KV per EN61000-4-5.

Emissions Per European Norm EN50081-1

Radiated Frequency Emissions
30 to 1000MHz per EN55022 Class B.

Approvals

CE marked
UL listed (UL3121 and UL1604).
cUL listed (C22.2, NO.1010.1-92).
Hazardous Locations: Class I: Div. 2; Groups A, B, C, D

◆ Physical

Enclosure

Case: Self-extinguishing NYLON type 6.6 polyamide thermoplastic UL94 V-2 NEMA Type 1 enclosure.

Connectors (Removable Terminal Blocks)

Wire Range: AWG #14-22 (AWG #12 stranded only).

Printed Circuit Boards

Military grade FR-4 epoxy glass circuit board.

Dimensions

1.05W x 4.68H x 4.35D inches.
26.7W x 95.3H x 110.5D millimeters.

Ordering Information

◆ Models

631T-0100

Single channel isolator, AC-powered

631T-0500

Single channel isolator, DC-powered

632T-0100

Dual channel isolator, AC-powered

632T-0500

Dual channel isolator, DC-powered

633T-0100

Single input with dual isolated output, AC-powered

633T-0500

Single input with dual isolated output, DC-powered

◆ Accessories (see Page 21)

PSSR-SD24

Power supply (24V DC, 2.5A).

TBK-B02

Optional terminal block kit, barrier strip style, 4 pcs.

TBK-S02

Optional terminal block kit, spring clamp style, 4 pcs.

DIN RAIL 3.0

DIN RAIL 16.7

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

20RM-16-DIN

19" rack-mount kit with DIN rail.
Holds sixteen 630T transmitters.

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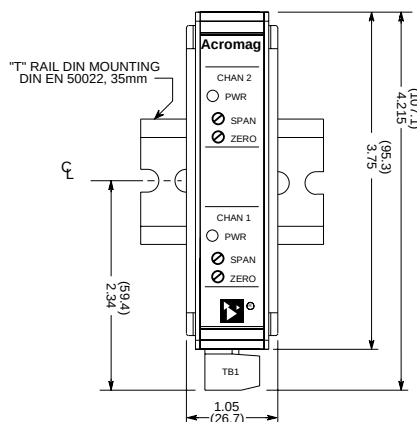
Isolated Transmitters: 600T Series

651T, 652T, 653T Multi-Channel, Two-Wire Isolators

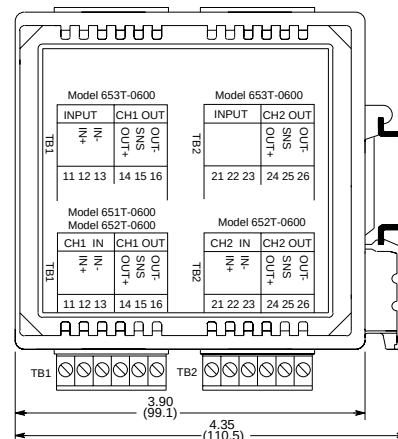


24 HR
STOCK ITEM

7 YEAR
WARRANTY



NOTE: ALL DIMENSION ARE IN INCHES (MILLIMETERS)



DC current input ♦ Single/dual-channel DC-powered isolators ♦ Signal splitter

Description

Models

651T: Single I/O channel

652T: Dual I/O channel

653T: Single input, dual output (splitter)

These units receive 4-20mA process current inputs and provide isolated 4-20mA output signals. Each channel operates independently and is isolated from the others to prevent interaction between channels.

For easy troubleshooting, each unit has LEDs and diagnostic test points. Power LEDs help identify output open loop conditions. The precision 10 ohm sense resistor enables monitoring of the output signal without disturbing field wiring.

Input / Output Ranges

4 to 20mA DC input

4 to 20mA DC output

Power Requirement

12 to 36V DC (loop-powered)

Two-wire transmitter

Approvals

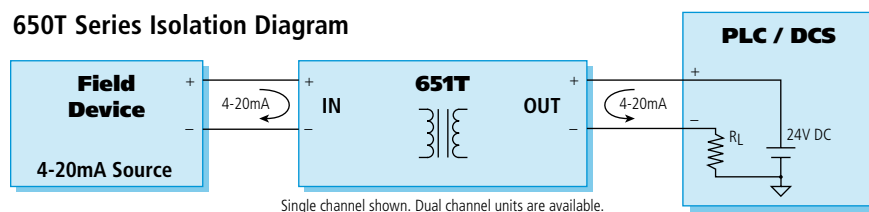
CE marked. UL, cUL listed

Class I, Division 2, Groups A, B, C, D.

Key Features & Benefits

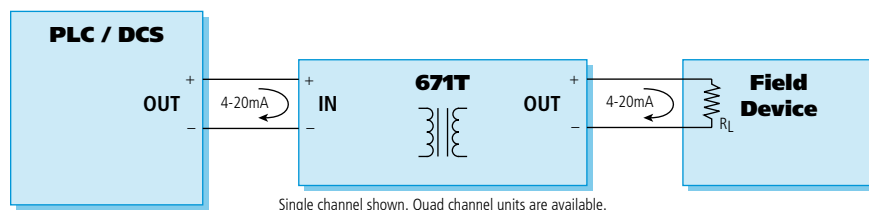
- Two channels in a single unit saves space and reduces costs.
- Signal splitter model (653T) provides two identical outputs from one input signal.
- Galvanic isolation eliminates ground loops, reduces noise, and blocks transient signals.
- Independent channels prevent signal interaction and offer spares for later use.
- Power LEDs provide a visual indication of operational process loops.
- Excellent accuracy and stability ensure reliable

650T Series Isolation Diagram



Note: 650T series transmitters are for two-wire transmitter interfaces (sinks current). For application notes using 650T Transmitters, refer to Page 16.

670T Series Isolation Diagram



Note: 670T series transmitters are for output resistive loads only (sources current). For more information on the 670T Transmitter, refer to Page 14. Application notes are on Page 16.

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Isolated Transmitters: 600T Series



Performance Specifications

Reference Test Conditions

Input/Output current: 4 to 20mA; output load 500 ohms; 77°F (25°C).

Input range

4 to 20mA input (each channel).

Input burden

Voltage drop (651T, 652T): Less than 1.5V, typical (75 ohm equivalent).

Voltage drop (653T): Less than 3.0V, typical (150 ohm equivalent).

Output range

4-20mA DC output (each channel).

$RI = (P_{supply} - 12V) / 0.02$

Output compliance

$P_{supply} = 12V + (0.02 \times R_{load})$

Output limiting

Outputs are limited to 36mA.

Output ripple

Less than $\pm 0.1\%$ of the maximum output span.

Accuracy

$\pm 0.1\%$ of output span. Error includes the combined effects of isolator repeatability, hysteresis, terminal point linearity and adjustment resolution.

Ambient temperature effect

Less than $\pm 0.006\%$ of input span per °F ($\pm 0.01\%$ per °C) over the ambient temperature range for reference test conditions. This specification includes the combined effects of zero and span over temperature.

Calibration

Two 15-turn potentiometers (zero and span) per channel, accessible from front of the unit.

Bandwidth

-3dB at 4.5Hz, typical.

Response time

For a step input, the output reaches 98% of output span in 15mS, typical.

Noise rejection

Common mode: 100dB at 60Hz, typical.

Normal mode: -5dB at 60Hz, 100 ohm source, typical.

Diagnostics

LED power indicator: Off for output open loop detection, power, or load compliance problem.

Field test points: An internal 10 ohm sense resistor provides test points for monitoring the output signal current during field maintenance.

Environmental

Ambient Temperature

Operating: -25 to 70°C (-13 to 158°F).

Storage: -40 to 85°C (-40 to 185°F).

Relative Humidity

5 to 95%.

Power Requirement

12 to 50V DC for each output channel.

Isolation

Inputs, outputs, and individual channels are isolated from each other for common-mode voltages up to 250V AC, or 354V DC off ground, on a continuous basis (will withstand 1500V AC dielectric strength test for one minute without breakdown).

Radiated Field Immunity (RFI)

Complies with EN61000-4-3 Level 3 (10V/m, 30 to 1000MHz) and European Norm EN50082-1.

Electromagnetic Field Immunity (EMI)

Less than $\pm 0.25\%$ of output span effect under the influence of electromagnetic fields from switching solenoids, commutator motors, and drill motors.

Surge Immunity

Complies with EN61000-4-5 Level 3 (2KV) and European Norm EN50082-1.

Electrical Fast Transient (EFT)

Complies with EN61000-4-4 Level 3 (2KV) and European Norm EN50082-1.

Electrostatic Discharge (ESD)

Complies with EN61000-4-2 Level 3 (8KV air, 4KV direct to the enclosure port) and European Norm EN50082-1.

Radiated Emissions

Meets or exceeds European Norm EN50081-1 for Class B equipment.

Approvals

CE marked

UL listed (UL508 and

17th Edition ANSI/ISA 12.12.01-2007).

cUL listed (C22.2, 142-M1987 and 213-M1987).

Hazardous Locations: Class I: Div. 2; Groups A, B, C, D

Physical

Enclosure

Case: Self-extinguishing NYLON type 6.6 polyamide thermoplastic UL94 V-2 NEMA Type 1 enclosure.

Connectors (Removable Terminal Blocks)

Wire Range: AWG #14-22 (AWG #12 stranded only).

Printed Circuit Boards

Military grade FR-4 epoxy glass circuit board.

Dimensions

1.05W x 4.68H x 4.35D inches.

26.7W x 95.3H x 110.5D millimeters.

Shipping Weight

1 pound (0.45 Kg) packed.

Ordering Information

Models

651T-0600

Single channel 2-wire transmitter

652T-0600

Dual channel 2-wire transmitter

653T-0600

Single input with dual isolated output transmitter

Accessories (see Page 21)

PS5R-SD24

Power supply (24V DC, 2.5A).

TBK-B01

Optional terminal block kit, barrier strip style, 2 pcs.

TBK-S01

Optional terminal block kit, spring clamp style, 2 pcs.

DIN RAIL 3.0

DIN RAIL 16.7

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

20RM-16-DIN

19" rack-mount kit with DIN rail.

Holds sixteen 650T transmitters.



Optional terminal blocks: barrier strip (left) and spring clamp (right). Cage clamp terminal is standard.

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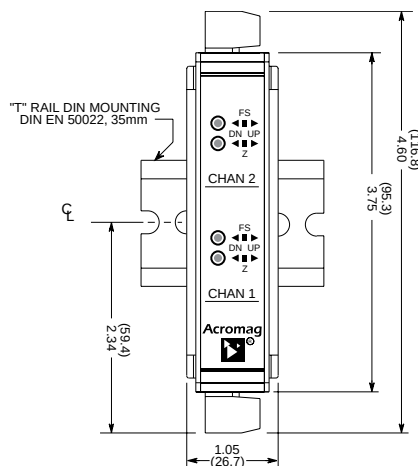
Isolated Transmitters: 600T Series

654T Multi-Channel, Two-Wire Transmitters

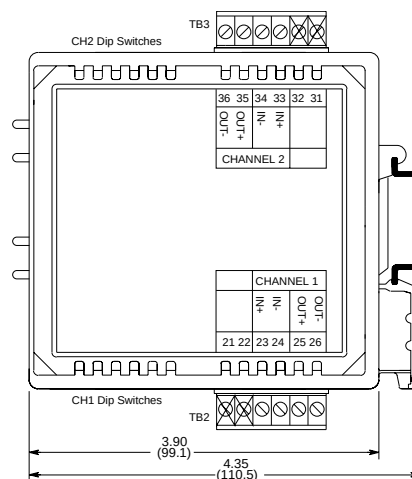


24 HR
STOCK ITEM

7 YEAR
WARRANTY



NOTE: ALL DIMENSIONS ARE IN INCHES (MILLIMETERS)



DC voltage input ♦ Dual-channel DC-powered transmitters

Description

Models

654T: Dual DC voltage input channels

These units accept DC voltage input signals, provide isolation, and output proportional DC current signals. With two independent I/O channels in a slim package, the 654T is ideal for panel shops and end-users who require a high-density signal conditioner that can cover a broad range of measurement applications.

Configuration is fast and easy. First, you select the input range for each channel with simple DIP switches. Then, you set your zero/full-scale output values using the noninteractive increase/decrease toggle switches on the front panel to modify the output signal until the desired output value is read on your voltmeter. The switches make it easy to calibrate a normal (proportional) or reverse-acting (inverse) response in seconds. After setting the desired calibration, you can engage the safety lockout feature on the DIP switch to prevent accidental changes and unauthorized tampering.

The 654T provides two independent high-voltage input isolation circuits. Loss of power or a failure on one channel has no effect on the other. The second channel can be used as a built-in spare for reduced downtime should the first channel fail. The spare channel becomes operational by simply moving the wired terminal block over to the vacant channel.

Input Ranges

Bipolar: $\pm 78\text{mV}$ to $\pm 625\text{mV}$ (selectable ranges)

Unipolar: 0–1.25 to 0–10V DC (selectable ranges)

Output Range

4 to 20mA DC

Power Requirement

12 to 50V DC (loop-powered)

Two-wire transmitter

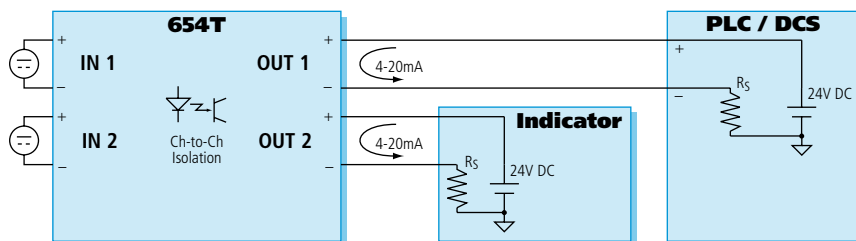
Approvals

CE marked. UL, cUL listed

Class I; Division 2; Groups A, B, C, D.

Key Features & Benefits

- DIP switch-configuration simplifies installation without analog pots, jumpers, or software.
- Isolation eliminates ground loops, reduces noise, and blocks transient signals.
- One-step calibration with increase/decrease toggle switches simplifies field adjustments for faster and easier maintenance.
- Automatic self-calibration compensates for temperature effects and component aging to deliver maintenance-free operation.
- Configuration lockout safety feature helps prevent tampering and accidental calibration changes.
- Reverse-acting output capability enables inverse proportional control signals.
- Dual channel model saves space and reduces equipment costs.
- High-resolution 16-bit $\Sigma\text{-}\Delta$ A/D converters deliver superior accuracy for more reliable measurements.
- Built-in transient voltage suppressors protect circuitry from electrical interference.



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Isolated Transmitters: 600T Series



Performance Specifications

◆ General Input

Analog to Digital Converter (ADC)

16-bit $\Sigma\text{-}\Delta$ A/D converter.

Noise Rejection

Normal Mode: Better than 40dB @ 60Hz with 100 ohm input unbalance.

Common Mode: Better than 140dB @ 60Hz with 100 ohm input unbalance.

Input Overvoltage Protection

Bipolar Transient Voltage Suppressors (TVS).

◆ DC Voltage Input

Input Range

DIP switch-selectable. See table below.

Input Range	Recommended Minimum Span (10%)
A) $\pm 78\text{mV}$	15mV
B) $\pm 156\text{mV}$	31mV
C) $\pm 313\text{mV}$	62mV
D) $\pm 625\text{mV}$	124mV
E) 0 to 1.25V	125mV
F) 0 to 2.5V	250mV
G) 0 to 5V	500mV
H) 0 to 10V	1000mV

Span adjust: See table above.

Zero adjust: 100% full range.

Input Impedance

110K ohms, typical

◆ Output

Output Range

Range: 4 to 20mA DC, 3.8 to 24mA range typical.

Output Compliance

$R_{LOAD} = (V_{SUPPLY} - 12V) / 0.02A$

600 ohms at 24V DC supply

Output Response Control

Proportional/inverse selectable.

Ambient Temperature Effect

Better than $\pm 0.018\%$ of input span per $^{\circ}\text{C}$ ($\pm 0.01\%$ per $^{\circ}\text{F}$).

Output Resolution

Output resolves to 1 part in 6546 for the nominal 4 to 20mA output span.

Output Response Time (for input step change)

980ms typical to 98% of final output value.

Accuracy (overall input to output)

$\pm 0.1\%$ of output span.

◆ Environmental

Ambient Temperature

Operating: -25 to 75°C (-13 to 167°F).

Storage: -40 to 85°C (-40 to 185°F).

Relative Humidity

5 to 95%, noncondensing.

Power Requirement

12 to 50V DC @ 25mA for each output channel.

Isolation

Inputs, outputs, and individual channels are isolated from each other for common-mode voltages up to 250V AC, or 354V DC off ground, on a continuous basis (will withstand 1500V AC dielectric strength test for one minute without breakdown).

Radiated Field Immunity (RFI)

Designed to comply with EN61000-4-3 Level 3 and EN50082-1.

Electromagnetic Field Immunity (EMI)

Less than $\pm 0.25\%$ of output span effect.

Electrical Fast Transient (EFT)

Complies with EN61000-4-4 Level 3 (2KV) and EN50082-1.

Electrostatic Discharge (ESD)

Complies with EN61000-4-2 Level 3 (8KV air or 4KV direct) and EN50082-1.

Radiated Emissions

Meets or exceeds EN50081-1 for Class B equipment.

Approvals

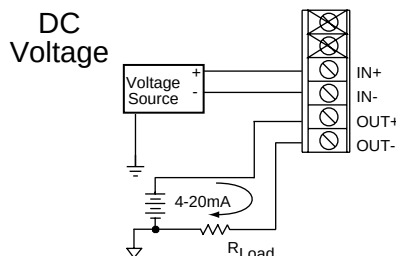
CE marked

UL listed (UL508 and UL1604)

cUL listed (C22.2, 142-M1987 and 213-M1987).

Hazardous Loc.: Class I; Division 2; Groups A, B, C, D.

Input Connections



◆ Physical

Enclosure

Case: Self-extinguishing NYLON type 6.6 polyamide thermoplastic UL94 V-2 NEMA Type 1 enclosure.

Connectors (Removable Terminal Blocks)

Wire Range: AWG #12-24.

Printed Circuit Boards

Military grade FR-4 epoxy glass circuit board.

Dimensions

1.05W x 4.68H x 4.35D inches.

26.7W x 118.9H x 110.5D millimeters.

Shipping Weight

1 pound (0.45 Kg) packed.

Ordering Information

◆ Models

654T-0600

Dual channel DC voltage 2-wire transmitter.

Add "-C" suffix for optional factory configuration.

◆ Accessories (see Page 21)

PS5R-SD24

Power supply (24V DC, 2.5A).

TBK-B01

Optional terminal block kit, barrier strip style, 2 pcs.

TBK-S01

Optional terminal block kit, spring clamp style, 2 pcs.

DIN RAIL 3.0

DIN RAIL 16.7

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

20RM-16-DIN

19" rack-mount kit with DIN rail.

Holds sixteen 650T transmitters.



Optional terminal blocks: barrier strip (left) and spring clamp (right). Cage clamp terminal is standard.

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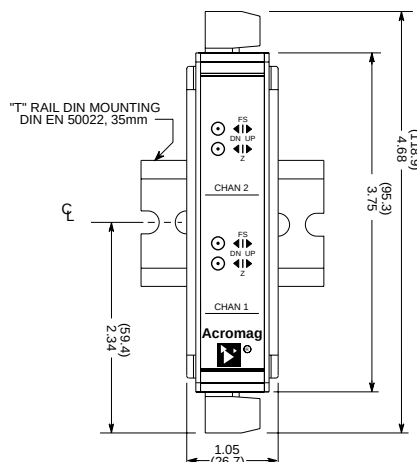
Isolated Transmitters: 600T Series

655T, 656T Multi-Channel, Two-Wire Transmitters

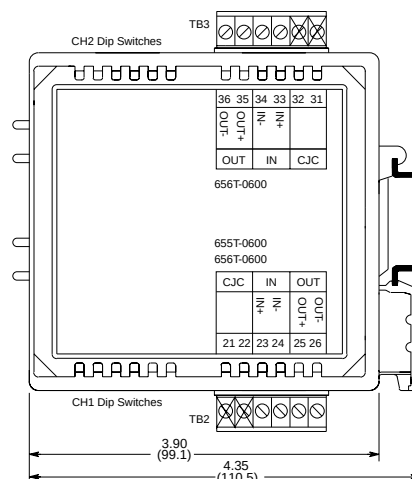


24 HR
STOCK ITEM

7 YEAR
WARRANTY



NOTE: ALL DIMENSION ARE IN INCHES (MILLIMETERS)



Thermocouple and millivolt input ♦ Single/dual channel loop-powered transmitter

Description

Models

655T: Single TC/mV input channel

656T: Dual TC/mV input channel

These units accept universal thermocouple and millivolt input signals, provide isolation, and output proportional DC current signals. The output can also be linearized to the input sensor signal. Single-channel 655T and dual-channel 656T units are ideal for panel shops and end-users who require a high-density signal conditioner that can cover a broad range of temperature measurement applications.

Configuration is fast and easy. First, you select the input type with a simple DIP switch. Then, you set your zero/full-scale output values using a toggle switch on the front panel to increase or decrease the signal until you read the desired output value on your voltmeter. The toggles make it easy to calibrate a normal (proportional) or reverse-acting (inverse) response in seconds. After setting the desired calibration, just press the mode/set toggle and your configuration settings are safely saved to nonvolatile memory.

Both models provide high-voltage input isolation (output and power circuits share a common). On dual channel units, each channel operates independently, with inputs isolated from each other, to prevent interaction between channels.

Input Ranges

TC types: J, K, T, R, S, E, B, N
(DIP switch selection)

DC voltage: $\pm 15.6\text{mV}$ to $\pm 62.5\text{mV}$, 0 to 1V DC

Output Ranges

4 to 20mA DC

Power Requirement

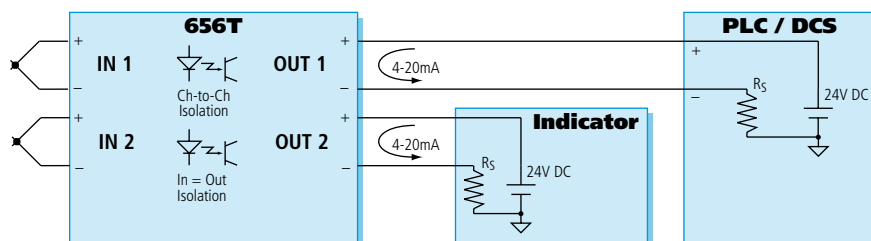
12 to 50V DC (loop-powered)
Two-wire transmitter

Approvals

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

Key Features & Benefits

- Selectable thermocouple input types offer flexibility to fit many applications.
- DIP switch-configuration and self-ranging technologies speed installation without pots, jumpers, or software.
- Linearizer function provides an output that is linear to the temperature or millivolt signal.
- Isolation eliminates ground loops, reduces noise, and blocks transient signals.
- Toggle-switch calibration simplifies field adjustments for faster and easier maintenance.
- Configuration lockout safety feature prevents tampering and accidental changes.
- Reverse-acting output capability enables inverse proportional control signals.
- Dual channel model saves space and reduces equipment costs.
- CJC control only requires a millivolt source to calibrate modules
- High-resolution $\Sigma\text{-}\Delta$ A/D converters deliver superior accuracy for reliable measurements.



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Isolated Transmitters: 600T Series



Performance Specifications

◆ General Input

Analog to Digital Converter (ADC)
16-bit S-D A/D converter.

Noise Rejection

Normal Mode: Better than 40dB @ 60Hz.
Common Mode: Better than 100dB @ 60Hz.

Input Overvoltage Protection

Bipolar Transient Voltage Suppressors (TVS).

◆ Thermocouple Input

Input Ranges (switch-selectable)

TC Type	Temperature Range	Accuracy
J	-210 to 760°C (-346 to 1400°F)	±0.5°C
K	200 to 1372°C (-328 to 2502°F)	±0.5°C
T	-260 to 400°C (-436 to 752°F)	±0.5°C
R	-50 to 1768°C (-58 to 3214°F)	±1.0°C
S	-50 to 1768°C (-58 to 3214°F)	±1.0°C
E	-200 to 1000°C (-328 to 1832°F)	±0.5°C
B	260 to 1820°C (500 to 3308°F)	±1.0°C
N	-230 to 1300°C (-382 to 2372°F)	±0.5°C

Span adjust: Full range. 100°C or 3mV minimum span recommended.

Zero adjust: 0 to 90 % of full range.

Thermocouple Linearization

On/off selectable.

Thermocouple Break Detection

TC sensor failure can be configured for either upscale or downscale.

Cold Junction Compensation (CJC) Control

On/off selectable.

◆ Millivolt Input

Input Range

Ranges: ±15.6, ±31.3, ±62.5mV
0 to 0.125, 0.25, 0.5, 1.0V DC
Span adjust: 10 to 100% of range.
Zero adjust: 0 to 90% of range.

◆ Output

Output Range

Range: 4 to 20mA DC, 3.8 to 22mA range typical.

Output Compliance

$$R_{load} = (V_{supply} - 12V) / 0.02A$$

Output Response Control

Proportional/inverse selectable.

Ambient Temperature Effect

Better than ±0.006% of input span per °C or ±100ppm/°C, whichever is greater.

Output Response Time (for input step change)

700mS typical to 98% of final output value.

◆ Environmental

Ambient Temperature

Operating: -25 to 75°C (-13 to 167°F).
Storage: -40 to 85°C (-40 to 185°F).

Relative Humidity

5 to 95%, noncondensing.

Power Requirement

12 to 50V DC @ 25mA for each output channel.

Isolation

Inputs, outputs, and individual channels are isolated from each other for common-mode voltages up to 250V AC, or 354V DC off ground, on a continuous basis (will withstand 1500V AC dielectric strength test for one minute without breakdown).

Radiated Field Immunity (RFI)

Complies with EN61000-4-3 Level 3 and EN50082-1.

Electromagnetic Field Immunity (EMI)

Less than ±0.25% of output span effect.

Electrical Fast Transient (EFT)

Complies with EN61000-4-4 Level 3 and EN50082-1.

Electrostatic Discharge (ESD)

Complies with EN61000-4-2 Level 3 and EN50082-1.

Radiated Emissions

Meets or exceeds EN50081-1 for Class B equipment.

Approvals

CE marked.
UL listed (UL508 and UL1604).
cUL listed (C22.2, 142-M-1987 and 213-M1987).
Hazardous Loc.: Class I; Division 2; Groups A, B, C, D.

◆ Physical

Enclosure

Case: Self-extinguishing NYLON type 6.6 polyamide thermoplastic UL94 V-2 NEMA Type 1 enclosure.

Connectors (Removable Terminal Blocks)

Wire Range: AWG #12-24.

Printed Circuit Boards

Military grade FR-4 epoxy glass circuit board.

Dimensions

1.05W x 4.68H x 4.35D inches.
26.7W x 118.9H x 110.5D millimeters.

Shipping Weight

1 pound (0.45 Kg) packed.

Ordering Information

◆ Models

655T-0600

Single channel TC 2-wire transmitter. Full feature set.

656T-0600

Dual channel TC 2-wire transmitter. Full feature set.

Add "-C" suffix for optional factory configuration.

656T-E600

Dual channel TC 2-wire transmitter. Economy version.
TC Type J, K and 0-125mV input ranges only.
No linearization. No inverse output (proportional only).

Accessories (see Page 21)

PS5R-SD24

Power supply (24V DC, 2.5A).

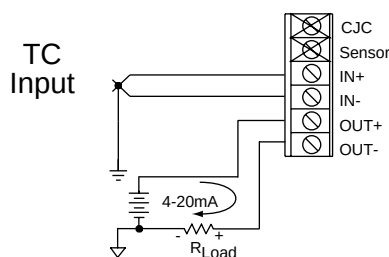
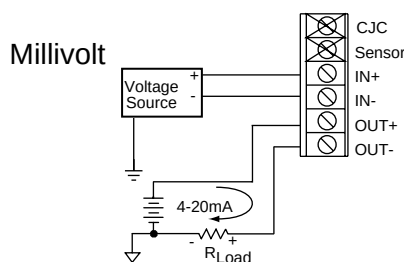
DIN RAIL 3.0

DIN RAIL 16.7

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

20RM-16 DIN

19" rack-mount kit with DIN rail.
Holds sixteen 650T series transmitters.



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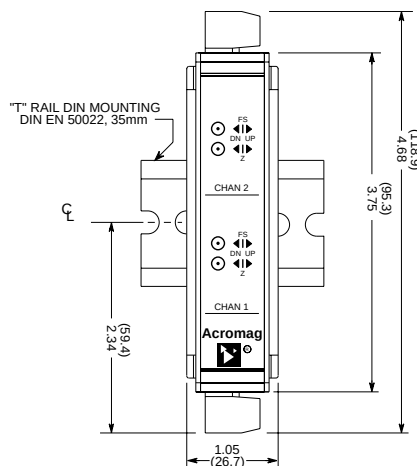
Isolated Transmitters: 600T Series

657T, 658T Multi-Channel, Two-Wire Transmitters

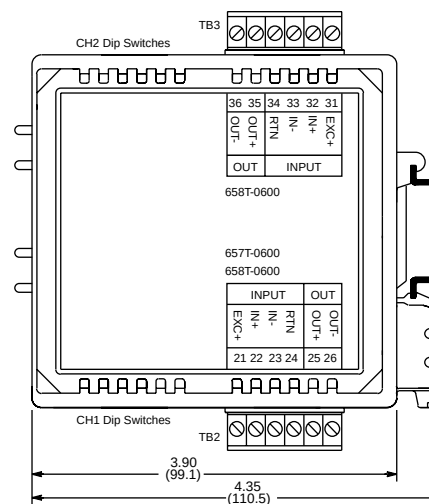


24 HR
STOCK ITEM

7 YEAR
WARRANTY



NOTE: ALL DIMENSION ARE IN INCHES (MILLIMETERS)



RTD / resistance input ♦ Single/dual channel loop-powered transmitter

Description

Models

657T: Single RTD input channel

658T: Dual RTD input channels

These units accept universal RTD or resistance input signals and output proportional DC current signals. The output can also be linearized to the input sensor signal. Single-channel 657T and dual-channel 658T units are ideal for panel shops and end-users who require a high-density signal conditioner that can accommodate a broad range of temperature measurement applications.

Configuration is fast and easy. First, you select the input type with a simple DIP switch. Then, you set your zero/full-scale output values using a toggle switch on the front panel to increase or decrease the signal until you read the desired output value on your voltmeter. The toggles make it easy to calibrate a normal (proportional) or reverse-acting (inverse) response in seconds. After completing the calibration, just press the mode/set toggle and your configuration settings are safely saved to nonvolatile memory.

Input Ranges

RTD: 100 ohm Pt, 120 ohm Ni, 10 ohm Cu

Resistance: 0 to 500 ohms

Output Range

4 to 20mA DC

Power Requirement

12 to 50V DC (loop-powered)

Two-wire transmitter

Approvals

CE marked. UL, cUL listed

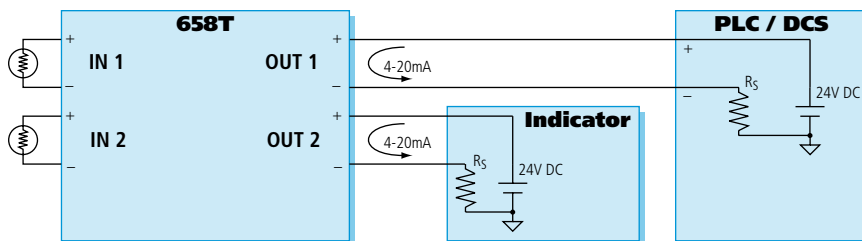
Class I; Division 2; Groups A, B, C, D.



Optional terminal blocks: barrier strip (left) and spring clamp (right). Cage clamp terminal is standard.

Key Features & Benefits

- Selectable RTD input types offer flexibility to fit many applications.
- DIP switch-configuration and self-ranging technologies speed installation without pots, jumpers, or software.
- Toggle-switch calibration simplifies field adjustments for faster and easier maintenance.
- Configuration lockout safety feature prevents tampering and accidental changes.
- Reverse-acting output capability enables inverse proportional control signals.
- Dual channel model saves space and reduces equipment costs.
- High-resolution $\Sigma\Delta$ A/D converters deliver superior accuracy for reliable measurements.
- Lead break detection supports upscale or downscale failsafe mode.



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Tel: 248-295-0880 ■ Fax: 248-624-9234 ■ sales@acromag.com ■ www.acromag.com ■ 30765 S Wixom Rd, Wixom, MI 48393 USA

Isolated Transmitters: 600T Series



Performance Specifications

General Input

Analog to Digital Converter (ADC)
16-bit S-D A/D converter.

Noise Rejection

Normal Mode: Better than 40dB @ 60Hz.
Common Mode: Better than 100dB @ 60Hz.

Input Overvoltage Protection

Bipolar Transient Voltage Suppressors (TVS).

Input Impedance

400K ohm at 10mV span;
input current, ± 25 nA, typical (± 30 nA, max.).

RTD Input

RTD Input Ranges

100 Ω Pt, 120 Ω Ni, or 10 Ω Cu; user-configured.

RTD	°C Range (°F Range)	Accuracy
Pt1	-200 to 850°C (-328 to 1562°F)	$\pm 0.25^\circ\text{C}$
Pt2	-200 to 850°C (-328 to 1562°F)	$\pm 0.25^\circ\text{C}$
Ni	-80 to 320°C (-112 to 608°F)	$\pm 0.25^\circ\text{C}$
Cu	200 to 260°C (-328 to 500°F)	$\pm 1.00^\circ\text{C}$

Alpha: Pt1 ($\alpha = 1.3850$), Pt2 ($\alpha = 1.3911$),
Ni $\alpha = 1.6720$, Cu ($\alpha = 1.4272$).

2, 3, or 4-wire configurations supported. Module provides sensor excitation, linearization, lead-wire compensation, and sensor break detection.

RTD Excitation Current

0.5mA DC typical, all types.

RTD Lead-Wire Compensation

25 ohms per lead.

RTD Break Detection

Configurable for either upscale or downscale.

Resistance Input

Resistance Input Range

0 to 500 ohms.

Resistance Accuracy

± 0.05 ohms.

Output

Output Range

Range: 4 to 20mA DC, 3.8 to 22mA range typical.

Output Compliance

$R_{load} = (V_{supply} - 12V) / 0.02A$

Output Response Control

Proportional/inverse selectable.

Ambient Temperature Effect

Better than $\pm 0.006\%$ of input span per $^\circ\text{C}$ or ± 100 ppm/ $^\circ\text{C}$, whichever is greater.

Output Response Time (for input step change)

700mS typical to 98% of final output value.

Environmental

Ambient Temperature

Operating: -25 to 75 $^\circ\text{C}$ (-13 to 167 $^\circ\text{F}$).

Storage: -40 to 85 $^\circ\text{C}$ (-40 to 185 $^\circ\text{F}$).

Relative Humidity

5 to 95%, noncondensing.

Power Requirement

12 to 50V DC @ 25mA for each output channel.

Isolation

Not isolated.

Radiated Field Immunity (RFI)

Complies with EN61000-4-3 Level 3 and EN50082-1.

Electromagnetic Field Immunity (EMI)

Less than $\pm 0.25\%$ of output span effect.

Electrical Fast Transient (EFT)

Complies with EN61000-4-4 Level 3 and EN50082-1.

Electrostatic Discharge (ESD)

Complies with EN61000-4-2 Level 3 and EN50082-1.

Radiated Emissions

Meets or exceeds EN50081-1 for Class B equipment.

Approvals

CE marked.

UL listed (UL508 and UL1604).

cUL listed (C22.2, 142-M1987 and 213-M1987).

Hazardous Loc.: Class I; Division 2; Groups A, B, C, D.

Physical

Enclosure

Case: Self-extinguishing NYLON type 6.6 polyamide thermoplastic UL94 V-2 NEMA Type 1 enclosure.

Connectors (Removable Terminal Blocks)

Wire Range: AWG #12-24.

Printed Circuit Boards

Military grade FR-4 epoxy glass circuit board.

Dimensions

1.05W x 4.68H x 4.35D inches.

26.7W x 118.9H x 110.5D millimeters.

Shipping Weight

1 pound (0.45 Kg) packed.

Ordering Information

Models

657T-0600 (add "-C" for factory calibration)
Single channel RTD 2-wire transmitter

658T-0600 (add "-C" for factory calibration)
Dual channel RTD 2-wire transmitter

Add "-C" suffix for optional factory configuration.

Accessories (see Page 21)

PS5R-SD24

Power supply (24V DC, 2.5A).

TBK-B01

Optional terminal block kit, barrier strip style, 2 pcs.

TBK-S01

Optional terminal block kit, spring clamp style, 2 pcs.

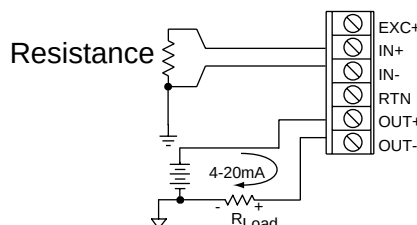
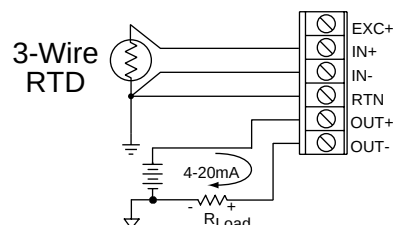
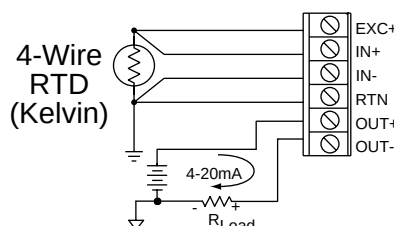
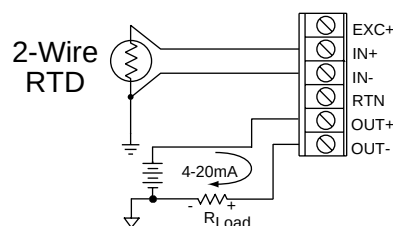
DIN RAIL 3.0

DIN RAIL 16.7

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

20RM-16-DIN

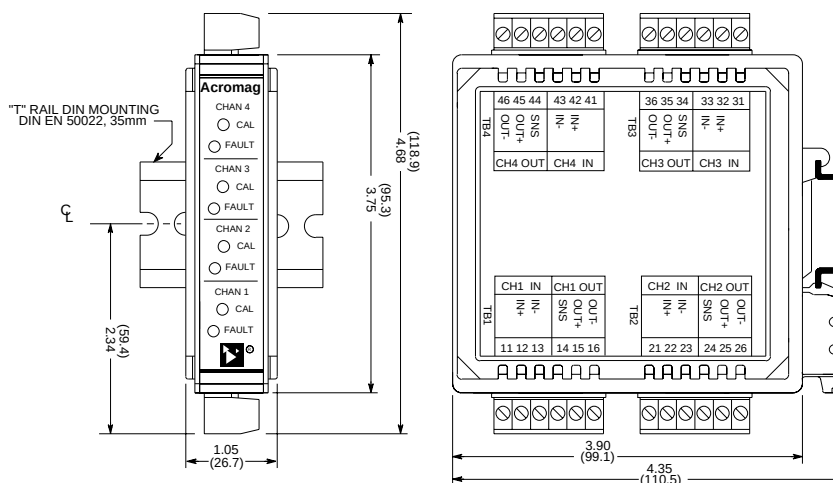
19" rack-mount kit with DIN rail.
Holds sixteen 650T transmitters.



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Isolated Transmitters: 600T Series

671T, 672T, 674T Multi-Channel, Two-Wire Isolators



NOTE: ALL DIMENSION ARE IN INCHES (MILLIMETERS)

DC current input ♦ Single, dual, or quad I/O loop-powered isolators

Description

Models

671T: Single I/O channel

672T: Dual I/O channel

674T: Quad I/O channel

These units receive 4-20mA process current inputs and provide isolated 4-20mA output signals. Each channel operates independently and is isolated from the others to prevent interaction between channels.

For easy troubleshooting, each unit has LEDs and diagnostic test points. Fault LEDs identify output open loop conditions and load compliance problems. The precision 10 ohm sense resistor enables monitoring of the output signal without disturbing field wiring.

Input / Output Ranges

4 to 20mA DC input

4 to 20mA DC output

Power Requirement

Loop-powered
(power derived from input signal current)

Approvals

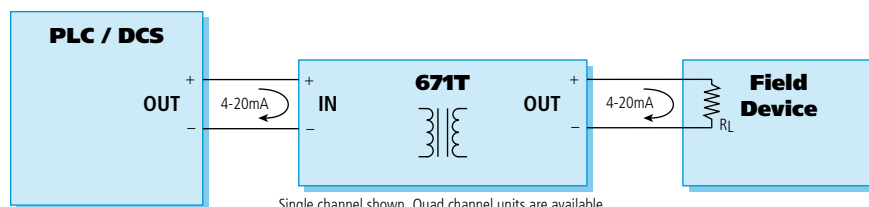
CE marked. UL, cUL listed.

Class I; Division 2; Groups A, B, C, D

Key Features & Benefits

- Multiple channels on a single unit saves space and reduces costs.
- Galvanic isolation eliminates ground loops, reduces noise, and blocks transient signals.
- Independent channels prevent signal interaction and offer spares for later use.
- Fault LEDs provide a clear visual warning of open or failed process loops.
- Single calibration pot per channel enables one-step, precise calibration.

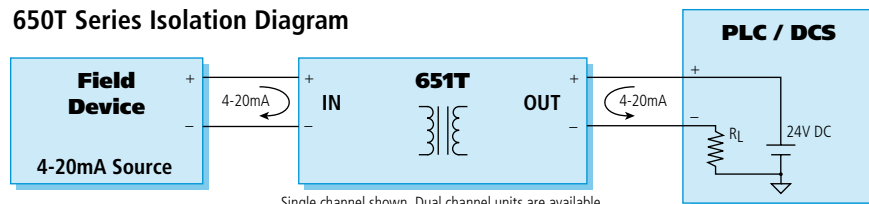
670T Series Isolation Diagram



Single channel shown. Quad channel units are available.

Note: 670T series transmitters are for output resistive loads only (sources current). For application notes using 670T Transmitters, refer to Page 16.

650T Series Isolation Diagram



Single channel shown. Dual channel units are available.

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Isolated Transmitters: 600T Series



Performance Specifications

Reference Test Conditions

Input/Output current: 4 to 20mA; output load 250 ohms; 77°F (25°C).

Input

4 to 20mA input (each channel).

Input burden

The voltage drop is a function of the input current and load resistance and is calculated as follows:

Input Voltage Drop = 4.9V DC + (0.0212A x Rload)

Example:

For Rload = 250 ohms, Vdrop = 10.2V DC

Output

4-20mA DC output (each channel).

Output load

0 to 525 ohms.

Accuracy

Better than $\pm 0.1\%$ of output span. Error includes the combined effects of isolator repeatability, hysteresis, terminal point linearity and adjustment resolution.

Calibration

One 15-turn potentiometer per channel accessible from front of the unit.

Ambient temperature effect

Less than $\pm 0.01\%$ of output span per °F ($\pm 0.018\%$ per °C) over the ambient temperature range for reference test conditions. This specification includes the combined effects of zero and span over temperature.

Output ripple

Less than $\pm 0.1\%$ of the maximum output span.

Bandwidth

-3dB at 2.2Hz, typical.

Response time

For a step input, the output reaches 98% of output span in less than 300ms, typical, into 250 ohms.

Noise rejection

Common mode: 110dB at 60Hz, typical.

Diagnostics

LED fault indicator: Lights for output open loop detection or load compliance problem.

Field test points: An internal 10 ohm sense resistor provides test points for monitoring the output signal current during field maintenance with a voltmeter.

◆ Environmental

Ambient Temperature

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

Relative Humidity

5 to 95%.

Power Requirement

Power is derived from the input signal loop. In the event of an open output circuit, the input loop voltage drop is limited below 20V, nominal. Isolator has reverse polarity protection.

Isolation

Inputs, outputs, and individual channels are isolated from each other for common-mode voltages up to 250V AC, or 354V DC off ground, on a continuous basis (will withstand 1500V AC dielectric strength test for one minute without breakdown).

Radiated Field Immunity (RFI)

Designed to comply with EN61000-4-3 Level 3 (10V/m, 80 to 1000MHz AM and 900MHz keyed) and European Norm EN50082-1.

Electromagnetic Field Immunity (EMI)

Less than $\pm 0.25\%$ of output span effect under the influence of electromagnetic fields from switching solenoids, commutator motors, and drill motors.

Electrical Fast Transient (EFT)

Complies with EN61000-4-4 Level 3 (8KV air, 4KV direct to the enclosure port) and European Norm EN50082-1.

Surge Immunity

Complies with EN61000-4-5 Level 3 (2KV) and European Norm EN50082-1.

Electrostatic Discharge (ESD)

Complies with EN61000-4-2 Level 3 (8KV air, 4KV direct to the enclosure port) and European Norm EN50082-1.

Radiated Emissions

Meets or exceeds European Norm EN50081-1 for Class B equipment.

Approvals

CE marked.

UL listed (UL508 and UL1604).

cUL listed (C22.2, 142-M1987 and 213-M1987).

Hazardous Loc.: Class I; Division 2; Groups A, B, C, D.

◆ Physical

Enclosure

Case: Self-extinguishing NYLON type 6.6 polyamide thermoplastic UL94 V-2 NEMA Type 1 enclosure.

Connectors (Removable Terminal Blocks)

Wire Range: AWG #14-22 (AWG #12 stranded only).

Printed Circuit Boards

Military grade FR-4 epoxy glass circuit board.

Dimensions

1.05W x 4.68H x 4.35D inches.

26.7W x 118.9H x 110.5D millimeters.

Shipping Weight

1 pound (0.45 Kg) packed.

Ordering Information

◆ Models

671T-0600

Single channel isolated transmitter

672T-0600

Dual channel isolated transmitter

674T-0600

Quad channel isolated transmitter

◆ Accessories (see Page 21)

PS5R-SD24

Power supply (24V DC, 2.5A).

TBK-B01

Optional terminal block kit, barrier strip style, 2 pcs. (For use with 671T and 672T model.s)

TBK-B02

Optional terminal block kit, barrier strip style, 4 pcs. (For use with 674T model.)

TBK-S01

Optional terminal block kit, spring clamp style, 2 pcs. (For use with 671T and 672T model.s)

TBK-S02

Optional terminal block kit, spring clamp style, 4 pcs. (For use with 674T model.)

DIN RAIL 3.0

DIN RAIL 16.7

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

20RM-16-DIN

19" rack-mount kit with DIN rail.
Holds sixteen 670T transmitters.

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Isolated Transmitters: 600T Series

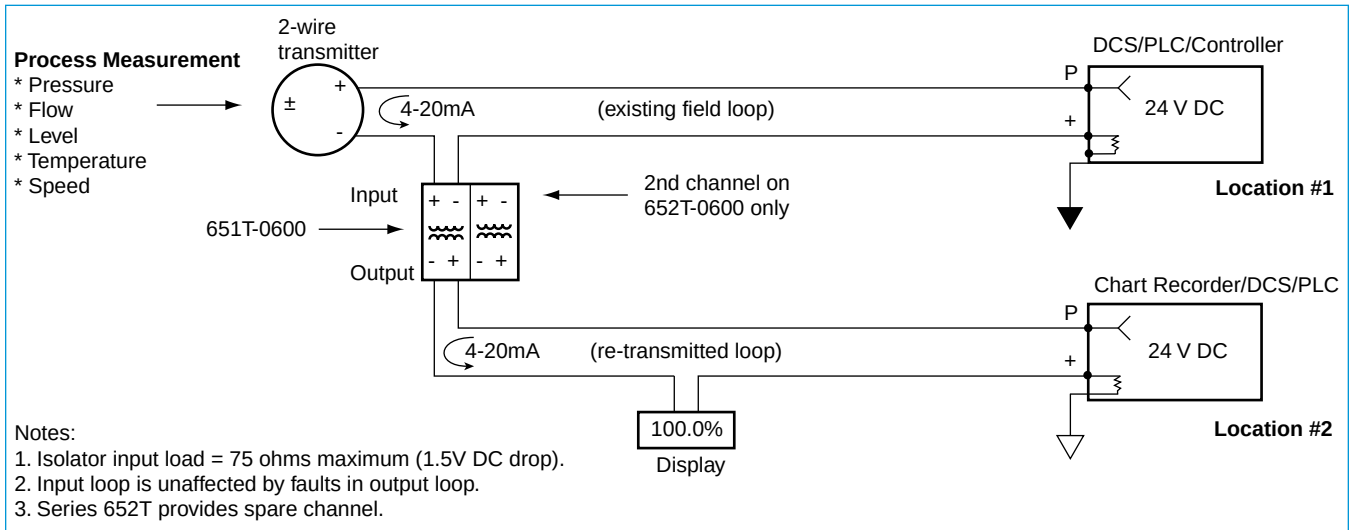
Application Notes

Application 1

Retransmitting a signal from a two-wire loop to a second location.

Solution

Use either a model 651T-0600 (single channel) or 652T-0600 (dual channel) transmitter.

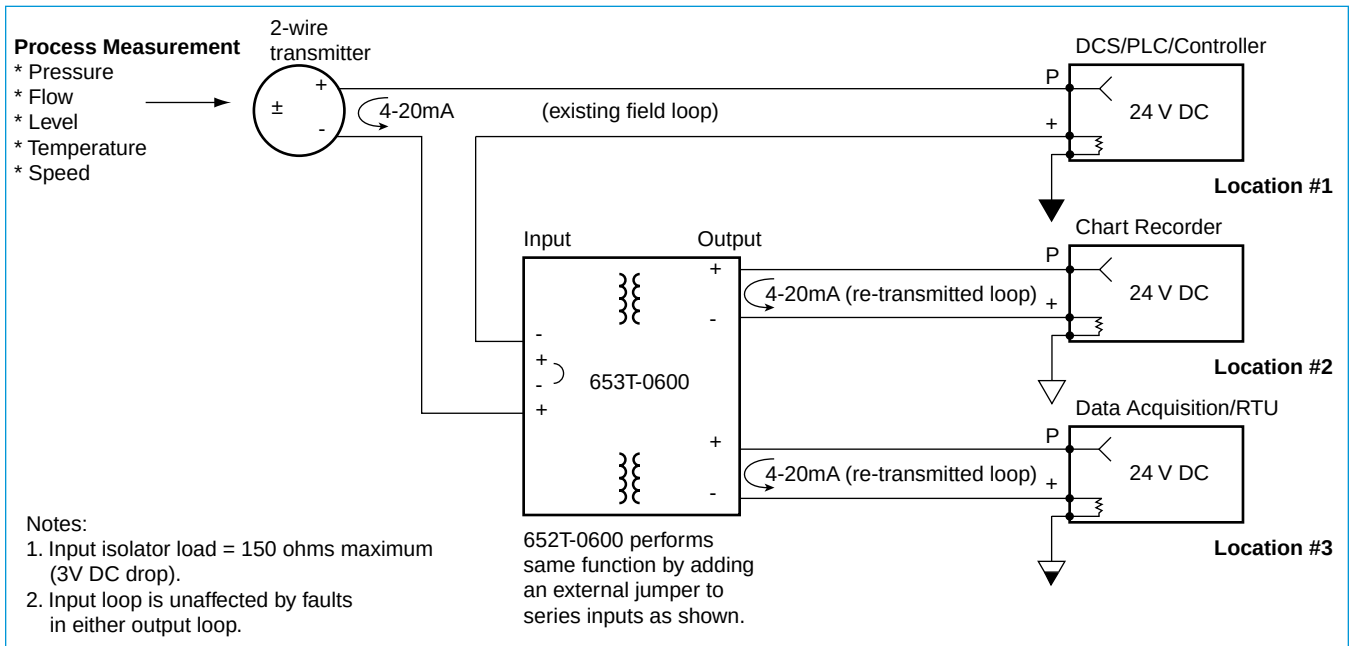


Application 2

Splitting a signal from a two-wire loop: two outputs for different locations.

Solution

Use either a 653T-0600 (single input, dual output) or 652T-0600 (dual input, dual output) unit.



Isolated Transmitters: 600T Series



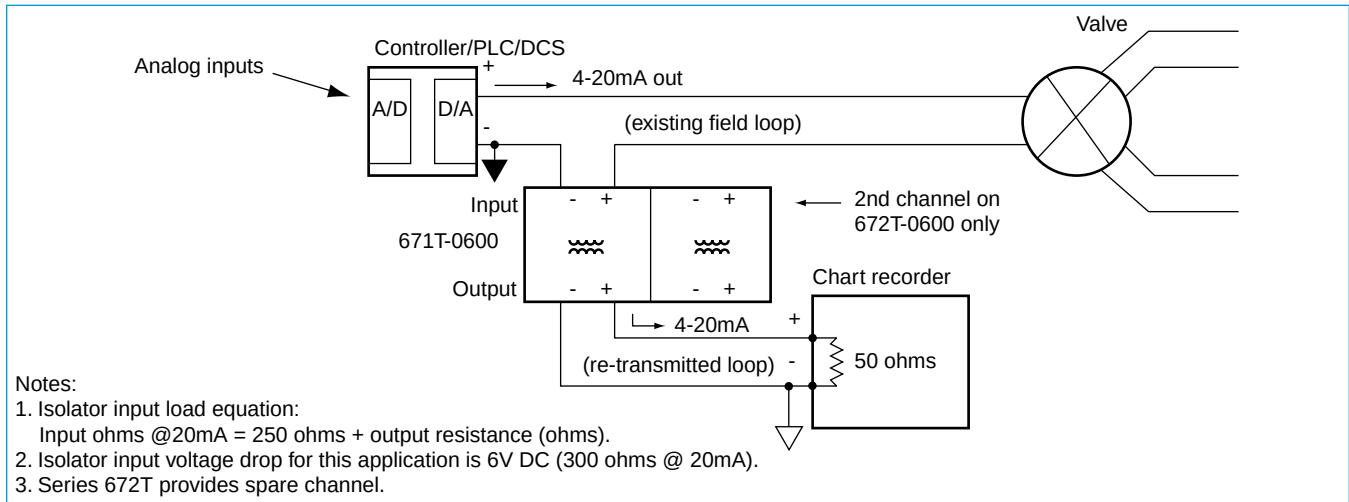
Application Notes

Application 3

Retransmitting a signal output from a controller or a D/A card.

Solution

Use either a model 671T-0600 (single channel) or 672T-0600 (dual channel) transmitter.

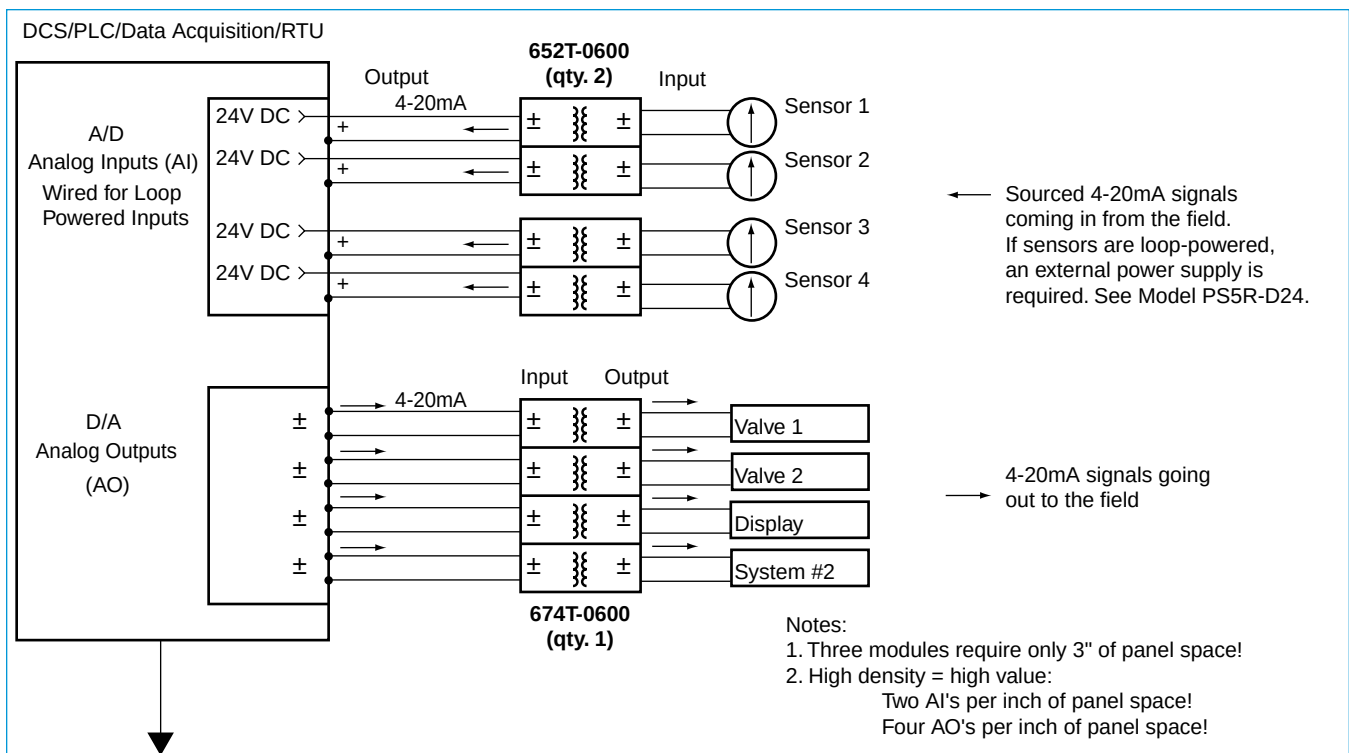


Application 4

Low-cost, channel-to-channel isolation of 4-20mA signals for controllers.

Solution

Use either a 652T-0600 (dual channel) for A/D cards or a 674T-0600 (quad channel) for D/A cards.



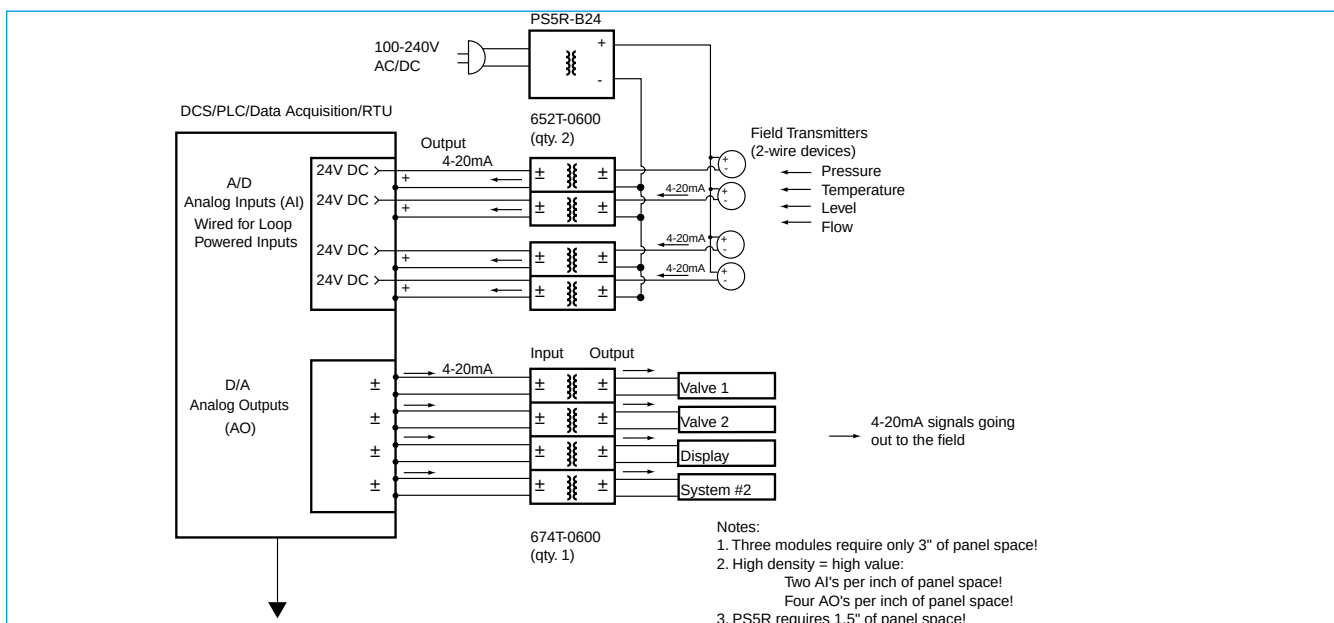
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Application 5

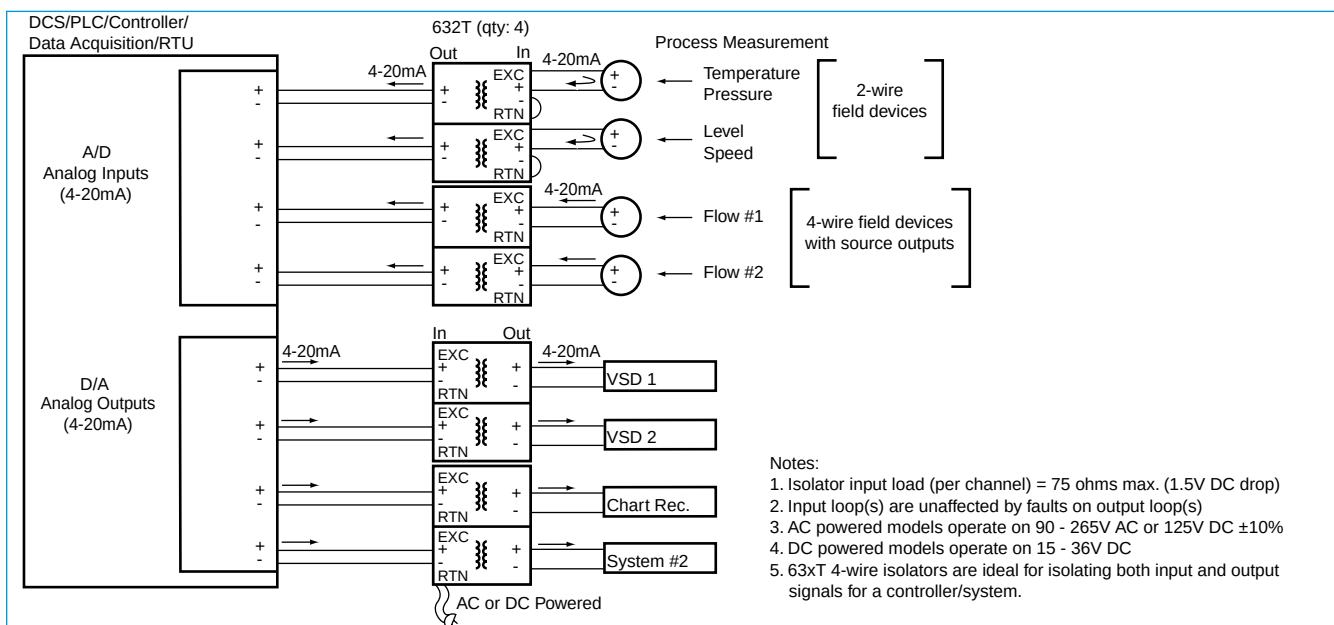
Solution

Model 652T-0600
Model 674T-0600
Model PS5R-B24



Solution

Model 632T-0100 (dual channel, AC powered) or
Model 632T-0500 (dual channel, DC powered).
Model 631T for single channel 4-wire isolators.



Isolated Transmitters: 600T Series



630T Application Notes

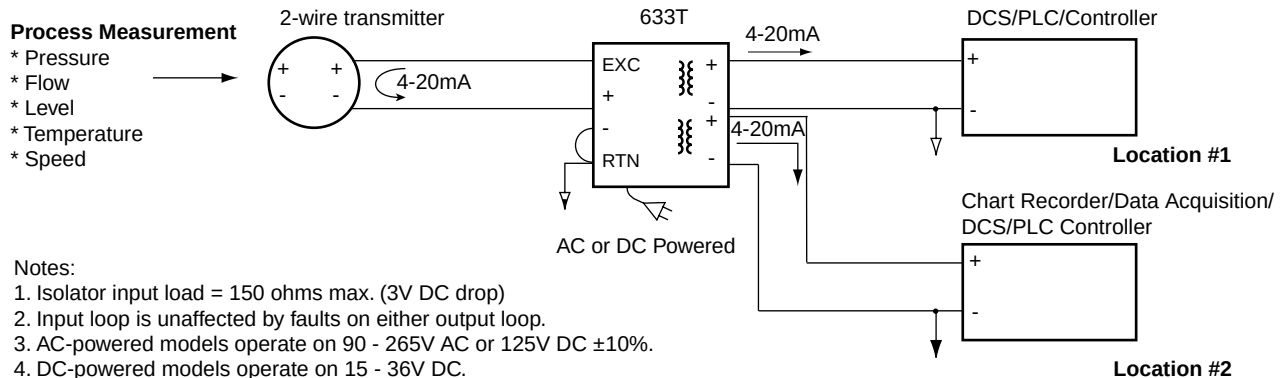
Application 7

Require a 4-wire isolator "splitter" to excite a field device and re-transmit 4-20mA to two locations.

Solution

Model 633T-0100 (AC powered) or
Model 633T-0500 (DC powered).

Use additional 633T units for re-transmitting to more locations. Install inputs in series with primary 4-20mA loop or the re-transmitted loops as required.

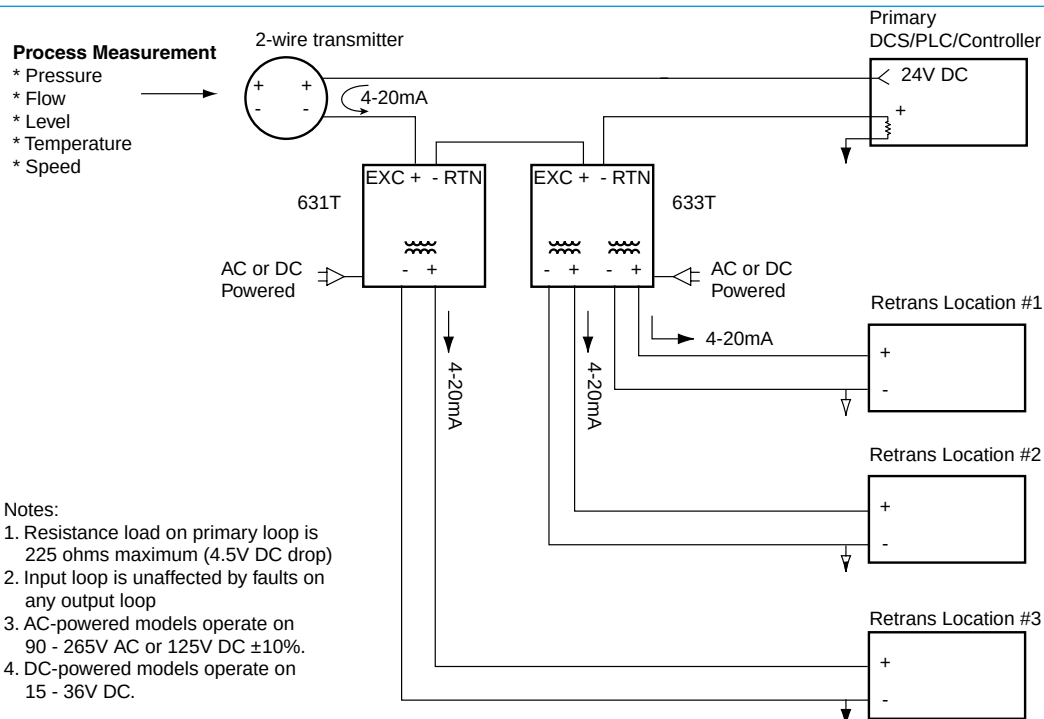


Application 8

Require 4-wire isolators to retransmit a 4-20mA signal to three locations.

Solution

Model 631T-0x00 (splitter) and
Model 631T-0x00 (one channel isolator).
(Where x = 1 or 5 for AC or DC power)



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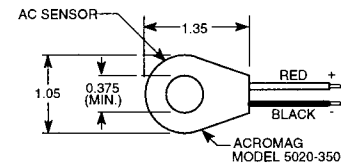


Isolated Transmitters: 600T Series

5020-350 Application Notes

24 HR
STOCK ITEM

7 YEAR
WARRANTY



Using Acromag's AC current sensor Model 5020-350

Many Acromag instruments with DC current input can be used in conjunction with an external AC Current Sensor to precondition an AC current input signal. This sensor is a highly accurate toroidal instrument transformer that converts an AC current signal to a safe, low-level, DC milliamper signal (0 to 11.17mA).

The transmitters only accept the isolated low-level signal produced by the AC current sensing transformer and cannot be connected directly to the source of AC power without damage or safety risk. The AC Current Sensor is fully insulated and designed for mounting near the source of the AC current. The input AC current range is a simple function of the number of turns placed on the AC Current Sensor (see the table below). The benefits to using an external sensor (external from the transmitter) include the following:

◆ Low losses:

It is not practical to run AC currents over long distances because of significant resistance voltage drops at high currents. The low-level DC milliamper signal output from the AC Current Sensor can be transmitted safely over long distances, allowing the transmitter to be remotely located from the AC power wiring.

◆ Safety:

The AC Current Sensor's output leads can be open or short circuited and these conditions do not affect the AC current loop or cause damage to the sensor. Likewise, the wires connecting the AC Current Sensor to the transmitter can be easily removed from the transmitter's input terminals without concern or hazard.

◆ Ease of Calibration:

The AC current input range can be easily scaled in the field by simply changing the number of primary turns at the sensor, with no additional calibration required. That is, the AC current input span is a simple function of the number of primary turns placed on the AC Current Sensor and sensor/transmitter calibration is not affected by this. Refer to Applications "A" & "B" of the diagrams on the next page.

Sensor Primary Turns	AC Current Input Range	Sensor Output (red/black wires)
1	0 to 20 Amps AC	0 to 11.17mA DC
2	0 to 10 Amps AC	0 to 11.17mA DC
4	0 to 5 Amps AC	0 to 11.17mA DC
10	0 to 2 Amps AC	0 to 11.17mA DC
20	0 to 1 Amps AC	0 to 11.17mA DC

The AC Current Sensor is isolated and can be used in AC circuits up to 250V AC, 50 or 60 Hz. It is designed to be mounted at the source of the AC current to be measured. The transmitter can be located remotely from the AC signal and wired using small gauge wire. The sensor's output wires can be shorted, open-circuited, or removed from the transmitter's input terminals, without hazard to personnel or the AC Current Sensor.

DANGER:

If the AC Current Sensor is used with an AC Current Transformer (C.T.), disconnect power to the C.T., or short the output of the C.T., before removing the wire going through the AC Current Sensor. If this is not done, an open circuited C.T. will generate high voltages (hazardous) and possible C.T. damage.

The output wires of the sensor are polarized: the Red wire is (+) plus and the Black wire is (-) minus. Normally, these output wires are attached to one end of a cable (user supplied) and the other end connects to the transmitter's input. Connect the Current Sensor output leads to the transmitter input by connecting Red (+) to the transmitter's plus (+) terminal, and Black (-) to the transmitter's minus (-) terminal. Proper polarity must be observed.

WARNING:

The input to the module can only come from the AC Current Sensor output wires (red/black). If AC current is directly attached to the transmitter's input terminals, the transmitter will be destroyed and safety compromised.

For most applications, it is recommended that the minus (-) transmitter input terminal be connected to an earth ground. The connections between the AC Current Sensor would be floating if not grounded. Grounding eliminates the risk of high common-mode voltages from showing up on the wires and reduces noise pickup.

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Isolated Transmitters: 600T Series



Accessories

Terminal Blocks

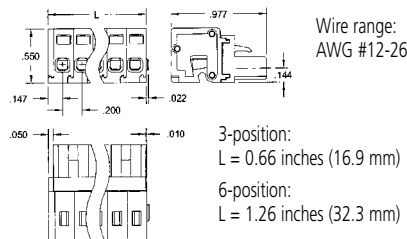
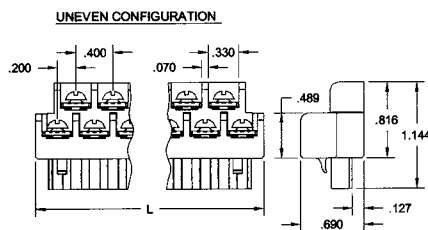


Barrier Strip Terminal Blocks*

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

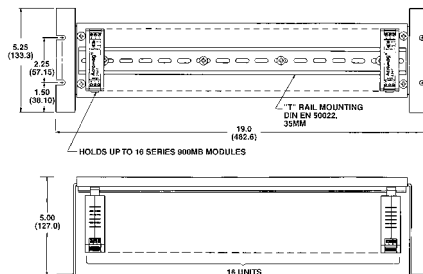
TBK-S03
Terminal block kit,
one 3-position and
three 6-position pieces

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

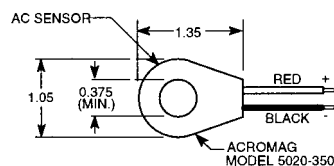
20RM-16-DIN
19" rack-mount kit with DIN rail.

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



60W Universal Slimline Power Supply

Input Power Requirement
85 to 264V AC or 100 to 370V DC

Output
24V DC, 2.5A (60W)

Ordering Information

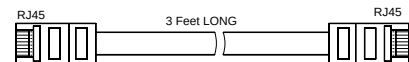
PS5R-SD24

Universal 60W power supply

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

Cables

STRAIGHT CAT5 CABLE



CONNECTS 900EN-S005 SWITCH
TO 900EN ETHERNET I/O MODULE

Ordering Information

5035-355

Ethernet straight cable, CAT5, 3 feet long, shielded

5035-360

Ethernet crossover cable, CAT5E, 5 feet long, shielded

5035-365

Configuration cable for advanced features, DB-25 PC
parallel port to dual row connector, 4 feet long

Acromag 
THE LEADER IN INDUSTRIAL I/O



Flat Pack Series

Isolated Transmitters

DC voltage/current input	Page 148
DC millivolt input	156
Thermocouple input	158
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Potentiometer/slidewire input	162
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AC current/voltage input	166

Limit Alarms

260A	Page 168
361A	170
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Technical Documentation

Dimension diagrams	Page 172
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Isolated Transmitters



Flat Pack analog transmitters deliver high performance signal conditioning for a broad range of I/O applications.

Limit Alarms



Flat Pack alarm trips offer simple and dependable operation for many monitoring and control functions.

	250T	270i	330i	340i	350T	430i	450T	260A	361A	461A
<u>FUNCTIONS</u>										
4-20mA isolator	x	x								
Isolated signal converter/transmitter	x		x	x	x	x	x			
Limit alarm								x	x	x
<u>POWER CONFIGURATIONS</u>										
Loop-powered	x	x						x		
DC-powered			x	x	x				x	
AC-powered						x	x			x
<u>INPUTS</u>										
DC voltage/current input	p148	p150	p154	p152	p148	p154	p148	p168	p170	p170
DC millivolt input	p156				p156		p156			
Thermocouple input	p158				p158		p158			
RTD input	p160				p160		p160			
Potentiometer/slidewire input	p162				p162		p162			
Frequency input	p164				p164		p164			
AC voltage/current input	p166				p166		p166			
<u>OUTPUTS</u>										
DC current (4-20mA)	x	x	x	x	x	x	x			
DC voltage (0-5V, 0-10V DC)					x		x			
Relay: Single SPDT dry contact								x	x	x
Relay: Dual SPDT dry contact									x	x
<u>ISOLATION CONFIGURATIONS</u>										
Input from output/power	x			x	x					
Output from input/power		x						x		
3-way (input/output/power)			x			x	x		x	x
<u>FORM FACTORS</u>										
Single-wide (1-inch) DIN rail mounting	x	x		x	x			x		
Double-wide (1.57-inch) DIN rail mounting			x			x	x		x	x



Isolated Transmitters



DC Voltage and DC Current Input

These models convert sensor inputs to proportional process current or voltage output signals.

Models

250T: Loop-powered transmitter series

350T: DC-powered transmitter series

450T: AC-powered transmitter series

Input Ranges

- DC voltage, $\pm 100\text{mV}$ to $\pm 100.0\text{V DC}$
- DC current, 0 to 20mA (10 ohm input load)

Output Ranges

- DC current: 4 to 20mA
- DC voltage: 0 to 5V or 0 to 10V

Power Requirements

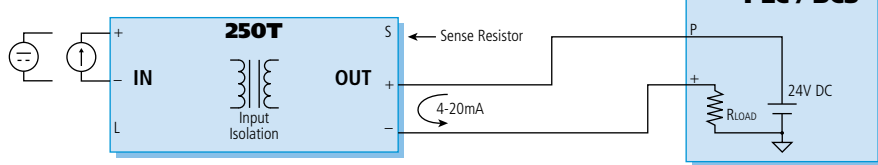
- 250T: 12 to 50V DC @ 20mA (loop-powered)
- 350T: DC voltage source (see table below)

Output range	Power
4 to 20mA	10 to 36V DC @ 30mA
0 to 5V	10 to 36V DC @ 9mA
0 to 10V	12.5 to 36V DC @ 9mA

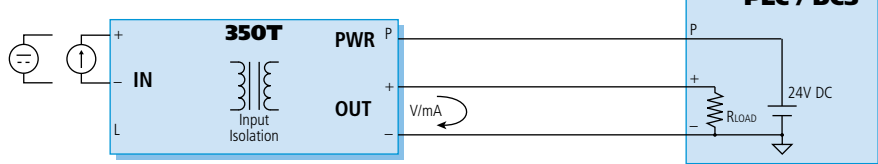
- 450T: 115V or 230V AC, $\pm 10\%$, 50 to 60Hz

Output range	Power
4 to 20mA	115V AC @ 0.050A
4 to 20mA	230V AC @ 0.025A
0 to 5V, 0 to 10V	115V AC @ 0.020A
0 to 5V, 0 to 10V	230V AC @ 0.010A

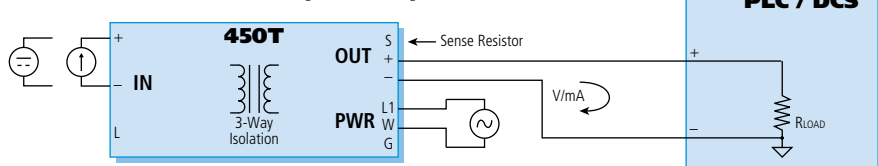
250T Loop-Powered (2-wire) Transmitter



350T DC-Powered (3-wire) Transmitter



450T AC-Powered (4-wire) Transmitter



Special Features

- Excellent accuracy and stability ensure reliable measurements in harsh industrial environments.
- RFI and EMI resistance minimize the effects of environmental noise.
- 90% span adjustment enables precise application calibration.
- Compact, 1-inch wide housing uses less space for easier installation in control panels.
- Low power consumption. 350T units operate on currents as low as 9mA to help prevent expensive upgrades to larger power supplies.
- 1500V AC peak isolation (250V AC or 354V DC continuous) prevents ground loops.

250T models:

Input isolated from output/power.

350T models:

Input isolated from output and power. Output and power share a common.

450T models:

3-way isolation. Input, output, and power circuits are isolated from each other.

Performance

Ambient Temperature Range

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

Accuracy

$\pm 0.1\%$ of calibrated span or ± 0.25 mV, whichever is greater. Includes repeatability, hysteresis, terminal point linearity, and adjustment resolution.

Ambient Temperature Effect

Less than $\pm 0.01\%$ of output span per $^{\circ}\text{F}$ ($\pm 0.018\%$ per $^{\circ}\text{C}$). (Specification includes the combined effects of zero and span over temperature).

Noise Resistance

RFI: Less than $\pm 0.5\%$ of output span effect.
EMI: Less than $\pm 0.25\%$ of output span effect.

Noise Rejection

Common Mode: 120dB at 60Hz, 100 ohm unbalance.
Normal Mode: 30dB at 60Hz, 100 ohm source.

Response Time

Output reaches 98% of output span in 300mS.

Bandwidth

-3dB at 3 Hz, typical.

Output Compliance

250T: $R_{LOAD}(\text{max.}) = (V_{SUPPLY} - 12\text{V}) / 20\text{mA}$.
350T: $R_{LOAD}(\text{max.}) = (V_{SUPPLY} - 2.5\text{V}) / 20\text{mA}$.
450T: $R_{LOAD} = 600$ ohms.



Ordering Information

Select one option from each column. Example: 450T-V4-V0-2-DIN-NCR-C
To order factory calibration, append "-C" to end of model number. Specify ranges on order.

Base	Input		Mounting		Approval
250T	-C1	-V4	-DIN	-N4	-NCR
	-V1	-V5	-ST	-N12	-OL1
	-V2	-V6	-SM	-XP	
	-V3				

Note:
All 250Ts have 4 to 20mA output and are loop-powered.

Base	Input		Output	Mounting	Approval
350T	-C1	-V4	-Y	-DIN	-NCR
	-V1	-V5	-V0		
	-V2	-V6	-V5		
	-V3				

Note:
All 350Ts accept 10 to 36V DC power supply.

Base	Input		Output	Power	Mounting	Approval
450T	-C1	-V4	-Y	-1	-DIN	-NCR
	-V1	-V5	-V0	-2		
	-V2	-V6	-V5			
	-V3					

Input Options

- C1: Current range 0 to 20mA
Span adjust: 4.0 to 20.0mA DC
Zero adjust: 0.0 to 16.0mA DC
Input impedance: 10 ohms.
- V1: Voltage range 0 to 1V DC
Span adjust: 0.1 to 1.0V DC
Zero adjust: 0 to 25% of input span
Input impedance: 40M ohms at 0.4V span.
- V2: Voltage range 0 to 10V DC
Span adjust: 1.0 to 10.0V DC
Zero adjust: 0 to 25% of input span
Input impedance: 100K ohms.
- V3: Voltage range 0 to 100V DC
Span adjust: 10.0 to 100.0V DC
Zero adjust: 0 to 25% of input span
Input impedance: 500K ohms.
- V4: Voltage range ± 1 V DC
Span adjust: ± 0.1 to ± 1.0 V DC
Zero adjust: symmetrical around 0V
Input impedance: 80M ohms at 0.8V span.
- V5: Voltage range ± 10 V DC
Span adjust: ± 1.0 to ± 10.0 V DC
Zero adjust: symmetrical around 0V
Input impedance: 100K ohms.
- V6: Voltage range ± 100 V DC
Span adjust: ± 10.0 to ± 100.0 V DC
Zero adjust: symmetrical around 0V
Input impedance: 500K ohms.

Output Options (350T, 450T only)

- Y: 4 to 20mA DC.
- V0: 0 to 10V DC into 10K ohms or greater
- V5: 0 to 5V DC into 5K ohms or greater

Power Options (450T only)

- 1: 115V AC power
- 2: 230V AC power

Mounting Options

Mountings

- DIN: DIN rail G or T mount
- ST: SNAPTRACK mount [250T only]
- SM: Surface-mount [250T only]

External housings

- N4: NEMA 4, water-tight [250T only], holds two
- N12: NEMA 12, oil-tight [250T only], holds two
- XP: Explosion-proof NEMA 4 [250T only], holds one

Approval Options

- NCR: No certification/approval required.

- DT1†: CSA approval, Div. 2 hazardous locations: Class I; Div. 2; Groups A, B, C, D [250T only].

Ordering Notes

- * Unit requires factory calibration. Append "-C" to end of model number. Specify ranges on order.
- † Units are shipped separately from any optional enclosures (i.e. units are not installed in any external housing).

Accessories

Power supplies

See Power Supplies on Page 199.

DIN RAIL 3.0

DIN RAIL 16.7

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

20RM-16-DIN

19" rack-mount kit with DIN rail. Holds sixteen 250T/350Ts or ten 450T transmitters.

350T-N4-WM

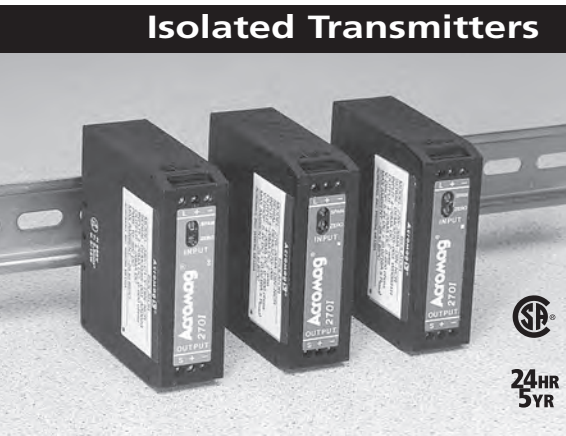
NEMA 4 water-tight enclosure, wall-mount. Holds two 350Ts or one 450T transmitter.

350T-N12-WM

NEMA 12 oil-tight enclosure, wall-mount. Holds two 350Ts or one 450T transmitter.



Isolated Transmitters



270i Isolators DC Current Input

The 270i accepts a process current input and provides an isolated 4 to 20mA process current output signal. Power is received from the input signal current.

These isolators use transformer isolation to effectively break the electrical path between the transmitted signal and the receiving device. This eliminates ground loops, reduces noise, and helps protect against transients for more accurate and reliable measurements.

This product is also extremely easy to install. All units are factory calibrated for loads up to 600 ohms to eliminate any need for load trim adjustments.

Input Range

- 4 to 20mA DC

Output Range

- 4 to 20mA DC

Power Requirement

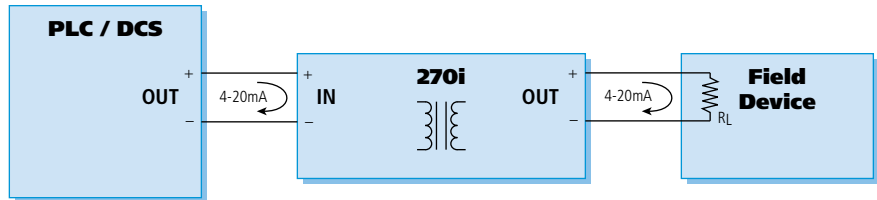
- 12 to 50V DC @ 20mA (loop-powered), power is derived from the input signal current. Loop-burden: 10.8V@250 ohm output load.

Approvals

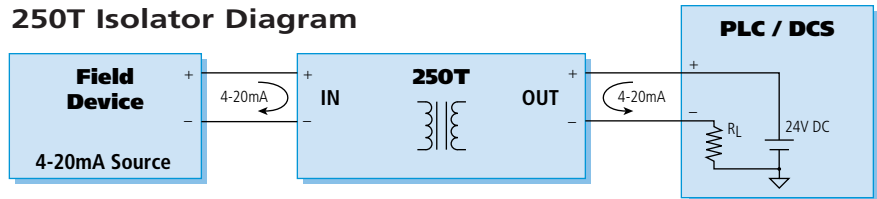
CSA: C22.2 No. 142

Class I; Division 1; Groups A, B, C, D
Class I; Division 2; Groups A, B, C, D
Class II; Division 1; Groups E, F, G

270i Isolator Diagram



250T Isolator Diagram



For more information about the 250T Transmitter, refer to Page 144.

Special Features

- Excellent accuracy and stability ensure reliable measurements in harsh industrial environments.
- 1500V AC peak isolation (250V AC or 354V DC continuous) prevents ground loops.
- RFI and EMI resistance minimize the effects of environmental noise.
- Calibration is independent of the load to eliminate load compensation adjustments
- Zero and span adjustment enable precise calibration.
- Compact, 1-inch wide housing uses less space for easier installation in control panels.
- Input current sense resistor simplifies field diagnostics

Performance

Input

Input Range

4 to 20mA input. Power is derived from the input signal loop. Input current should be limited to less than 50mA to prevent damage to the isolator. In the event of an open output circuit, the input loop voltage drop is limited to 20V, nominal. Isolator has reverse polarity protection.

Zero and span

Zero and span trim adjustments utilize 22-turn potentiometers accessible from front of the unit.

Input voltage drop

The voltage drop is a function of the input current and load resistance and is calculated as follows:

$$\text{Input Voltage Drop} = 5.4V \text{ DC} + (0.0216A \times R_{\text{LOAD}})$$

Example ($R_{\text{LOAD}} = 250 \text{ ohms}$):

$$\text{Input Voltage Drop} =$$

$$5.4V \text{ DC} + (0.0216A \times 250 \text{ ohms}) = 10.8V \text{ DC}.$$

Current sense resistor

A built-in 10 ohm ($\pm 0.1\%$) resistor can monitor input current to the isolator. Wiring to the isolator's input terminals determines if this resistor is included in the current loop. Use of this resistor provides a test signal of 40 to 200mV, representing 4 to 20mA.

Continued on the next page.



Performance (continued)

■ Output

Output Range

4-20mA DC output.

A. For R_{LOAD} from 50 to 600 ohms, connect R_{LOAD} between Output (+) and Output (-) terminals.

B. For R_{LOAD} from 0 to 50 ohms, connect R_{LOAD} between Output (S) and Output (-) terminals. For optimum performance at low values of R_{LOAD}, the isolator has a built-in pad resistor of 50 ohms.

1. Input Voltage Drop (input sense resistor not used):
 $V_{DROP} = 5.4V\ DC + (0.0216A \times (R_{LOAD} + 50\ ohms))$

2. Input Voltage Drop (input sense resistor used)
 $V_{DROP} = 5.6V\ DC + (0.0216A \times (R_{LOAD} + 50\ ohms))$

Accuracy

±0.1% of output span. Error includes the combined effects of isolator repeatability, hysteresis, terminal point linearity and adjustment resolution.

Load resistance effect

Less than ±0.1% of output span as load resistance is changed over entire range. Allows use of isolator, within resistance load range, without the need to recalibrate the isolator for a particular load.

Output ripple

Less than ±0.1% of the maximum output span.

Bandwidth

-3dB at 3Hz, typical.

Response time

For a step input, the output reaches 98% of output span in 180ms, typical.

■ Environmental

Ambient temperature range

Operating: -13 to 185°F (-25 to 85°C).

Storage: -40 to 185°F (-40 to 85°C).

Ambient temperature effect

Less than ±0.006% of output span per °F (±0.01% per °C) over the ambient temperature range for reference test conditions. This specification includes the combined effects of zero and span over temperature.

Isolation

The input and output circuits are isolated from each other for common-mode voltages up to 250V AC, or 354V DC off ground, on a continuous basis (will withstand 1500V AC dielectric strength test for one minute without breakdown).

Noise rejection

Common mode: 110dB at 60Hz, typical.

RFI resistance

Less than ±0.5%, of output span effect.

EMI resistance

Less than ±0.25% of output span effect.

Surge withstand capability (SWC)

Input/Output terminations rated per ANSI/IEEE C37.90-1978. Unit is tested to a standardized test waveform that is representative of surges (high frequency transient electrical interference), observed in actual installations.

■ Ordering Information

Select one option from each column. Example: 270i-20MA-DIN-NCR

Base	Input	Mounting		Approval
270i	-20MA	-DIN	-N4	-NCR
		-ST	-N12	-AQ1
		-SM	-XP	

Input Options

-20MA: 4.0 to 20.0mA DC

Mounting Options

Mountings

-DIN: DIN rail G or T mount

-ST: SNAPTRACK mount

-SM: Surface-mount

External housings

-N4: NEMA 4, water-tight, holds two

-N12: NEMA 12, oil-tight, holds two

-XP: Explosion-proof NEMA 4, holds one

Approval Options

-NCR: No certification/approval required.

-DT1†: CSA approval, Div. 2 hazardous locations:

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

Ordering Notes

* Unit requires factory calibration. Append "-C" to end of model number. Specify ranges on order.

† Units are shipped separately from any optional enclosures (i.e. units are not installed in any external housing).

Accessories

Power supplies

See Power Supplies on Page 199.

DIN RAIL 3.0

DIN RAIL 16.7

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

20RM-16-DIN

19" rack-mount kit with DIN rail.

Holds sixteen 270i isolators.



Isolated Transmitters



340i Isolators DC Current Input

Input Range

- 4 to 20mA DC

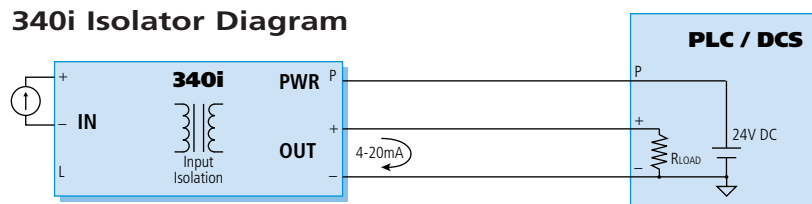
Output Range

- 4 to 20mA DC

Power Requirement

- 10 to 36V DC @ 30mA

340i Isolator Diagram



Description

The 340i accepts a process current input and provides an isolated 4 to 20mA process current output signal.

These isolators use transformer isolation to effectively break the electrical path between the transmitted signal and the receiving device. This eliminates ground loops, reduces noise, and helps protect against transients for more accurate and reliable measurements.

This product is also extremely easy to install. All units are factory calibrated to eliminate any need for load trim adjustments. Also, up to eight isolators at a location can share a single Acromag 35PS power supply for a more convenient and cost-effective solution.

Special Features

- Excellent accuracy and stability ensure reliable measurements in harsh industrial environments.
- 1500V AC peak isolation (250V AC or 354V DC continuous) prevents ground loops.
- Calibration is independent of the load to eliminate load compensation adjustments
- Zero and span adjustment enable precise calibration.
- RFI and EMI resistance minimize the effects of environmental noise.
- Low power consumption helps prevent expensive upgrades to larger power supplies.
- 25mS response time delivers fast updates to monitoring and control systems.
- Compact, 1-inch wide housing uses less space for easier installation in control panels.



■ Performance

Reference test conditions

Input/Output current: 4 to 20mA; output load 250 ohms; 77°F (25°C); 15V DC supply.

■ Input

Input

4 to 20mA DC, input drop less than 1.5V at full-scale. Input current must not exceed 100mA.

Zero and span

The Zero and Span trim adjustments utilize 15-turn potentiometers which are accessible from the front of the unit. Isolator is DIN-rail mounted.

■ Output

Output

4 to 20mA DC.

The output shares a common with the power supply.

NOTE: Voltage output is not available on this unit, use Model 350T on Page 144 if this is a requirement.

Load resistance range equation

$R_{LOAD\ MAX} = (Min. VDC\ supply - 5.0V) / 0.02A$

At 10.0V DC supply, $R_{LOAD} = 0$ to 250 ohms

At 15.0V DC supply, $R_{LOAD} = 0$ to 500 ohms

At 24.0V DC supply, $R_{LOAD} = 0$ to 950 ohms

Output limiting

135% of full scale output, nominal.

Output ripple

Less than $\pm 0.1\%$ of maximum output span.

Bandwidth

-3dB at 50Hz, typical, with 500 ohm load.

Response time

For a step input, the output reaches 98% of output span in 25mS, typical, 500 ohm load.

Accuracy

Better than $\pm 0.1\%$ of output span. Error includes the combined effects of isolator repeatability, hysteresis, terminal point linearity and adjustment resolution. Does not include sensor error.

■ Power

Power

10.0V to 36.0V DC, 30mA at full scale, 35mA at limit. The external DC power supply is connected between the output (P) and (-) terminals. The current specified is for rated supply inputs and full scale output. Diode on isolator provides reverse polarity protection. Note: Do not exceed 36V DC peak, to avoid damage to the isolator.

Power supply effect

DC Volts: Less than $\pm 0.001\%$ of output span per volt.

60/120Hz Ripple: Less than $\pm 0.01\%$ of span per volt peak to peak of power supply ripple.

■ Environmental

Ambient temperature range

Operating: -13 to 185°F (-25 to 85°C).

Storage: -40 to 185°F (-40 to 85°C).

Ambient temperature effect

Less than $\pm 0.003\%$ of output span per °F ($\pm 0.005\%$ per °C) over the ambient temperature range for reference test conditions. This specification includes the combined effects of zero and span over temperature.

Isolation

The input circuit is electrically isolated from the output and power circuits, allowing the input to operate at up to 250V AC, or 354V DC off ground, on a continuous basis (will withstand 1500V AC dielectric strength test for one minute without breakdown). Complies with test requirements outlined in ANSI C39.5-1974 for the voltage rating specified.

Noise rejection

Common mode: -6 dB at 60Hz, typical, 500 ohm load.

RFI resistance

Less than $\pm 0.5\%$, of output span with RFI field strengths of up to 10V/meter at frequencies of 27, 151 and 467 MHz.

EMI resistance

Less than $\pm 0.25\%$ of output span effect with switching solenoids or commutator motors.

Surge withstand capability (SWC)

Input/Output terminations rated per ANS/IEEE C37.90-1978. Unit is tested to a standardized test waveform that is representative of surges (high frequency transient electrical interference), observed in actual installations.

■ Physical

Construction

Circuit boards: Military grade FR-4 epoxy glass.

Terminals: Compression type, 14 AWG max.

Case: Self-extinguishing NYLON Type 6.6 polyamide thermoplastic UL94V-2, color black. General Purpose, NEMA Type 1 enclosure.

Circuit board coating: Fungus resistant acrylic conformal coat.

Mounting position: Position insensitive.

■ Ordering Information

Isolator

340i-C1-Y-DIN-NCR

Single-channel 4-20mA isolator.

Accessories

Power supplies

See Power Supplies on Page 199.

DIN RAIL 3.0

DIN RAIL 16.7

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

20RM-16-DIN

19" rack-mount kit with DIN rail. Holds sixteen 340i transmitters.

350T-N4-WM

NEMA 4 water-tight enclosure, wall-mount. Holds two 340i transmitters.

350T-N12-WM

NEMA 12 oil-tight enclosure, wall-mount. Holds two 340i transmitters.



Isolated Transmitters



330i and 430i Signal Isolators DC Current Input

Models

330i: DC-powered transmitter series

430i: AC-powered transmitter series

Input Range

- 4 to 20mA DC

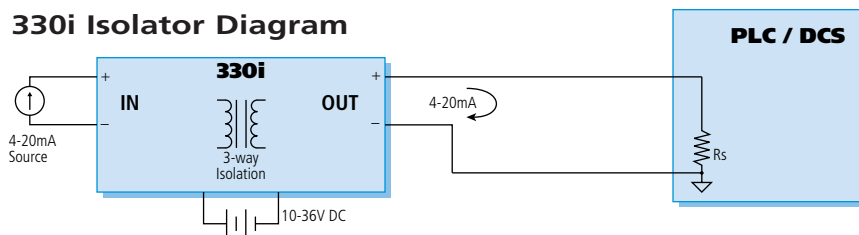
Output Range

- 4 to 20mA DC

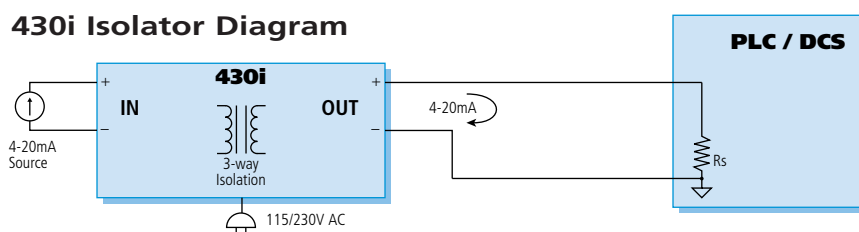
Power Requirements

- 330i: 10 to 36V DC
85mA with 15V supply, 55mA at 24V
- 430i:
115V AC @ 0.040A
230V AC @ 0.020A

330i Isolator Diagram



430i Isolator Diagram



Description

Series 330i and 430i isolators provide 3-way isolation and do not require recalibration for different loads.

Both the 330i and 430i accept a 4 to 20mA process current input and provide a 3-way isolated process current output signal.

These isolators use transformer isolation to effectively break the electrical path between the transmitted signal, receiving device, and power. This eliminates ground loops, reduces noise, and helps protect sensitive instruments from transients for more accurate and reliable measurements.

The 330i and 430i are also extremely easy to use. Advanced circuitry eliminates the need to recalibrate as loads change and allows us to provide factory calibration regardless of the load. And, for highly reliable field operation, they withstand extreme ambient temperatures and have excellent temperature coefficients.

Special Features

- 3-way isolation; input, output, and power circuits are isolated from each other.
- 1500V AC peak isolation (250V AC or 354V DC continuous) prevents ground loops.
- Excellent accuracy and stability ensure reliable measurements in harsh industrial environments
- RFI and EMI resistance minimize the effects of environmental noise
- Factory calibration is provided standard
- Calibration is independent of the load to eliminate load compensation adjustments
- Wide power supply range on 330i handles more applications to reduce inventory stock
- DC power used with 330i carry lower voltages and do not require expensive conduit for safer and easier installation.
- Low input burden (1.3V typical), independent of load, helps prevent overloading of the loop
- High load compliance drives output load resistances up to 1050 ohms independent of supply voltage
- 25mS response time delivers fast updates to monitoring and control systems.
- Zero and span adjustment enable precise calibration.



■ Performance

Reference test conditions

Input/Output current: 4 to 20mA; output load 250 ohms; 25°C ambient; 15V DC or 115V AC supply.

■ Input

Input

4 to 20mA DC, with an input drop less than 1.5V DC (75 ohms) at full-scale. IMPORTANT: Input current must not exceed 100mA or damage to the unit may occur.

Zero and span

Zero and span trim adjustments utilize 15-turn potentiometers accessible on front of the unit.

■ Output

Output

4 to 20mA DC $R_{LOAD} = 0$ to 1050 ohms.

Output limiting

Output current limited to less than 28mA, nominal.

Output ripple

Less than $\pm 0.1\%$ of maximum output span.

Accuracy

Better than $\pm 0.1\%$ of output span. Error includes the combined effects of isolator repeatability, hysteresis, terminal point linearity and adjustment resolution. Does not include sensor error.

Bandwidth

-3dB at 50Hz, typical, with 500 ohm load.

Response time

For a step input, the output reaches 98% of output span in 25ms, typical, with a 500 ohm load. Response time will vary with load resistance.

■ Power

Power (330i)

10V to 36V DC, current draw is a function of supply voltage (refer to table below)

Supply Voltage	Supply Current at 20mA Output	At Current Limit
10V	135mA	200mA
12V	105mA	145mA
15V	85mA	110mA
24V	55mA	70mA
36V	45mA	50mA

Power (430i)

-1: 115V AC $\pm 10\%$, 50 to 60Hz, 0.040A max.

-2: 230V AC $\pm 10\%$, 50 to 60Hz, 0.020A max.

Power supply effect

330i: Less than $\pm 0.001\%$ of output span per volt for rated supply variations.

430i: Less than $\pm 0.01\%$ of output span for rated supply variations.

■ Environmental

Ambient temperature range

-13 to 185°F (-25 to 85°C)

Ambient temperature effect

Less than $\pm 0.003\%$ of output span per °F ($\pm 0.005\%$ per °C) over the ambient temperature range for reference test conditions. This specification includes the combined effects of zero and span over temperature.

Isolation

Three-way isolation between input, output, and power circuits for common mode voltages up to 250V AC, or 354V DC off ground, on a continuous basis (withstand 1500V AC dielectric strength test for sixty seconds without breakdown).

Noise rejection

Normal Mode: -6 dB at 60Hz, typical, 500 ohm load.

RFI resistance

Less than $\pm 0.5\%$, of output span with RFI field strengths of up to 10V/meter at frequencies of 27, 151 and 467 MHz.

EMI resistance

Less than $\pm 0.25\%$ of output span effect with switching solenoids or commutator motors.

Surge withstand capability (SWC)

Input/Output terminations rated per ANSI/IEEE C37.90-1978. Unit is tested to a standardized test waveform that is representative of surges (high frequency transient electrical interference), observed in actual installations.

■ Physical

Construction

Circuit boards: Military grade FR-4 epoxy glass.

Terminals: Compression type, 14 AWG max.

Case: Self-extinguishing NYLON Type 6.6 polyamide thermoplastic UL94V-2, color black. General Purpose, NEMA Type 1 enclosure.

Circuit board coating: Fungus resistant acrylic conformal coat.

Mounting position: Position insensitive.

■ Ordering Information

Isolators

330i-C1-Y-DIN-NCR

Single-channel isolator unit, DC-powered.

430i-C1-Y-1-DIN-NCR

Single-channel isolator unit, 115V AC-powered.

430i-C1-Y-2-DIN-NCR

Single-channel isolator unit, 230V AC-powered.

Accessories

Power supplies

See Power Supplies on Page 199.

DIN RAIL 3.0

DIN RAIL 16.7

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

20RM-16-DIN

19" rack-mount kit with DIN rail. Holds ten 330i or 430i transmitters.

350T-N4-WM

NEMA 4 water-tight enclosure, wall-mount. Holds one 330i/430i transmitter.

350T-N12-WM

NEMA 12 oil-tight enclosure, wall-mount. Holds one 330i/430i transmitter.



Isolated Transmitters



DC Millivolts Input

These models convert sensor inputs to proportional process current or voltage output signals.

Models

250T: Loop-powered transmitter series

350T: DC-powered transmitter series

450T: AC-powered transmitter series

Input Ranges

- Millivolt: -25 to 250mV
narrow span: 3 to 5mV, custom calibration

Output Ranges

- DC current: 4 to 20mA
- DC voltage: 0 to 5V or 0 to 10V

Power Requirements

- 250T: 12 to 50V DC @ 20mA (loop-powered)

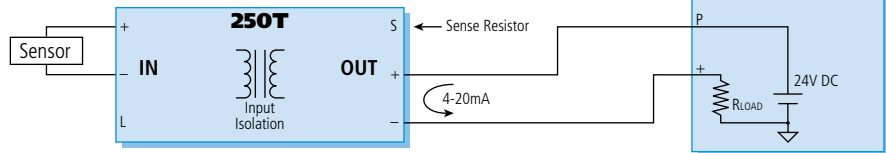
- 350T: DC voltage source (see table below)

Output range	Power
4 to 20mA	10 to 36V DC @ 30mA
0 to 5V	10 to 36V DC @ 9mA
0 to 10V	12.5 to 36V DC @ 9mA

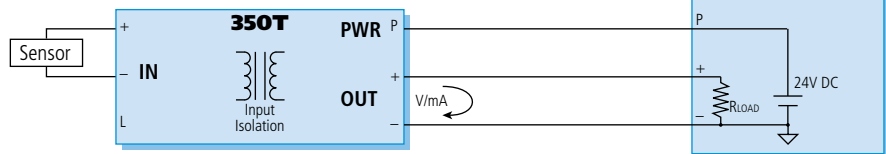
- 450T: 115V or 230V AC, $\pm 10\%$, 50 to 60Hz

Output range	Power
4 to 20mA	115V AC @ 0.050A
4 to 20mA	230V AC @ 0.025A
0 to 5V, 0 to 10V	115V AC @ 0.020A
0 to 5V, 0 to 10V	230V AC @ 0.010A

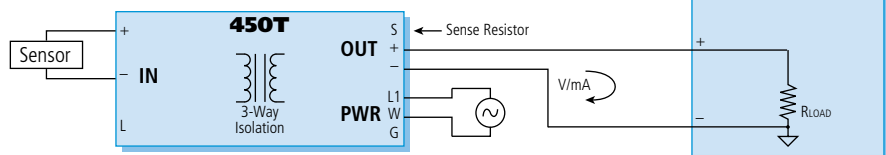
250T Loop-Powered (2-wire) Transmitter



350T DC-Powered (3-wire) Transmitter



450T AC-Powered (4-wire) Transmitter



Special Features

- Excellent accuracy and stability ensure reliable measurements in harsh industrial environments.
- RFI and EMI resistance minimize the effects of environmental noise.
- 90% span adjustment enables precise application calibration.
- 1500V AC peak isolation (250V AC or 354V DC continuous) prevents ground loops.

250T models:

Input isolated from output/power.

350T models:

Input isolated from output and power.
Output and power share a common.

450T models:

3-way isolation. Input, output, and power circuits are isolated from each other.

- Compact, 1-inch wide housing uses less space for easier installation in control panels.
- Low power consumption. 350T units operate on currents as low as 9mA to help prevent expensive upgrades to larger power supplies.

Performance

Ambient Temperature Range

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

Accuracy

$\pm 0.1\%$ of calibrated span or $\pm 0.01\text{mV}$, whichever is greater. Includes repeatability, hysteresis, terminal point linearity, and adjustment resolution.

Ambient Temperature Effect

Less than $\pm 0.01\%$ of output span per °F ($\pm 0.018\%$ per °C). $\pm 0.025\%$ of output span per °F ($\pm 0.045\%$ per °C) for narrow span units. (Specification includes the combined effects of zero and span over temperature).

Noise Resistance

RFI: Less than $\pm 0.5\%$ of output span effect.
EMI: Less than $\pm 0.25\%$ of output span effect.

Noise Rejection

Common Mode: 130dB at 60Hz, 100 ohm unbalance.
Normal Mode: 30dB at 60Hz, 100 ohm source.

Response Time

Output reaches 98% of output span in 300ms.

Bandwidth

-3dB at 3 Hz, typical.

Output Compliance

250T: $R_{LOAD} (\text{max.}) = (V_{SUPPLY} - 12V) / 20\text{mA}$.
350T: $R_{LOAD} (\text{max.}) = (V_{SUPPLY} - 2.5V) / 20\text{mA}$.
450T: $R_{LOAD} = 600 \text{ ohms}$.

Input Impedance

1.0M ohm at 10mV span, typical; input current, $\pm 10\text{nA}$, typical.



Ordering Information

Select one option from each column. Example: 450T-MV1-Y-1-DIN-NCR-C

To order factory calibration, append "-C" to end of model number. Specify ranges on order.

Base	Input	Mounting		Approval
250T	-MV1	-DIN	-N4	-NCR
	-MV2	-ST	-N12	-AQ1
	-MV3	-SM	-XP	

Note:
All 250Ts have 4 to 20mA output and are loop-powered.

Base	Input	Output	Mounting	Approval
350T	-MV1	-Y	-DIN	-NCR
	-MV2	-V0		
	-MV3	-V5		

Note:
All 350Ts accept 10 to 36V DC power supply.

Base	Input	Output	Power	Mounting	Approval
450T	-MV1	-Y	-1	-DIN	-NCR
	-MV2	-V0	-2		
	-MV3	-V5			

Input Options

-MV1: Millivolt.

Span adjust: 5 to 55mV DC

Zero adjust: -5 to 25mV DC

-MV2: Millivolt.

Span adjust: 25 to 250mV DC

Zero adjust: -25 to 125mV DC

-MV3*: Millivolt, narrow span.

Span adjust: 3 to 5mV DC

Zero adjust: -5 to 25mV DC

Specify calibration range on order.

Output Options (350T, 450T only)

-Y: 4 to 20mA DC.

-V0: 0 to 10V DC into 10K ohms or greater

-V5: 0 to 5V DC into 5K ohms or greater

Power Options (450T only)

-1: 115V AC power

-2: 230V AC power

Mounting Options

Mountings

-DIN: DIN rail G or T mount

-ST: SNAPTRACK mount [250T only]

-SM: Surface-mount [250T only]

External housings

-N4: NEMA 4, water-tight [250T only], holds two

-N12: NEMA 12, oil-tight [250T only], holds two

-XP: Explosion-proof NEMA 4 [250T only], holds one

Approval Options

-NCR: No certification/approval required.

-DT1*: CSA approval, Div. 2 hazardous locations:

Class I; Div. 2; Groups A, B, C, D [250T only].

Ordering Notes

* Unit requires factory calibration. Append "-C" to end of model number. Specify ranges on order.

† Units are shipped separately from any optional enclosures (i.e. units are not installed in any external housing).

Accessories

Power supplies

See Power Supplies on Page 199.

DIN RAIL 3.0

DIN RAIL 16.7

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

20RM-16-DIN

19" rack-mount kit with DIN rail. Holds sixteen 250T/350Ts or ten 450T transmitters.

350T-N4-WM

NEMA 4 water-tight enclosure, wall-mount. Holds two 350Ts or one 450T transmitter.

350T-N12-WM

NEMA 12 oil-tight enclosure, wall-mount. Holds two 350Ts or one 450T transmitter.



Isolated Transmitters



Thermocouple Input

These models convert sensor inputs to proportional process current or voltage output signals.

Models

250T: Loop-powered transmitter series

350T: DC-powered transmitter series

450T: AC-powered transmitter series

Input Ranges

- Thermocouple types J, K, T, R, S, E, B
- Linearized thermocouple (custom ranges)

Output Ranges

- DC current: 4 to 20mA
- DC voltage: 0 to 5V or 0 to 10V

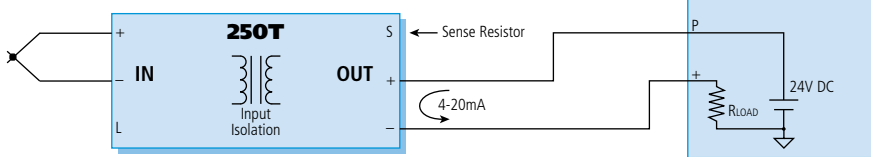
Power Requirements

- 250T: 12 to 50V DC @ 20mA (loop-powered)
- 350T: DC voltage source (see table below)
- 450T: 115V or 230V AC, $\pm 10\%$, 50 to 60Hz

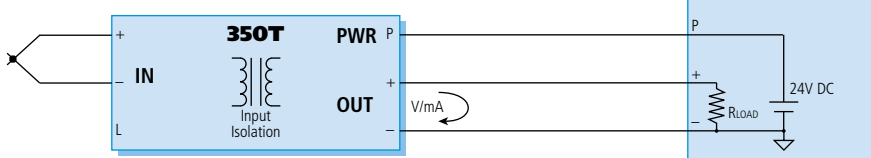
Output range	Power
4 to 20mA	10 to 36V DC @ 30mA
0 to 5V	10 to 36V DC @ 9mA
0 to 10V	12.5 to 36V DC @ 9mA

Output range	Power
4 to 20mA	115V AC @ 0.050A
4 to 20mA	230V AC @ 0.025A
0 to 5V, 0 to 10V	115V AC @ 0.020A
0 to 5V, 0 to 10V	230V AC @ 0.010A

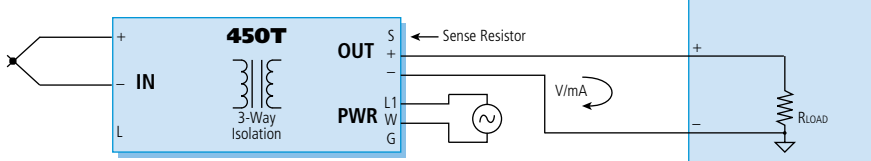
250T Loop-Powered (2-wire) Transmitter



350T DC-Powered (3-wire) Transmitter



450T AC-Powered (4-wire) Transmitter



Special Features

- Excellent accuracy and stability ensure reliable measurements in harsh industrial environments.
- Field-selectable input types reduce stocking requirements.
- Thermocouple reference junction compensation reduces drift and corrects nonlinearity.
- TC linearizer (5-slope) improves accuracy.
- TC break detection indicates open circuit failures with selectable up/downscale operation.
- RFI and EMI resistance minimize the effects of environmental noise.
- 75% span adjustment enables precise application calibration.
- 1500V AC peak isolation (250V AC or 354V DC continuous) prevents ground loops.

250T models:

Input isolated from output/power.

350T models:

Input isolated from output and power.
Output and power share a common.

450T models:

3-way isolation. Input, output, and power circuits are isolated from each other.

Performance

Ambient Temperature Range

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

Accuracy

$\pm 0.1\%$ of calibrated span or $\pm 0.01\text{mV}$, whichever is greater. Includes repeatability, hysteresis, terminal point linearity, and adjustment resolution.

Ambient Temperature Effect

Less than $\pm 0.01\%$ of output span per °F ($\pm 0.018\%$ per °C). $\pm 0.025\%$ of output span per °F ($\pm 0.045\%$ per °C) for narrow span units. (Specification includes the combined effects of zero and span over temperature).

Noise Resistance

RFI: Less than $\pm 0.5\%$ of output span effect.
EMI: Less than $\pm 0.25\%$ of output span effect.

Noise Rejection

Common Mode: 130dB at 60Hz, 100 ohm unbalance.
Normal Mode: 30dB at 60Hz, 100 ohm source.

Response Time

Output reaches 98% of output span in 300ms.

Bandwidth

-3dB at 3 Hz, typical.

Output Compliance

250T: $R_{LOAD} (\text{max.}) = (V_{SUPPLY} - 12V) / 20\text{mA}$.
350T: $R_{LOAD} (\text{max.}) = (V_{SUPPLY} - 2.5V) / 20\text{mA}$.
450T: $R_{LOAD} = 600 \text{ ohms}$.

Linearization (-xLxx) Option

5-segment TC linearizer provides minimum 10 to 1 improvement $\pm 0.1\%$ in the linearity curve.



Ordering Information

Select one option from each column. Example: 450T-TC3-Y-1-DIN-NCR-C
To order factory calibration, append "-C" to end of model number. Specify ranges on order.

Base	Input	Mounting	Approval
250T	-TC 1 -RL00*	-DIN -N4	-NCR
	-TC3* -SL00*	-ST -N12	-AQ1
	-JL00* -EL00*	-SM -XP	
	-KL00* -BL00*		
	-TL00*		

Note:
All 250Ts have 4 to 20mA output and are loop-powered.

Base	Input	Output	Mounting	Approval
350T	-TC 1 -RL00*	-Y	-DIN	-NCR
	-TC3* -SL00*	-V0		
	-JL00* -EL00*	-V5		
	-KL00* -BL00*			
	-TL00*			

Note:
All 350Ts accept 10 to 36V DC power supply.

Base	Input	Output	Power	Mounting	Approval
450T	-TC 1 -RL00*	-Y	-1	-DIN	-NCR
	-TC3* -SL00*	-V0	-2		
	-JL00* -EL00*	-V5			
	-KL00* -BL00*				
	-TL00*				

Input Options

Nonlinearized Input Options (output linear to millivolts)

-TC1: Thermocouple;
Field-selectable for J,K,T,R,S,E,B

Type J:

Span: 100 to 760°C (180 to 1368°F)
Zero: -100 to 450°C (-148 to 842°F)

Type K:

Span: 100 to 1200°C (180 to 2160°F)
Zero: -100 to 600°C (-148 to 1112°F)

Type T:

Span: 150 to 400°C (270 to 720°F)
Zero: -150 to 300°C (-238 to 572°F)

Type E:

Span: 100 to 700°C (180 to 1260°F)
Zero: -100 to 350°C (-148 to 662°F)

Type R:

Span: 550 to 1750°C (990 to 3150°F)
Zero: 0 to 1200°C (32 to 2192°F)

Type S:

Span: 550 to 1750°C (990 to 3150°F)
Zero: 0 to 1200°C (32 to 2192°F)

Type B:

Span: 1000 to 1820°C (1800 to 3276°F)
Zero: 0 to 1000°C (32 to 2192°F)

-TC3*: Narrow span TC, Field selectable J,K,T,R,S,E,B;
(spans from 3 to 5mV); . Specify ranges on order.

Linearized Input Options

(output linear to temperature for spans over 5mV
consult factory for spans under 5mV)

-JL00*: Linearized TC for Type J
Specify ranges on order.

-KL00*: Linearized TC for Type K
Specify ranges on order.

-TL00*: Linearized TC for Type T
Specify ranges on order.

-RL00*: Linearized TC for Type R
Specify ranges on order.

-SL00*: Linearized TC for Type S
Specify ranges on order.

-EL00*: Linearized TC for Type E
Specify ranges on order.

-BL00*: Linearized TC for Type B
Specify ranges on order.

Input Impedance

Without TC Break Detection: 1.0M ohm at 10mV span, typical; input current, ± 10 nA, typical.

With TC Break Detection: 400K ohm at 10mV span; input current, ± 25 nA, typical (± 30 nA, max.).

Output Options (350T, 450T only)

-Y: 4 to 20mA DC.

-V0: 0 to 10V DC into 10K ohms or greater

-V5: 0 to 5V DC into 5K ohms or greater

Power Options (450T only)

-1: 115V AC power

-2: 230V AC power

Mounting Options

Mountings

-DIN: DIN rail G or T mount

-ST: SNAPTRACK mount [250T only]

-SM: Surface-mount [250T only]

External housings

-N4: NEMA 4, water-tight [250T only], holds two

-N12: NEMA 12, oil-tight [250T only], holds two

-XP: Explosion-proof NEMA 4 [250T only], holds one

Approval Options

-NCR: No certification/approval required.

-DT1: CSA approval, Div. 2 hazardous locations:
Class I; Div. 2; Groups A, B, C, D [250T only].

Ordering Notes

* Unit requires factory calibration. Append "-C" to end of model number. Specify ranges on order.

† Units are shipped separately from any optional enclosures (i.e. units are not installed in any external housing).

Accessories

Power supplies

See Power Supplies on Page 199.

DIN RAIL 3.0

DIN RAIL 16.7

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

20RM-16-DIN

19" rack-mount kit with DIN rail. Holds sixteen 250T/350Ts or ten 450T transmitters.

350T-N4-WM

NEMA 4 water-tight enclosure, wall-mount. Holds two 350Ts or one 450T transmitter.

350T-N12-WM

NEMA 12 oil-tight enclosure, wall-mount. Holds two 350Ts or one 450T transmitter.



Isolated Transmitters



RTD Input

These models convert sensor inputs to proportional process current or voltage output signals.

Models

250T: Loop-powered transmitter series

350T: DC-powered transmitter series

450T: AC-powered transmitter series

Input Ranges

- 100 ohm Pt RTD (2, 3, or 4-wire), Pt-385/392
- 10 ohm Cu RTD (2, 3, or 4-wire)

Output Ranges

- DC current: 4 to 20mA
- DC voltage: 0 to 5V or 0 to 10V

Power Requirements

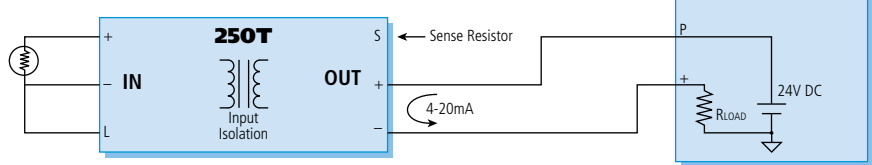
- 250T: 12 to 50V DC @ 20mA (loop-powered)
- 350T: DC voltage source (see table below)

Output range	Power
4 to 20mA	10 to 36V DC @ 30mA
0 to 5V	10 to 36V DC @ 9mA
0 to 10V	12.5 to 36V DC @ 9mA

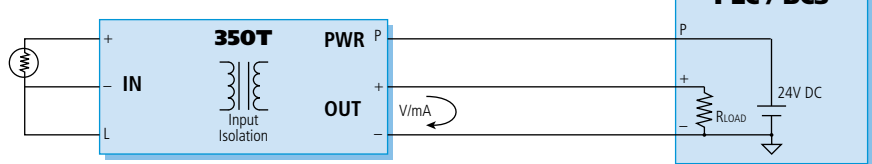
- 450T: 115V or 230V AC, $\pm 10\%$, 50 to 60Hz

Output range	Power
4 to 20mA	115V AC @ 0.050A
4 to 20mA	230V AC @ 0.025A
0 to 5V, 0 to 10V	115V AC @ 0.020A
0 to 5V, 0 to 10V	230V AC @ 0.010A

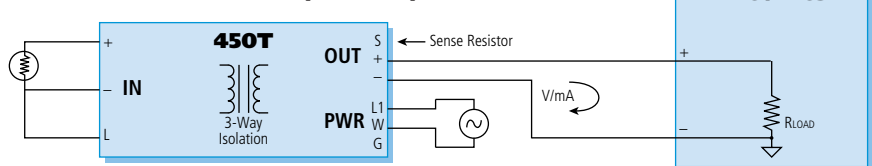
250T Loop-Powered (2-wire) Transmitter



350T DC-Powered (3-wire) Transmitter



450T AC-Powered (4-wire) Transmitter



Special Features

- Excellent accuracy and stability ensure reliable measurements in harsh industrial environments.
- RTD signal linearization improves accuracy and reduces drift.
- RTD break detection indicates open RTD failures with upscale operation.
- RTD lead wire compensation eliminates the effect of the wire's resistance.
- RFI and EMI resistance minimize the effects of environmental noise.
- 75% span adjustment enables precise application calibration.
- Low power consumption (350T as low as 9mA).
- 1500V AC peak isolation (250V AC or 354V DC continuous) prevents ground loops.

250T models:

Input isolated from output/power.

350T models:

Input isolated from output and power.
Output and power share a common.

450T models:

3-way isolation. Input, output, and power circuits are isolated from each other.

Performance

Ambient Temperature Range

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

Accuracy

$\pm 0.1\%$ of calibrated span or ± 0.25 mV, whichever is greater. Includes repeatability, hysteresis, terminal point linearity, and adjustment resolution.

Ambient Temperature Effect

-RBPx: $\pm 0.01\%$ of output span per °F ($\pm 0.018\%$ / °C).
-RBCx: $\pm 0.025\%$ of output span per °F ($\pm 0.045\%$ / °C).
(Specification includes the combined effects of zero and span over temperature).

Noise Resistance

RFI: Less than $\pm 0.5\%$ of output span effect.
EMI: Less than $\pm 0.25\%$ of output span effect.

Noise Rejection

Common Mode: 120dB at 60Hz, 100 ohm unbalance.
Normal Mode: 26dB at 60Hz, 100 ohm source, 20dB at 60Hz, 10 ohm source.

Response Time

Output reaches 98% of output span in 350ms.

Bandwidth

-3dB at 3 Hz, typical.

Output Compliance

250T: $R_{LOAD} (max.) = (V_{SUPPLY} - 12V) / 20mA$.

350T: $R_{LOAD} (max.) = (V_{SUPPLY} - 2.5V) / 20mA$.

450T: $R_{LOAD} = 600$ ohms.



Ordering Information

Select one option from each column. Example: 450T-RBP2-V0-2-DIN-NCR-C
To order factory calibration, append "-C" to end of model number. Specify ranges on order.

Base	Input	Mounting	Approval
250T	-RBP1 -RBC1	-DIN -N4	-NCR
	-RBP2 -RBC2	-ST -N12	-DT1
	-RBP3	-SM -XP	

Note:
All 250Ts have 4 to 20mA output and are loop-powered.

Base	Input	Output	Mounting	Approval
350T	-RBP1 -RBC1	-Y	-DIN	-NCR
	-RBP2 -RBC2	-V0		
	-RBP3	-V5		

Note:
All 350Ts accept 10 to 36V DC power supply.

Base	Input	Output	Power	Mounting	Approval
450T	-RBP1 -RBC1	-Y	-1	-DIN	-NCR
	-RBP2 -RBC2	-V0	-2		
	-RBP3	-V5			

Input Options

Platinum RTD input

- RBP1: Platinum RTD, 100 ohm
Span adjust: 25 to 100°C (45 to 180°F)
Zero adjust: -150 to 150°C (-238 to 302°F),
Accuracy: $\pm 0.1\%$
- RBP2: Platinum RTD, 100 ohm
Span adjust: 50 to 200°C (90 to 360°F)
Zero adjust: -150 to 150°C (-238 to 302°F),
Accuracy: $\pm 0.1\%$
- RBP3: Platinum RTD, 100 ohm
Span adjust: 200 to 800°C (360 to 1440°F)
Zero adjust: -150 to 150°C (-238 to 302°F),
Accuracy: $\pm 0.3\%$

Copper RTD input

- RBC1: 10 ohm Copper RTD
Span: 50 to 100°C (90 to 180°F)
Zero: -50 to 50°C (-58 to 122°F)
Accuracy: $\pm 0.25\%$
- RBC2: 10 ohm Copper RTD
Span: 100 to 200°C (180 to 360°F)
Zero: -50 to 50°C (-58 to 122°F)
Accuracy: $\pm 0.25\%$

Maximum Excitation Current

- Platinum RTD: 1.0mA (0.5mA for -RBP3)
- Copper RTD: 1.5mA.

Lead Wire Compensation

- A. 100 ohm, Pt RTD: Zero shift is less than 0.01%/ohm of lead resistance, for up to 10 ohms/leg, with a total maximum shift of 0.1%.
- B. 10 ohm Cu RTD: Zero shift is less than 0.05%/ohm of lead resistance, for up to 10 ohms/leg, with a total maximum shift of 0.5%.

Output Options (350T, 450T only)

- Y: 4 to 20mA DC.
- V0: 0 to 10V DC into 10K ohms or greater
- V5: 0 to 5V DC into 5K ohms or greater

Power Options (450T only)

- 1: 115V AC power
- 2: 230V AC power

Mounting Options

Mountings

- DIN: DIN rail G or T mount
- ST: SNAPTRACK mount [250T only]
- SM: Surface-mount [250T only]

External housings

- N4: NEMA 4, water-tight [250T only], holds two
- N12: NEMA 12, oil-tight [250T only], holds two
- XP: Explosion-proof NEMA 4 [250T only], holds one

Approval Options

- NCR: No certification/approval required.
- DT1†: CSA approval, Div. 2 hazardous locations:
Class I; Div. 2; Groups A, B, C, D [250T only].

Ordering Notes

† Units are shipped separately from any optional enclosures (i.e. units are not installed in any external housing).

Accessories

Power supplies

See Power Supplies on Page 199.

DIN RAIL 3.0

DIN RAIL 16.7

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

20RM-16-DIN

19" rack-mount kit with DIN rail. Holds sixteen 250T/350Ts or ten 450T transmitters.

350T-N4-WM

NEMA 4 water-tight enclosure, wall-mount. Holds two 350Ts or one 450T transmitter.

350T-N12-WM

NEMA 12 oil-tight enclosure, wall-mount. Holds two 350Ts or one 450T transmitter.



Isolated Transmitters



Potentiometer/Slidewire Input

These models convert sensor inputs to proportional process current or voltage output signals.

Models

250T: Loop-powered transmitter series

350T: DC-powered transmitter series

450T: AC-powered transmitter series

Input Ranges

- Resistance, 100 to 10,000 ohm three-wire pot/slidewire

Output Ranges

- DC current: 4 to 20mA
- DC voltage: 0 to 5V or 0 to 10V

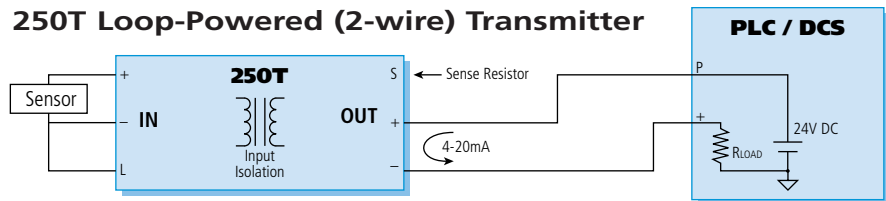
Power Requirements

- 250T: 12 to 50V DC @ 20mA (loop-powered)
- 350T: DC voltage source (see table below)
- 450T: 115V or 230V AC, $\pm 10\%$, 50 to 60Hz

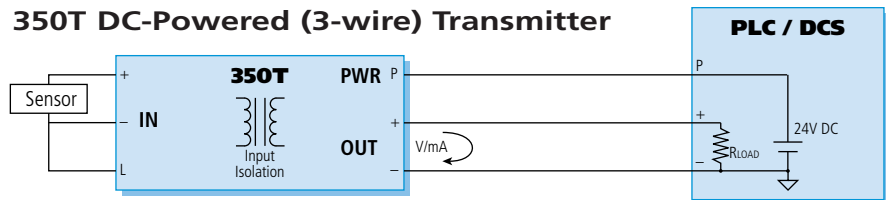
Output range	Power
4 to 20mA	10 to 36V DC @ 30mA
0 to 5V	10 to 36V DC @ 9mA
0 to 10V	12.5 to 36V DC @ 9mA

Output range	Power
4 to 20mA	115V AC @ 0.050A
4 to 20mA	230V AC @ 0.025A
0 to 5V, 0 to 10V	115V AC @ 0.020A
0 to 5V, 0 to 10V	230V AC @ 0.010A

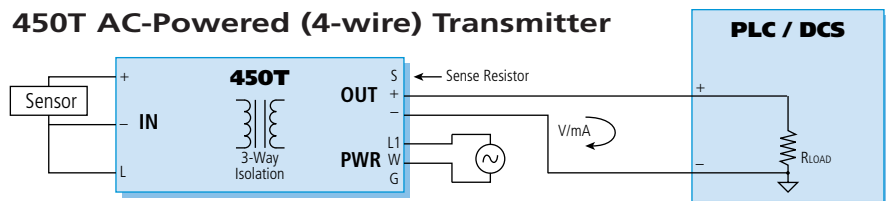
250T Loop-Powered (2-wire) Transmitter



350T DC-Powered (3-wire) Transmitter



450T AC-Powered (4-wire) Transmitter



Special Features

- Excellent accuracy and stability ensure reliable measurements in harsh industrial environments.
- RFI and EMI resistance minimize the effects of environmental noise.
- 75% span adjustment enables precise application calibration.
- Compact, 1-inch wide housing uses less space for easier installation in control panels.
- Low power consumption. 350T units operate on currents as low as 9mA to help prevent expensive upgrades to larger power supplies.
- 1500V AC peak isolation (250V AC or 354V DC continuous) prevents ground loops.

250T models:

Input isolated from output/power.

350T models:

Input isolated from output and power. Output and power share a common.

450T models:

3-way isolation. Input, output, and power circuits are isolated from each other.

Performance

Ambient Temperature Range

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

Accuracy

$\pm 0.1\%$ of calibrated span. Includes repeatability, hysteresis, terminal point linearity, and adjustment resolution.

Ambient Temperature Effect

Less than $\pm 0.01\%$ of output span per °F ($\pm 0.018\%$ per °C). (Specification includes the combined effects of zero and span over temperature).

Noise Resistance

RFI: Less than $\pm 0.5\%$ of output span effect.
EMI: Less than $\pm 0.25\%$ of output span effect.

Noise Rejection

Common Mode: 120dB at 60Hz, 100 ohm unbalance.
Normal Mode: 26dB at 60Hz, 100 ohm source.

Response Time

Output reaches 98% of output span in 300mS.

Bandwidth

-3dB at 3 Hz, typical.

Output Compliance

250T: $R_{LOAD} (max.) = (V_{SUPPLY} - 12V) / 20mA$.
350T: $R_{LOAD} (max.) = (V_{SUPPLY} - 2.5V) / 20mA$.
450T: $R_{LOAD} = 600 \text{ ohms}$.



Ordering Information

Select one option from each column. Example: 450T-P-V0-2-DIN-NCR

NOTE: Factory calibration is not available. Zero and full scale values vary for each application.

Base	Input	Mounting		Approval
250T	-P	-DIN	-N4	-NCR
		-ST	-N12	
		-SM	-XP	

Note:
All 250Ts have 4 to 20mA output and are loop-powered.

Base	Input	Output	Mounting	Approval
350T	-P	-Y	-DIN	-NCR
		-V0		
		-V5		

Note:
All 350Ts accept 10 to 36V DC power supply.

Base	Input	Output	Power	Mounting	Approval
450T	-P	-Y	-1	-DIN	-NCR
		-V0	-2		
		-V5			

Accessories

Power supplies

See Power Supplies on Page 199.

DIN RAIL 3.0

DIN RAIL 16.7

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

20RM-16-DIN

19" rack-mount kit with DIN rail. Holds sixteen 250T/350Ts or ten 450T transmitters.

350T-N4-WM

NEMA 4 water-tight enclosure, wall-mount. Holds two 350Ts or one 450T transmitter.

350T-N12-WM

NEMA 12 oil-tight enclosure, wall-mount. Holds two 350Ts or one 450T transmitter.

Input Options

-P: Potentiometer/Slidewire Input

100 to 10,000 ohms

Span adjust: 25 to 100% of slidewire resistance

Zero adjust: 0 to 75% of slidewire resistance

Excitation: 0.2V DC (current limited to 3.0mA).

Output Options (350T, 450T only)

-Y: 4 to 20mA DC.

-V0: 0 to 10V DC into 10K ohms or greater

-V5: 0 to 5V DC into 5K ohms or greater

Power Options (450T only)

-1: 115V AC power

-2: 230V AC power

Mounting Options

Mountings

-DIN: DIN rail G or T mount

-ST: SNAPTRACK mount [250T only]

-SM: Surface-mount [250T only]

External housings

-N4: NEMA 4, water-tight [250T only], holds two

-N12: NEMA 12, oil-tight [250T only], holds two

-XP: Explosion-proof NEMA 4 [250T only], holds one

Approval Options

-NCR: No certification/approval required.



Isolated Transmitters



Frequency Input

These transmitters accept periodic or pulse wave-form signals such as those originating from tachometers, magnetic transducers, and turbine flow meters, and provide a proportional process current or voltage output signal.

Models

250T: Loop-powered transmitter series

350T: DC-powered transmitter series

450T: AC-powered transmitter series

Input Ranges

- Frequency, span ranges 0 to 25.6KHz, field-selectable, direct coupled inputs, $\pm 25\text{mV}$ to 150V RMS

Output Ranges

- DC current: 4 to 20mA
- DC voltage: 0 to 5V or 0 to 10V

Power Requirements

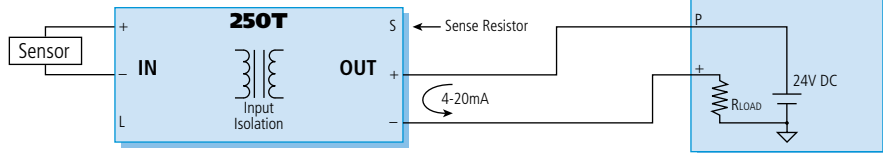
- 250T: 12 to 50V DC @ 20mA (loop-powered)
- 350T: DC voltage source (see table below)

Output range	Power
4 to 20mA	10 to 36V DC @ 30mA
0 to 5V	10 to 36V DC @ 9mA
0 to 10V	12.5 to 36V DC @ 9mA

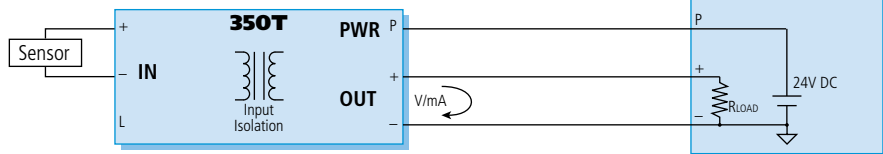
- 450T: 115V or 230V AC, $\pm 10\%$, 50 to 60Hz

Output range	Power
4 to 20mA	115V AC @ 0.050A
4 to 20mA	230V AC @ 0.025A
0 to 5V, 0 to 10V	115V AC @ 0.020A
0 to 5V, 0 to 10V	230V AC @ 0.010A

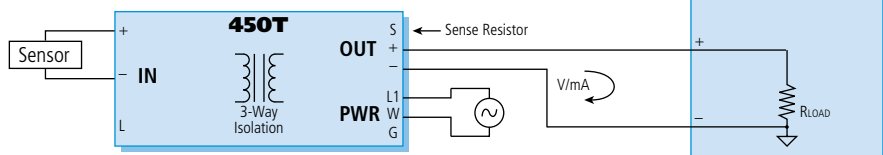
250T Loop-Powered (2-wire) Transmitter



350T DC-Powered (3-wire) Transmitter



450T AC-Powered (4-wire) Transmitter



Special Features

- Excellent accuracy and stability ensure reliable measurements in harsh industrial environments.
- RFI and EMI resistance minimize the effects of environmental noise.
- 90% span adjustment enables precise application calibration.
- Quartz crystal time-base design improves temperature performance
- Field-selectable time constants optimize output response time and ripple characteristics
- Selectable threshold circuits accept unipolar/bipolar inputs (0V bipolar, 1.5V unipolar)
- Excitation/pull-up circuit adds flexibility
- 1500V AC peak isolation (250V AC or 354V DC continuous) prevents ground loops.

250T models:

Input isolated from output/power.

350T models:

Input isolated from output and power.
Output and power share a common.

450T models:

3-way isolation. Input, output, and power circuits are isolated from each other.

Performance

Ambient Temperature Range

Operating: -13 to 185°F (-25 to 85°C).

Storage: -40 to 185°F (-40 to 85°C).

Accuracy

$\pm 0.1\%$ of calibrated span. Includes repeatability, hysteresis, terminal point linearity, and adjustment resolution.

Ambient Temperature Effect

Less than $\pm 0.01\%$ of output span per $^{\circ}\text{F}$ ($\pm 0.018\%$ per $^{\circ}\text{C}$). (Specification includes the combined effects of zero and span over temperature).

Noise Resistance

RFI: Less than $\pm 0.5\%$ of output span effect.

EMI: Less than $\pm 0.25\%$ of output span effect.

Noise Rejection

Common Mode: 115dB at 60Hz, 100 ohm unbalance.

Normal Mode: Not applicable.

Response Time

Time for output to reach 98% of output span depends on jumper-selectable frequency range.

Range 1: 8.0 sec response time (98%).

Range 2: 5.0 sec response time (98%).

Range 3: 0.4 sec response time (98%).

Bandwidth

-3dB at 25,600Hz, typical.

Output Compliance

250T: $R_{LOAD} (\text{max.}) = (V_{SUPPLY} - 12V) / 20\text{mA}$.

350T: $R_{LOAD} (\text{max.}) = (V_{SUPPLY} - 2.5V) / 20\text{mA}$.

450T: $R_{LOAD} = 600$ ohms.



Ordering Information

Select one option from each column. Example: 450T-V4-V0-2-DIN-NCR-C

To order factory calibration, append "-C" to end of model number. Specify ranges on order.

Base	Input	Mounting		Approval
250T	-FQ1	-DIN	-N4	-NCR
		-ST	-N12	-DT1
		-SM	-XP	

Note:
All 250Ts have 4 to 20mA output and are loop-powered.

Base	Input	Output	Mounting	Approval
350T	-FQ1	-Y	-DIN	-NCR
		-V0		
		-V5		

Note:
All 350Ts accept 10 to 36V DC power supply.

Base	Input	Output	Power	Mounting	Approval
450T	-FQ1	-Y	-1	-DIN	-NCR
		-V0	-2		
		-V5			

Input Options

-FQ1: Frequency, range 0 to 25.6KHz

Span adjust: 50 to 100% of range selected below.

Zero adjust: 0 to 20% of span.

Jumper-selectable ranges:

Range A: 25 to 50 Hz span.

Range B: 50 to 100 Hz span.

Range C: 100 to 200 Hz span.

Range D: 200 to 400 Hz span.

Range E: 400 to 800 Hz span.

Range F: 800 to 1,600 Hz span.

Range G: 1,600 to 3,200 Hz span.

Range H: 3,200 to 6,400 Hz span.

Range I: 6,400 to 12,800 Hz span.

Range J: 12,800 to 25,600 Hz span.

Input Circuit Open Response

Down-scale drive standard.

Bipolar Input Configuration

Threshold: 0.0V DC.

Input Amplitude: ± 25 mV to 150V RMS.

Hysteresis: Fixed: ± 25 mV, nominal. Switching points are -25mV and +25mV (nominal), or 0.0V ± 0.025 V.

Unipolar Input Configuration

Threshold: 1.5V DC. Attenuator resistors may be installed to further reduce sensitivity, consult factory.

Hysteresis: Fixed: ± 25 mV, nominal. Switching points are +1.525V and +1.475V (nominal), or +1.5V ± 0.025 V.

Input Amplitude: 0 to 2V to 150V RMS.

Unipolar Excitation Supply: For contact closure or open collector transistor switching circuits. Nominal excitation/pull-up is 5V DC through 15K ohms (0.333mA, nominal).

Minimum Pulse Width

The minimum pulse width required is 10 μ S.

Output Options (350T, 450T only)

-Y: 4 to 20mA DC.

-V0: 0 to 10V DC into 10K ohms or greater

-V5: 0 to 5V DC into 5K ohms or greater

Power Options (450T only)

-1: 115V AC power

-2: 230V AC power

Mounting Options

Mountings

-DIN: DIN rail G or T mount

-ST: SNAPTRACK mount [250T only]

-SM: Surface-mount [250T only]

External housings

-N4: NEMA 4, water-tight [250T only], holds two

-N12: NEMA 12, oil-tight [250T only], holds two

-XP: Explosion-proof NEMA 4 [250T only], holds one

Approval Options

CE marked [250T only].

-NCR: No certification/approval required.

-DT1†: CSA approval, Div. 2 hazardous locations: Class I; Div. 2; Groups A, B, C, D [250T only].

Ordering Notes

* Unit requires factory calibration. Append "-C" to end of model number. Specify ranges on order.

† Units are shipped separately from any optional enclosures (i.e. units are not installed in any external housing).

Accessories

Power supplies

See Power Supplies on Page 199.

DIN RAIL 3.0

DIN RAIL 16.7

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

20RM-16-DIN

19" rack-mount kit with DIN rail. Holds sixteen 250T/350Ts or ten 450T transmitters.

350T-N4-WM

NEMA 4 water-tight enclosure, wall-mount. Holds two 350Ts or one 450T transmitter.

350T-N12-WM

NEMA 12 oil-tight enclosure, wall-mount. Holds two 350Ts or one 450T transmitter.



Isolated Transmitters



AC Voltage and AC Current Input

These models convert sensor inputs to proportional process current or voltage output signals.

AC voltage transmitters accept direct voltage inputs. Current models include an external AC current sensor. This toroidal sensor outputs a safe DC milliamp signal which transmits accurately over long distances. Input span is a function of the primary turns placed on the sensor.

Input Ranges

- AC voltage, 50/60Hz
0 to 150V AC
- AC current, 0 to 20A

Output Ranges

- DC current: 4 to 20mA
- DC voltage: 0 to 5V or 0 to 10V

Power Requirements

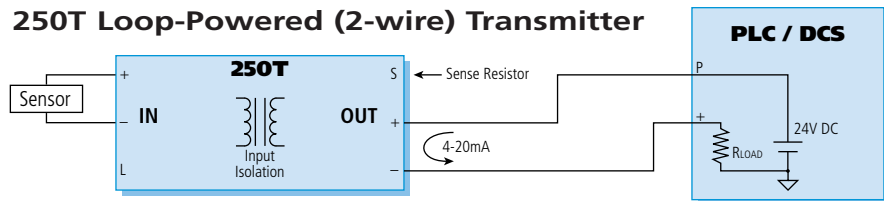
- 250T: 12 to 50V DC @ 20mA (loop-powered)
- 350T: DC voltage source (see table below)

Output range	Power
4 to 20mA	10 to 36V DC @ 30mA
0 to 5V	10 to 36V DC @ 9mA
0 to 10V	12.5 to 36V DC @ 9mA

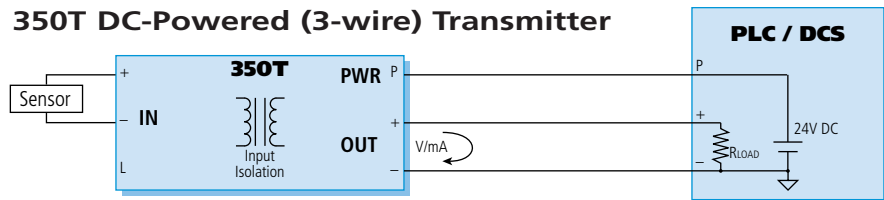
- 450T: 115V or 230V AC, $\pm 10\%$, 50 to 60Hz

Output range	Power
4 to 20mA	115V AC @ 0.050A
4 to 20mA	230V AC @ 0.025A
0 to 5V, 0 to 10V	115V AC @ 0.020A
0 to 5V, 0 to 10V	230V AC @ 0.010A

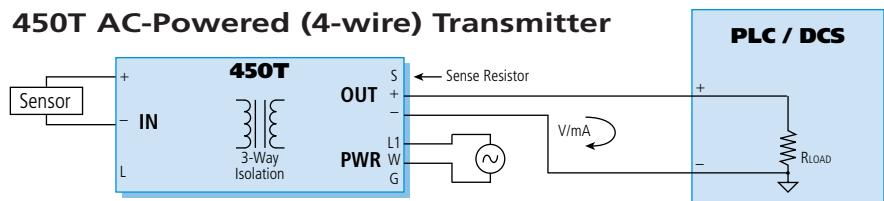
250T Loop-Powered (2-wire) Transmitter



350T DC-Powered (3-wire) Transmitter



450T AC-Powered (4-wire) Transmitter



Special Features

- Excellent accuracy and stability ensure reliable measurements in harsh industrial environments.
- External AC current sensor with DC mA output enables remote mounting of transmitter (for safe monitoring of the AC signal)
- AC current range is a function of sensor primary turns for easy rescaling in field
- Factory-calibrated AC current transmitter does not need recalibration
- RFI and EMI resistance minimize the effects of environmental noise.
- Compact, 1-inch wide housing uses less space.
- Low power consumption. (350T as low as 9mA).
- 1500V AC peak isolation (250V AC or 354V DC continuous) prevents ground loops.

250T models:

Input isolated from output/power.

350T models:

Input isolated from output and power.
Output and power share a common.

450T models:

3-way isolation. Input, output, and power circuits are isolated from each other.

Performance

Ambient Temperature Range

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

Accuracy

$\pm 0.5\%$ of calibrated span. Includes repeatability, hysteresis, terminal point linearity, and adjustment resolution.

Ambient Temperature Effect

Less than $\pm 0.01\%$ of output span per °F ($\pm 0.018\%$ per °C). (Specification includes the combined effects of zero and span over temperature).

Noise Resistance

RFI: Less than $\pm 0.5\%$ of output span effect.
EMI: Less than $\pm 0.25\%$ of output span effect.

Noise Rejection

Common Mode (-VAC): 120dB at 60Hz, 100 ohm unbalance.

Common Mode (-CACX): 120dB at 60Hz, 1 ohm unbalance.

Normal Mode: Not Applicable.

Response Time

Output reaches 98% of output span in 300mS.

Bandwidth

-3dB at 3 Hz, typical.

Output Compliance

250T: $R_{LOAD} (max.) = (V_{SUPPLY} - 12V) / 20mA$.
350T: $R_{LOAD} (max.) = (V_{SUPPLY} - 2.5V) / 20mA$.
450T: $R_{LOAD} = 600 \text{ ohms}$.



Ordering Information

Select one option from each column. Example: 450T-VAC-V5-2-DIN-NCR-C

To order factory calibration, append "-C" to end of model number. Specify ranges on order.

Base	Input	Mounting	Approval
250T	-VAC -CACX	-DIN -N4 -ST -N12 -SM -XP	-NCR

Note:
All 250Ts have 4 to 20mA output and are loop-powered.

Base	Input	Output	Mounting	Approval
350T	-VAC -CACX	-Y -V0 -V5	-DIN	-NCR

Note:
All 350Ts accept 10 to 36V DC power supply.

Base	Input	Output	Power	Mounting	Approval
450T	-VAC -CACX	-Y -V0 -V5	-1 -2	-DIN	-NCR

Input Options

-VAC: AC Voltage,
0 to 150V AC range,
Span adjust: 60 to 150V AC
Zero adjust: 0 to 90VAC
Input impedance 100k ohms
Input burden is 0.3 volt-amps

-CACX*: AC Current

AC Current Sensor (5020-350): One sensor is supplied with each transmitter. The sensor is a high-accuracy toroidal instrument transformer. See Page 205 for more information.

AC Input Range	Primary Turns	Sensor Output
0 to 20 Amps AC	1	0 to 11.17 mA DC
0 to 10 Amps AC	2	0 to 11.17 mA DC
0 to 5 Amps AC	4	0 to 11.17 mA DC
0 to 1 Amps AC	20	0 to 11.17 mA DC

Input Burden: A function of the wire gauge resistance used for the primary turns.

Input Overload: The AC Current Sensor withstands overloads as follows: 20 times full-scale for 0.01 second., 10 times full-scale for 0.1 second., and 5 times full-scale for 1.0 second.

AC Current Sensor to Transmitter Wiring Distance: 400 feet maximum for 18 AWG wire gauge. Other wire gauges can be used as long as the resistance of both wires is less than 5.0 ohms.

Output Options (350T, 450T only)

-Y: 4 to 20mA DC.
-V0: 0 to 10V DC into 10K ohms or greater
-V5: 0 to 5V DC into 5K ohms or greater

Power Options (450T only)

-1: 115V AC power
-2: 230V AC power

Mounting Options

Mountings

-DIN: DIN rail G or T mount
-ST: SNAPTRACK mount [250T only]
-SM: Surface-mount [250T only]

External housings

-N4: NEMA 4, water-tight [250T only], holds two
-N12: NEMA 12, oil-tight [250T only], holds two
-XP: Explosion-proof NEMA 4 [250T only], holds one

Approval Options

-NCR: No certification/approval required.

Ordering Notes

* Unit is factory calibrated for fixed range (adjustable by windings of sensor). Custom factory calibration '-C' option is not available with this input.

Accessories

Power supplies

See Power Supplies on Page 199.

5020-350

AC current sensor. (See page 205)

DIN RAIL 3.0

DIN RAIL 16.7

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

20RM-16-DIN

19" rack-mount kit with DIN rail. Holds sixteen 250T/350Ts or ten 450T transmitters.

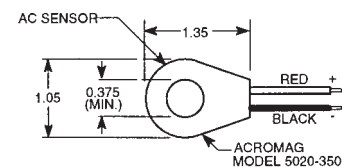
350T-N4-WM

NEMA 4 water-tight enclosure, wall-mount. Holds two 350Ts or one 450T transmitter.

350T-N12-WM

NEMA 12 oil-tight enclosure, wall-mount. Holds two 350Ts or one 450T transmitter.

AC Current Sensor





Relay Trips



260A Series Fail-safe Limit Alarms

The 260A accepts a 4 to 20mA input signal and provides a dry contact relay output if the input exceeds a user-defined setpoint limit. Power is received from the input loop.

These alarm relays are ideal for local failsafe alarming with existing process transmitters. They are easily installed on a process loop because they do not require an additional power supply and feature a very low voltage burden. A long list of features allows the 260A to adapt to most applications.

Input

4 to 20mA DC

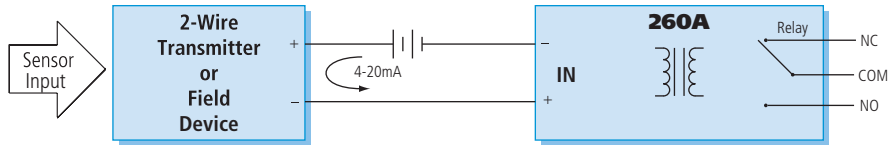
Output

2A SPDT dry contact relay

Power Requirement

4.5V DC (loop-powered)

260A Loop-Powered Limit Alarm



Special Features

- Excellent accuracy and stability ensure reliable measurements in harsh industrial environments.
- RFI and EMI resistance minimize the effects of environmental noise.
- Loop-power design and low 4.5V DC voltage drop enable easy installation.
- Hi/low failsafe option trips alarms above or below setpoint.
- Automatic or manual reset option permits latching alarms.
- Adjustable setpoint (4 to 24mA) handles more applications.
- LED gives visual indication of alarm status.
- Six deadband levels (DIP switch select) offer further flexibility.
- 50mS response time delivers fast alarm notification.
- Compact, 1-inch wide housing uses less space for easier installation.

Performance

Reference test conditions

Input: 4 to 20mA; Setpoint at 20mA (1.0VDC);
Failsafe High Alarm; Deadband 0.5%;
Ambient 77°F (25°C).

Input

Input

4 to 20mA input. Power to operate the loop-alarm is derived from the input signal loop. Input current should be limited to 50mA or less to prevent damage to the alarm. Alarm input is reverse polarity protected.

Input Impedance

225 ohms at 20mA (input voltage drop: 4.5V DC) typical.

Setpoint adjust

The alarm setpoint is adjustable from 0 to 125% of input current span, readable as 0V DC (0mA) to 1.2V DC (24mA) at terminals. Resolution is 0.1% of span, continuous, on 22-turn potentiometer. The setpoint voltage represents the true trip-point to within $\pm 0.5\%$ of span. By monitoring the input current and adjusting the setpoint pot, the setpoint may be set to within 0.1%.

Deadband adjust (hysteresis)

Field selectable deadband: 0.5, 1, 2, 4, 8 and 16 percent of span, set via an internal DIP switch.

Continued on the next page.



Performance

Continued from the previous page.

Output/Relays

Output

Single-Pole, Double Throw (SPDT), Form C, dry contact relay. Isolated contacts rated at 2A (3A max.), 28V DC or 120V AC resistive.

Relay

Contact material: Fine silver.

Breakdown: 500V AC across contact gaps.

Life: 1 Million operations at 1 amp, 28V DC.

Operation: failsafe, coil normally energized, de-energizes on alarm.

Alarm LED

The LED will be ON if the setpoint is exceeded (relay not energized).

Alarm action

Failsafe high or low alarm. Can be field configured to trip on increasing signal (Failsafe HI Alarm), or decreasing signal (Failsafe LOW Alarm), via an internal DIP switch (S2). Set S2 to C2 position for High Alarm, or the C1 position for Low Alarm. Relay is normally energized and becomes de-energized on alarm or signal failure.

Alarm latch

Automatic Reset (Non-Latching or Latching). Latch action enabled via internal DIP switch. In the Non-Latching mode, the alarm will reset to its non-alarm state as soon as the signal is outside of the selected deadband. In the Latched mode, the alarm will reset when the local Reset button is pushed. Latch action can be locked out by pushing down and turning the Reset button 1/4-turn to lock it in its depressed state, or via the on-board DIP switch.

Accuracy

Repeatable within $\pm 0.1\%$ of input span for constant conditions (25°C).

Response time

The relay contacts switch from closed to open within 50mS for a step input change from 10% of span on one side of the alarm point, to 5% of span on the other side of the alarm point, for high or low alarms.

Minimum time between events: 100mSec.

Ordering Information

Select one option from each column. Example: 260A-20MA-SN-DIN-NCR-C

To order factory calibration, append "-C" to end of model number. Specify ranges on order.

Base	Input	Output	Mounting	Approval
260A	-20MA	-SN	-DIN -N4 -ST -N12 -SM -IH -IHW	-NCR

See Ordering Notes for model number descriptions.

Environmental

Ambient temperature range

-13 to 167°F (-25 to 75°C).

Ambient temperature effect

Less than $\pm 0.01\%$ of output span per °F ($\pm 0.018\%$ per °C) over the ambient temperature range for reference test conditions.

Isolation

The output contacts are isolated from the input/power circuits for common-mode voltages up to 250V AC, or 354V DC off ground, on a continuous basis (will withstand 1500V AC dielectric strength test for one minute without breakdown). This complies with test requirements outlined in ANSI C39.5-1974 for the voltage rating specified.

Noise rejection

Normal mode: 10dB at 60 Hz, typical.

RFI resistance

Unit will not trip, under influence of RFI, when input is $\pm 0.5\%$ of input span from setpoint voltage, with RFI field strengths of up to 10V/meter at frequencies of 27, 151 and 467 MHz.

EMI resistance

Unit will not trip when input is $\pm 0.25\%$ of input span from setpoint voltage with switching solenoids or commutator motors.

Surge withstand capability (SWC)

Input/Output terminations rated per ANSI/IEEE C37.90-1978. Unit is tested to a standardized test waveform that is representative of surges (high frequency transient electrical interference), observed in actual installations.

Physical

Construction

Circuit board: Military grade FR-4 epoxy glass circuit board

Terminals: Compression type, 14 AWG max.

DIP switch contacts: Gold flash over Nickel contacts.

Printed circuit board coating: Fungus resistant acrylic conformal coat.

Mounting position: Position insensitive.

Ordering Notes

Input Option

-20MA: 4 to 20mA

Output Option

-SN: SPDT dry contact relay

Mounting options

Mountings

-DIN: DIN rail G or T mount

-ST: SNAPTRACK mount

-SM: Surface-mount

External housings

-N4: NEMA 4, water-tight, holds two

-N12: NEMA 12, oil-tight, holds two

-IH: Rugged pipe mount housing, water-tight

-IHW: Same as -IH above with window

Approval Options

-NCR: No certification required

Ordering Notes

† Units are shipped separately from any optional enclosures (i.e. units are not installed in any external housing).

†† Units shipped installed in external enclosure.

Accessories

Power supplies

See Power Supplies on Page 199.

DIN RAIL 3.0

DIN RAIL 16.7

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

20RM-16-DIN

19" rack-mount kit with DIN rail.

Holds sixteen 260A alarms.



Relay Trips



361A and 461A Limit Alarms

These alarms accept DC voltage/current input signals and provide relay output if the input exceeds user-defined setpoint limits.

Numerous options and features make these alarms easy to use and well-suited for a wide range of limit monitoring and on/off controller applications. Three-way isolation eliminates ground loops to simplify installation. And for easier use in the field, these alarms withstand extreme temperatures and have accessible setpoint voltage test points. Other features include alarm/power status LEDs and independent setpoint and deadband adjustment pots.

Models

361A: DC-powered

461A: AC-powered

Input Ranges

- 0 to 20mA DC
- 0 to 1V, 0 to 5V, 0 to 10V, 0 to 50V, 0 to 100V DC
- 0 to 20A AC (with external AC current sensor)

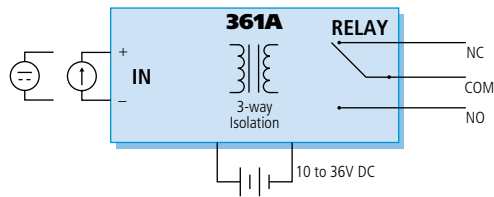
Output

- Electromechanical SPDT dry contact sealed relays; CSA rated for 5A

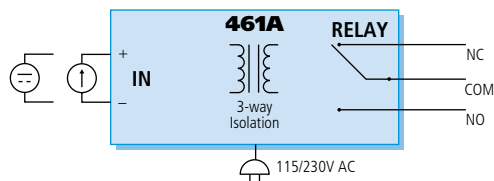
Power Requirements

- 361A: 10 to 36V DC (0.9W max.)
- 461A: 115V AC (0.0320A) or 230V AC (0.016A)

361A DC-Powered Limit Alarm



461A AC-Powered Limit Alarm



Special Features

- 100% adjustable setpoint via 15-turn pot handles more applications and provides better resolution.
- 100% adjustable deadband via 15-turn pot prevents false trips and eliminates alarm chatter.
- Setpoint test points are accessible on front of unit for quick verification with digital voltmeter probe.
- Dual relays offer the flexibility of high/low, high/high, or low/low alarm setpoint operation.
- Three-way isolation eliminates ground loops.
- Jumper-selectable DC voltage or current input reduces inventory stock.
- Jumper-selectable failsafe operation enables alarm actuation on power loss in critical applications.
- Wide power supply range (361A) handles more applications to reduce inventory stock.
- DC power units (361A only) carry lower voltages and do not require expensive conduit for safer and easier installation.
- Diode-coupled power (361A only) supports the use of redundant power supplies for critical applications.
- Excellent accuracy, stability and no loose internal wiring ensure reliable alarm trips.

Performance

Input

Input

-V1: 0 to 1V DC.

1M ohm input impedance or 0 to 20mA DC via 50 ohm internal resistor.

-V5: 0 to 5V DC.

1M ohm input impedance or 0 to 20mA DC via 250 ohm internal resistor.

-V0: 0 to 10V DC. 100K ohm input impedance.

-V50: 0 to 50V DC. 500K ohm input impedance.

-V100: 0 to 100V DC. 1M ohm input impedance.

AC current sensor (5020-350)

Used with -V1 input option only.

Input range is function of turns placed on sensor.

1 turn = 0 to 20A AC; 2 turns = 0 to 10A;

4 turns = 0 to 5A; 10 turns = 0 to 2A.

Setpoint adjust

0 to 115% of input span via 15-turn potentiometer.

Resolution better than 0.1% of span, continuous.

Deadband adjust (hysteresis)

1 to 100% of input span for each channel via 15-turn potentiometer(s). Adjustments are independent on dual alarm models.

Automatic reset (non-latching alarms)

The alarm resets to its non-alarm state as soon as input signal is outside of the selected deadband. If the deadband is set to its extreme (100%), then the alarm is effectively latching and will not reset till the input signal is at or below 0%.

Repeatability

Repeatable to better than $\pm 0.1\%$ of input span

Continued on the next page.



Performance

Continued from the previous page.

Output/Relays

Output

-SMRN: Single alarm.

One SPDT dry-contact sealed relay.

-DMRN: Dual Alarm, two SPDT relays.

Electrical Life - CSA Ratings:

25V DC, 5A, 100,000 operations, resistive.

48V DC, 0.8A, 100,000 operations, resistive.

120V AC, 5A, 30,000 operations, resistive.

240V AC, 5A, 30,000 operations, resistive.

Contact Material: Silver-cadmium oxide.

Breakdown Voltage: Between open contacts:

1000VAC rms. Between contacts and coil: 1500VAC rms, 50-60 Hz for one minute.

Mechanical Life: 20 million operations.

Response time

Fixed delay of 100mS (nominal). Relay transfers

≤100mS, typical, after input signal exceeds setpoint.

Relay transfers within 50mS after input passes dead-band, as it returns to normal range.

Power

Power requirement (361A)

10V to 36V DC.

Current draw is a function of supply voltage.

Currents specified are maximum values with the relay(s) energized.

Supply Voltage	Mechanical Relay Output	
	Single	Dual
10V	65mA	100mA
12V	50mA	75mA
15V	40mA	60mA
24V	30mA	40mA
36V	25mA	30mA

Power requirement (461A)

-1: 115V AC ±10%, 50 to 60Hz, 0.032A.

-2: 230V AC ±10%, 50 to 60Hz, 0.032A.

Power supply effect (461A)

Trip-point varies less than ±0.05% of input span.

Ordering Information

Select one option from each column. Example: 461A-V5-DMRN-1-DIN-NCR-C

To order factory calibration, append "-C" to end of model number. Specify ranges on order.

Base	Input		Output	Mounting	Approval
361A	-V1	-V50	-SMRN	-DIN	-NCR
	-V5	-V100	-DMRN		
	-V0				

Note:
All 361As accept
10 to 36V DC
power supply.

Base	Input		Output	Power	Mounting	Approval
461A	-V1	-V50	-SMRN	-1	-DIN	-NCR
	-V5	-V100	-DMRN	-2		
	-V0					

See Ordering Notes for model number descriptions.

Environmental

Ambient temperature range

-13°F to 167°F (-25°C to 75°C).

Ambient temperature effect

Less than ±0.01% of output span per °F (±0.018% per °C) over the ambient range.

Isolation

Three way; input, contacts, and power are isolated from each other for common mode voltages up to 250V AC, or 354V DC, continuous (withstands 1500V AC for sixty seconds without breakdown).

Noise rejection

Common mode: Better than 100dB at 60 Hz, 250ohm unbalance, typical.

Normal mode: 26dB at 60 Hz, 250ohm source, typical.

RFI resistance

Unit will not trip under influence of RFI when input is ±0.5% of input span from setpoint voltage for RFI field strengths of up to 10V/meter, at frequencies of 27MHz, 151MHz, and 467MHz.

EMI resistance

Unit will not trip when input is ±0.25% of input span from setpoint voltage with switching solenoids or commutator motors.

Surge withstand capability (SWC)

Meets ANSI/IEEE C37.90-1978.

Physical

Construction

Circuit boards: Military grade FR-4 epoxy glass circuit board, 0.063 inches thick.

Coating: Fungus resistant acrylic conformal coat.

Terminals: Compression type, wire 14 AWG max.

Case: Self-extinguishing NYLON Type 6.6 polyamide thermoplastic, UL94 V-2. NEMA 1 enclosure.

Test points (setpoint): Accepts 0.080" dia. probe.

Mounting position: Position insensitive.

Ordering Notes

Input Options

-V1: 0 to 1V DC, 0 to 20mA DC, or
0 to 20A AC with AC current sensor

-V5: 0 to 5V DC or 0 to 20mA DC

-V0: 0 to 10V DC

-V50: 0 to 50V DC

-V100: 0 to 100V DC

Output Options

-SMRN: One SPDT relay, single setpoint alarm

-DMRN: Two SPDT relays, dual setpoint alarm

Power Options

-1: 115V AC power

-2: 230V AC power

Mounting Option

-DIN: DIN rail G or T mount

Approval Option

-NCR: No certification/approval required.

Accessories

Power supplies

See Power Supplies on Page 199.

5020-350

AC current sensor. (See page 205)

DIN RAIL 3.0 or DIN RAIL 16.7

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

20RM-16-DIN

19" rack-mount kit with DIN rail. Holds ten alarms.

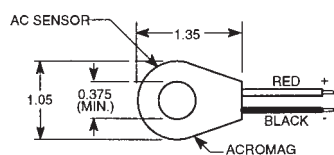
350T-N4-WM

NEMA 4 water-tight enclosure, wall-mount.
Holds one 361A or 461A alarm.

350T-N12-WM

NEMA 12 oil-tight enclosure, wall-mount.
Holds one 361A or 461A alarm.

AC Current Sensor





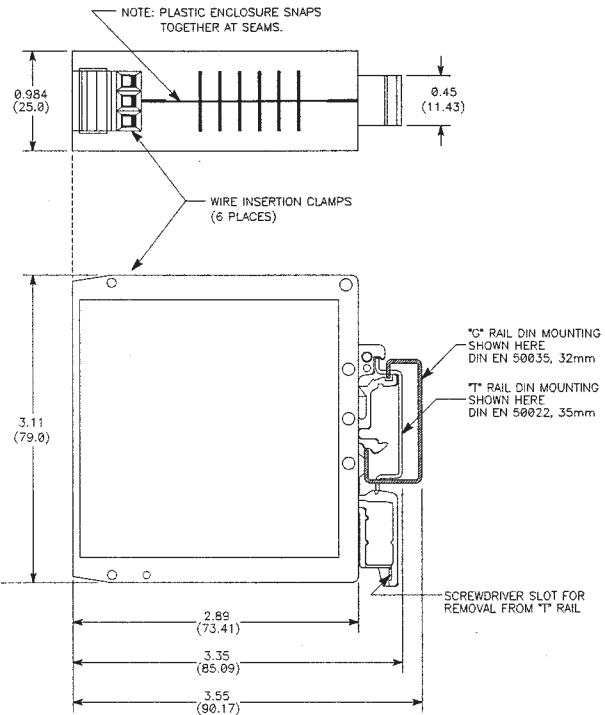
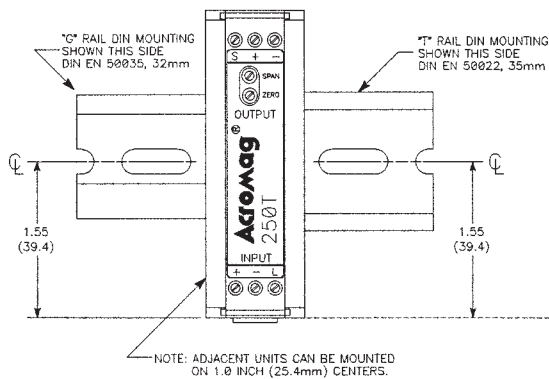
Dimensions

Transmitters: 250T, 350T

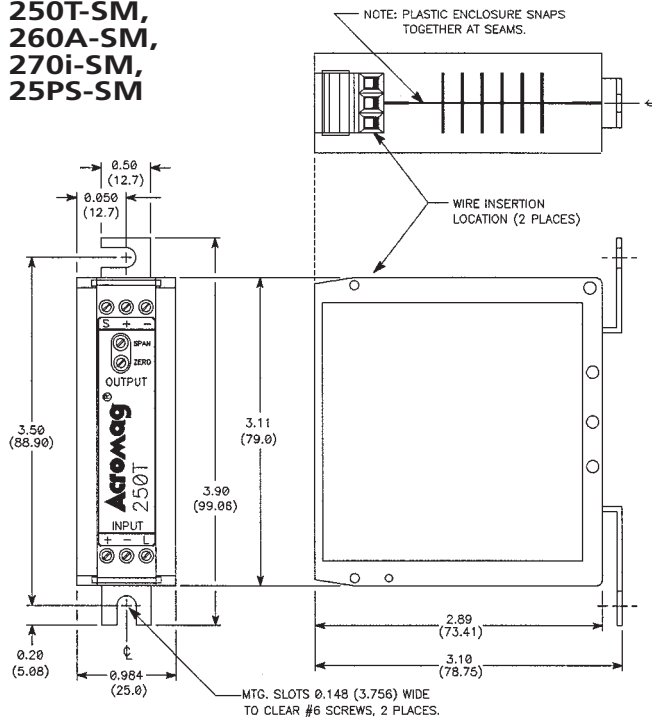
Isolators: 270i, 340i,

Limit Alarms: 260A

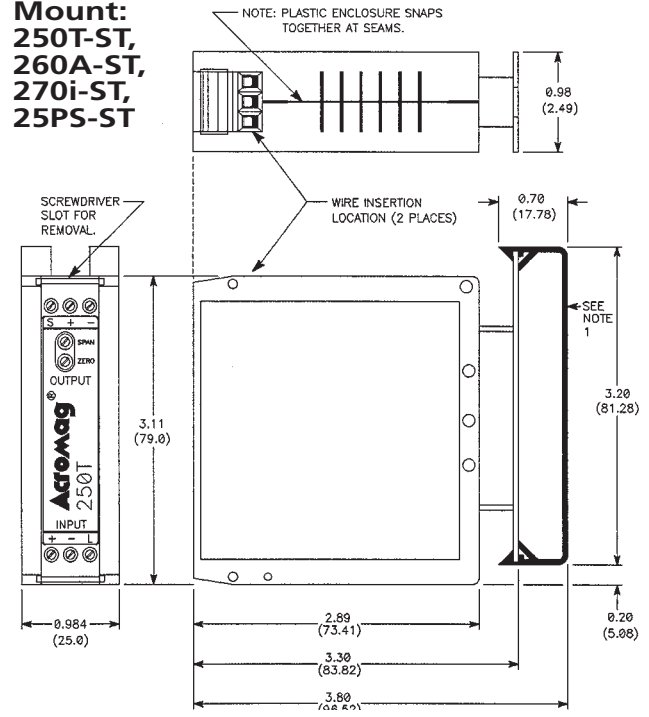
Power Supplies: 25PS, 35PS-2U



Surface Mount:
250T-SM,
260A-SM,
270i-SM,
25PS-SM



Snaptrack Mount:
250T-ST,
260A-ST,
270i-ST,
25PS-ST



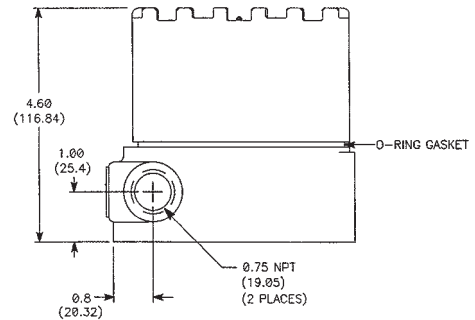
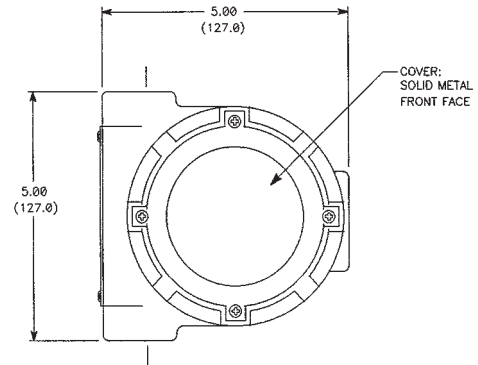
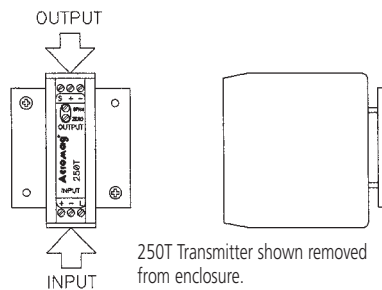
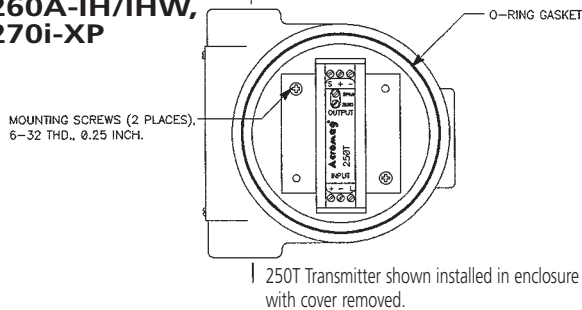
Dimensions are in inches (millimeters).



Dimensions

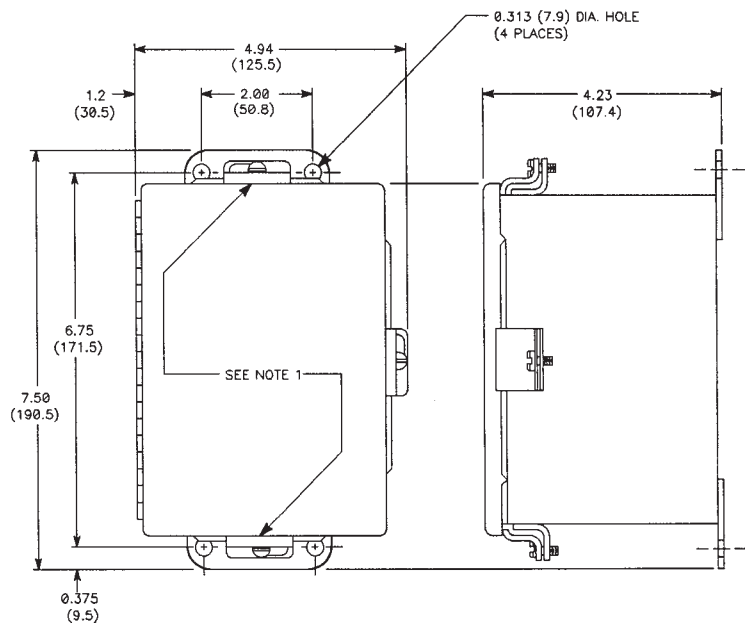
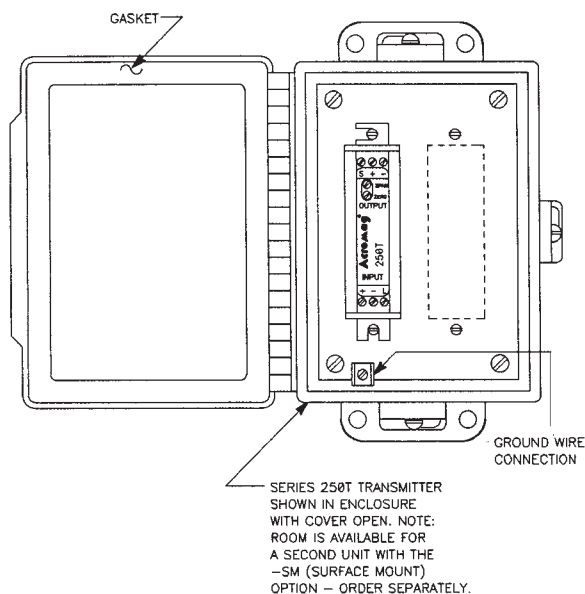
Explosion-Proof and Industrial Housing

**250T-XP,
260A-IH/IHW,
270i-XP**



NEMA-4 and NEMA-12 Enclosures

**250T-N4 / N12, 25PS-N4 / N12
260A-N4 / N12, 270i-N4 / N12**



NOTES:

1. THESE SPECIFIC CLAMPS ON NEMA 4 ENCLOSURES ONLY.
2. CONDUIT MOUNTING HOLES AND FITTINGS ARE CUSTOMER SUPPLIED.

Dimensions are in inches (millimeters).



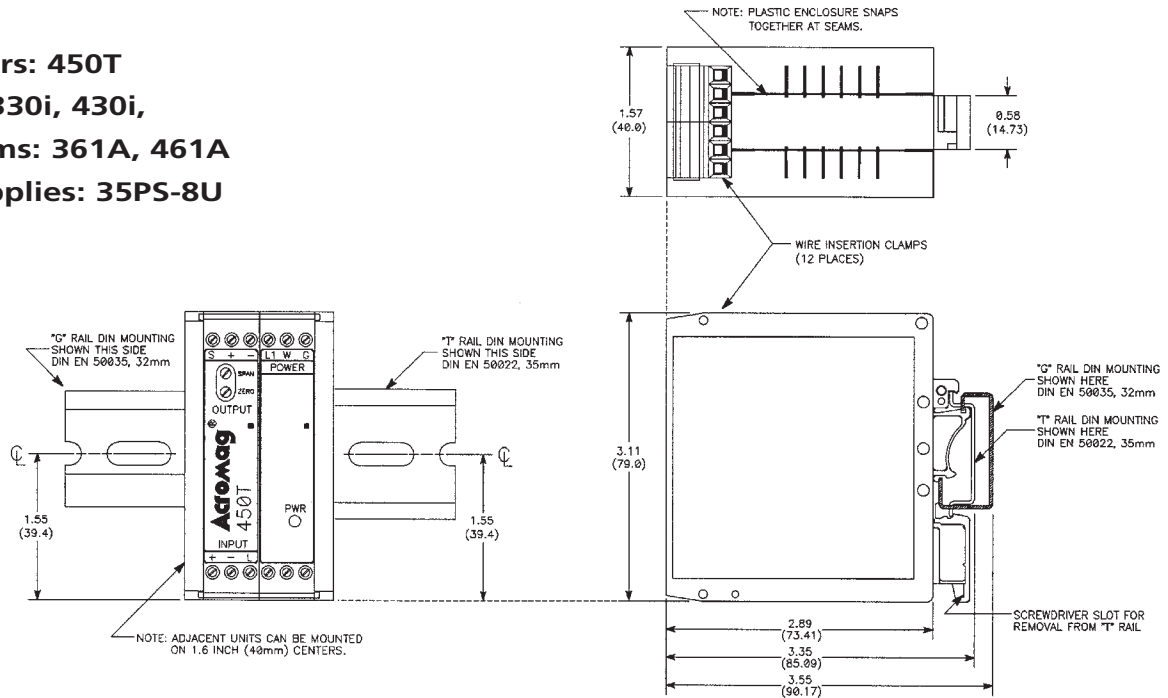
Dimensions

Transmitters: 450T

Isolators: 330i, 430i,

Limit Alarms: 361A, 461A

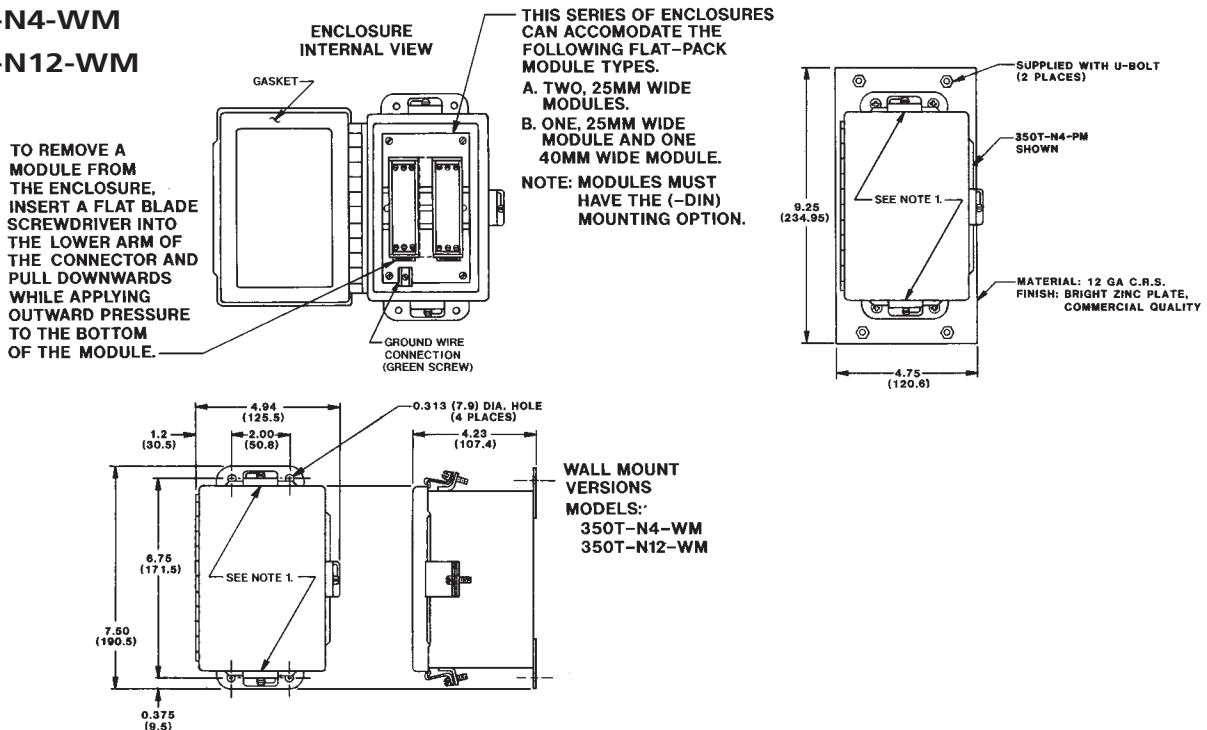
Power Supplies: 35PS-8U



NEMA-4 and NEMA-12 Enclosures

350T-N4-WM

350T-N12-WM



NOTES:

1. THESE SPECIFIC CLAMPS ON NEMA 4 ENCLOSURES ONLY.

2. CONDUIT MOUNTING HOLES AND FITTINGS ARE CUSTOMER SUPPLIED.

3. ALL DIMENSIONS ARE IN INCHES (MILLIMETERS).

Dimensions are in inches (millimeters).

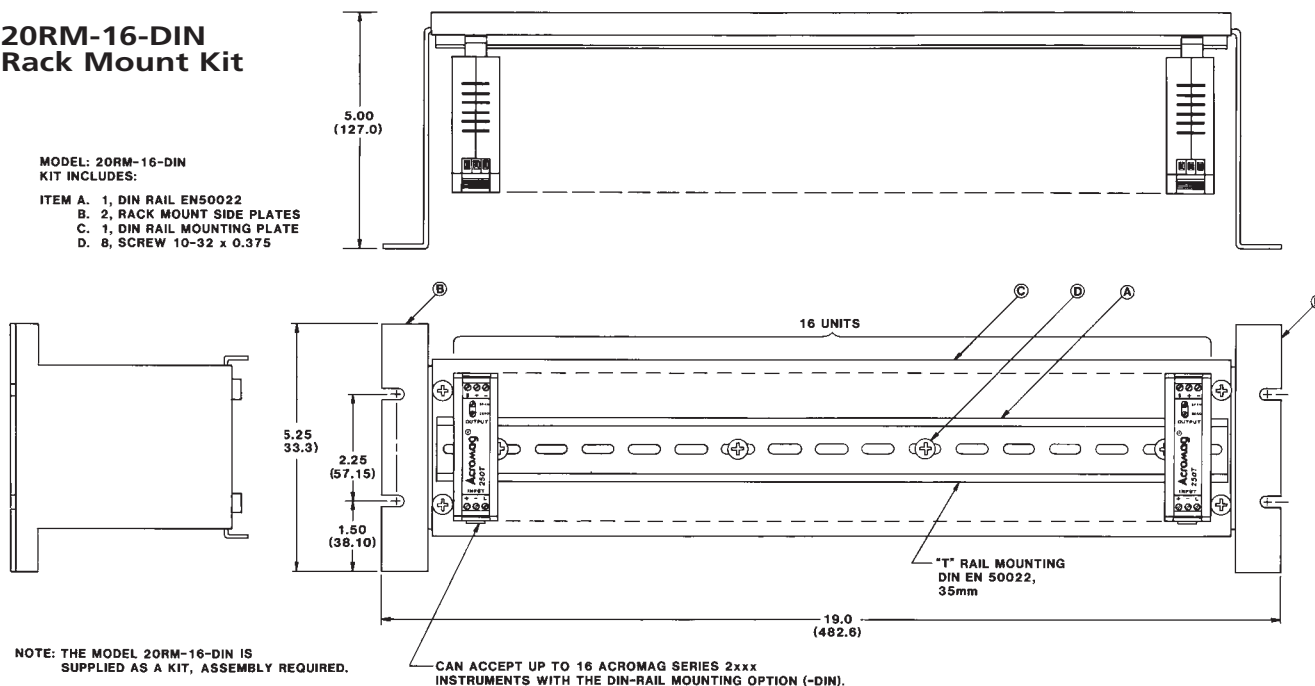


Dimensions

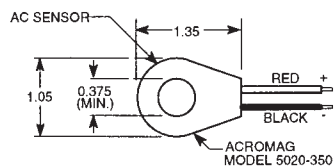
20RM-16-DIN Rack Mount Kit

MODEL: 20RM-16-DIN
KIT INCLUDES:

- ITEM A. 1, DIN RAIL EN50022
B. 2, RACK MOUNT SIDE PLATES
C. 1, DIN RAIL MOUNTING PLATE
D. 8, SCREW 10-32 x 0.375



AC Sensor 5020-350



Dimensions are in inches (millimeters).



1500 Series

Programmable Transmitters

151T PC-programmable, universal input . . .Page 178
155H HART-programmable, universal input 178

Standard Transmitters

150i DC current input Page 182
150T DC current, volt/millivolt input 184
150T Thermocouple input 186
150T RTD input 188
150T Potentiometer/slidewire input 192
150T Frequency input 194
150T AC current input 196

Technical Documentation

Dimension diagrams Page 198

Programmable Transmitters



These transmitters offer universal temperature inputs and are configured using a Windows® software program or a HART protocol communicator device.

Standard Transmitters



These transmitters have a variety of models to condition a broad range of input signals and are calibrated using zero and span potentiometers.

	150i	150T	151T	155H
FUNCTIONS				
4-20mA isolator	X	X	X	X
Isolated signal converter/transmitter		X	X	X
POWER CONFIGURATIONS				
Input loop-powered	X			
Output loop-powered		X	X	X
ISOLATION CONFIGURATIONS				
Input from output/power		X	X	X
Output from input/power	X			
INPUTS				
DC current input	X	X	X	X
DC millivolt input		X	X	X
Thermocouple input		X	X	X
RTD input		X	X	X
Resistance input			X	X
Potentiometer/slidewire input		X		
Frequency input		X		
AC current input		X		
OUTPUTS				
DC current (4-20mA)	X	X	X	X
HART communication				X
LCD indicator			X	X



Smart Transmitters



151T/155H Units Universal Input (TC, RTD, mV, ohms)

Models

151T: PC-configured transmitter

155H: HART®-configured transmitter

ATW-TLD: Optional plug-in LCD display with two-line text and bar graph readout

Input Ranges

Universal input with PC or HART configuration

- RTD (2, 3, and 4-wire),
100 ohm Pt DIN (alpha = 0.00385),
100 ohm Pt SAMA, (alpha = 0.003923)
10 ohm Cu, 100 ohm Ni, 120 ohm Ni
- Thermocouple: B, C, E, J, K, L, N, R, S, T, U
- Millivolt (-15 to 115mV)
- 4 to 20mA DC (with optional 5 ohm resistor)
- Resistance (0 to 500 ohms)

Output Ranges

- 4 to 20mA (both models)
- HART protocol (155H model only)

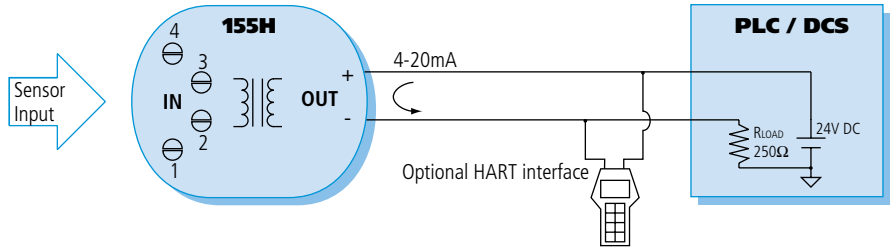
Power Requirement

- Loop-powered (2-wire), 12 to 42V DC

Approvals

- CE marked. CSA:
Class I Division 2 Groups A, B, C, D.

PC or HART®-configured Two-Wire Transmitter



Description

These programmable transmitters convert temperature and other sensor inputs to a proportional process current signal. A HART protocol output is optional.

Acromag's 1500 series transmitters bring the best elements of analog and smart digital technologies together to offer unsurpassed value for temperature measurement applications. They deliver superior accuracy, unrivaled versatility, and are extremely easy to use. Save time. Cut costs. And improve performance.

Two models are available. The 151T model is a standard PC-configurable two-wire transmitter. The 155H is a two-wire transmitter with a HART interface for communication and configuration.

Options include a plug-in LCD display and an explosion-proof enclosure. The two-line display provides a 4½ digit readout in °C or °F, a bar graph, and a text line for tag information. Push-buttons on the display unit allow you to configure the transmitter in the field. The enclosure is ideal for field mounting in hazardous locations. A window maintains visibility for the LCD display.



Special Features

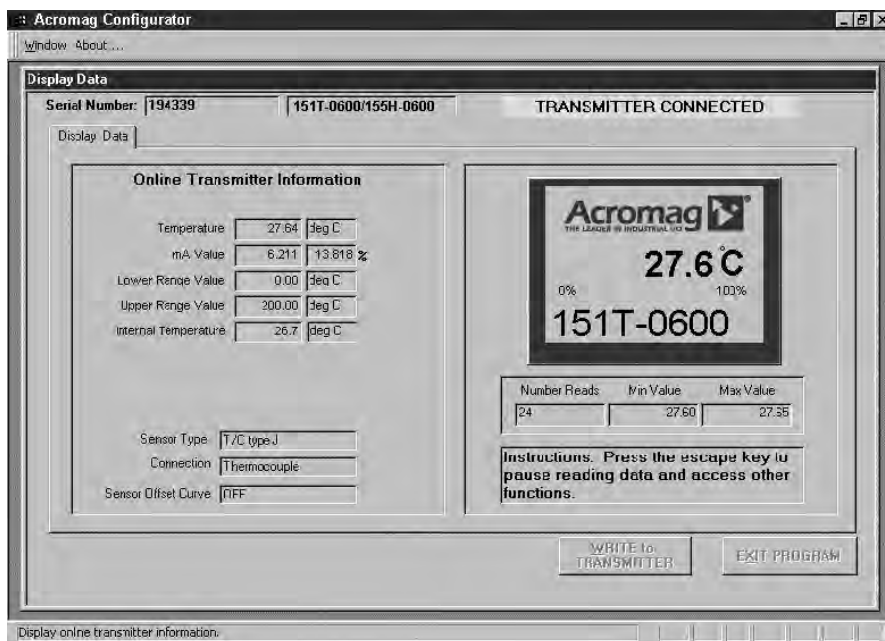
- Microprocessor reduces setup time, improves performance, and performs self-diagnostics.
- Multivariable transmitter accepts a variety of input sensor types to meet most applications and help minimize inventory requirements.
- Multifunction LCD readout displays temperature in °C or °F, a bar graph, the tag name, and diagnostic data.
- Flexible configuration supports setup via a PC with Acromag's software interface package, a standard handheld 275 HART communicator (155H only), or by using pushbuttons on the optional LCD display.
- 22-breakpoint linearizer table helps the user define custom output transfer functions.
- Sensor break detection and reporting functions allow users to specify a failsafe output and post a message on the optional LCD display.
- Automatic cold-junction compensation ensures high accuracy over a wide temperature range.
- Isolation between input/output circuits allows the use of grounded or ungrounded sensors.
- Output ranges can be set in engineering units anywhere within the input sensor range. No minimum/maximum span limitation.



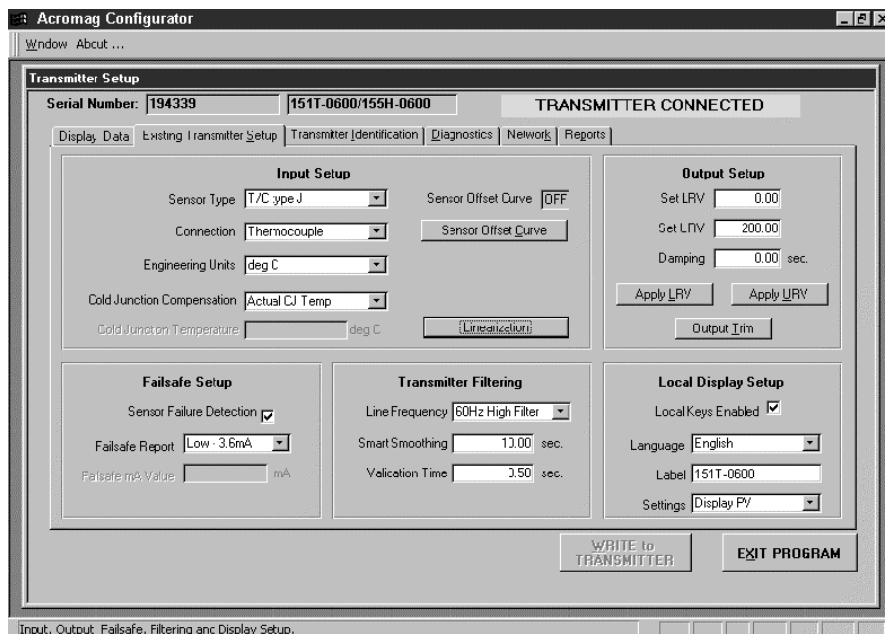
Explosion-proof and NEMA 4X stainless steel industrial enclosures are available.



Model 151T PC Configuration



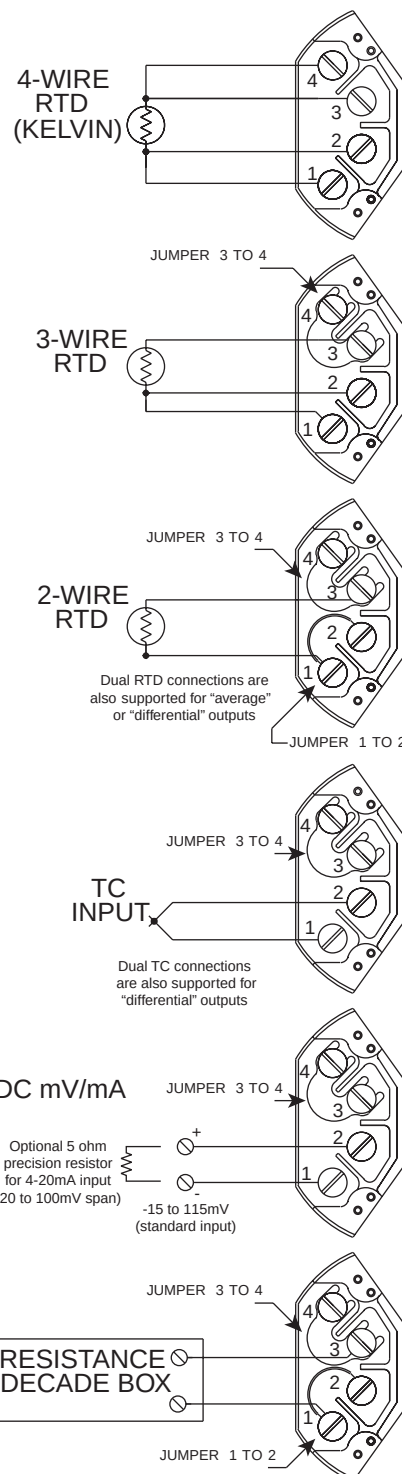
The Display Data screen shows the current status of the transmitter and simulates the readout on the optional LCD display.



Configuring Acromag's 151T and 155H transmitters is easy. The software interface package provides simple pull-down selection menus and fill-in-the-blank fields.

1500 Series Installation

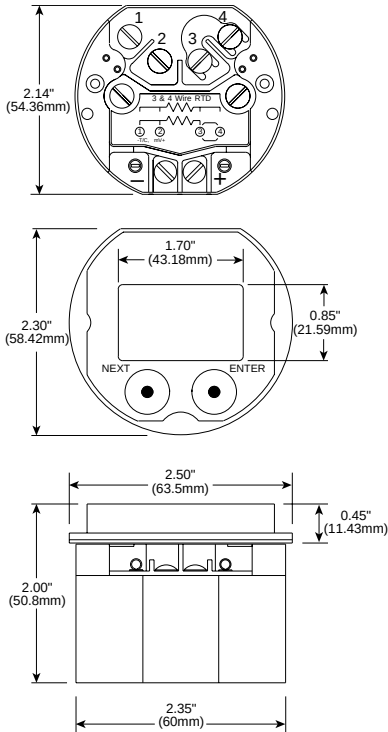
Input Connections



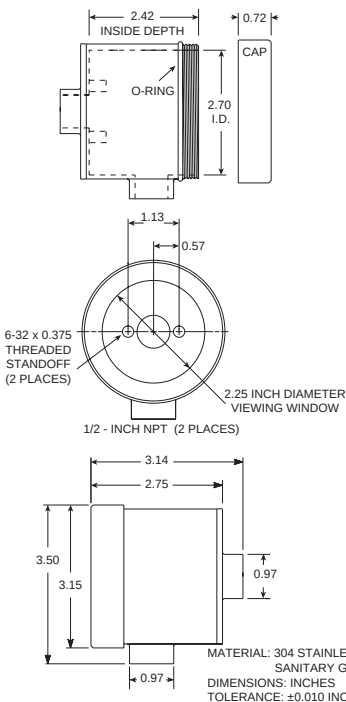


151T/155H Units Installation

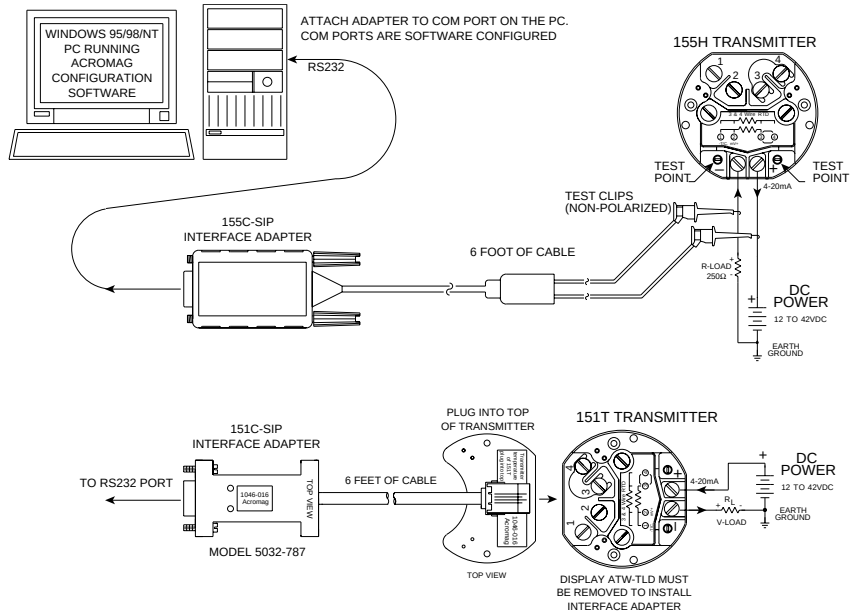
Dimensions



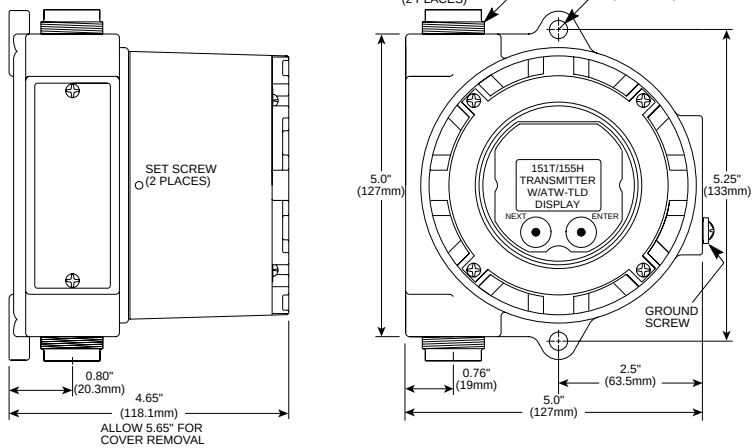
ATW-SSW Dimensions



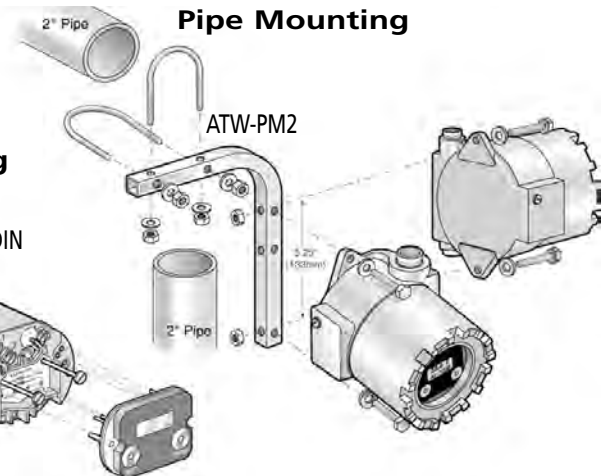
PC Configuration Connections



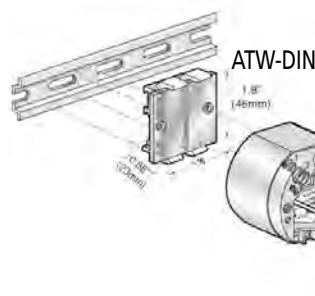
ATW-XPW Dimensions



Pipe Mounting



DIN Rail Mounting





■ Performance

■ General Input

Digital Input Accuracy

±0.05% of equivalent millivolt or ohm reading, or the accuracy shown in range tables, whichever is greater.

Ambient Temperature Effect

Self-correcting over full operating temperature range for changes up to 20°C/hour. Error is less than half the reference accuracy plus 0.1°C per 28°C change.

Noise Rejection

Common Mode: Better than 120dB @ 60Hz.

Sensor Break Detection

Failsafe response configurable for upscale (23mA), downscale (3.6mA), or no circuit response.

Linearization

TC and RTD linearization to ±0.05°C. Custom software configuration table supports up to 22 breakpoints.

Input Conversion Rate

7 conversions per second (150mS), typical.

Cold Junction Measurement Accuracy

±0.5°C (±0.9°F).

Input Impedance

Thermocouple/millivolt input: 0.2M ohm.
RTD/resistance input: 1M ohm.

RTD Input Configuration

Supports two, three, and four-wire (Kelvin) RTDs.

RTD Excitation Current

0.3mA nominal.

■ Input Ranges & Accuracy

Input Type	Input Range	Minimum Span	Accuracy
TC Type B	260 to 1820°C (109 to 3272°F)	100°C (212°F)	±0.8°C (±1.5°F)
TC Type C	0 to 2320°C (32 to 4208°F)	100°C (212°F)	±0.8°C (±1.5°F)
TC Type E	-270 to 1000°C (-454 to 1832°F)	20°C (68°F)	±0.3°C (±0.5°F)
TC Type J	-210 to 1200°C (-346 to 2192°F)	20°C (68°F)	±0.3°C (±0.5°F)
TC Type K	-270 to 1372°C (-454 to 2502°F)	20°C (68°F)	±0.3°C (±0.5°F)
TC Type L	-200 to 900°C (-328 to 1652°F)	20°C (68°F)	±0.3°C (±0.5°F)
TC Type N	270 to 1300°C (518 to 2372°F)	20°C (68°F)	±0.3°C (±0.5°F)
TC Type R	50 to 1768°C (122 to 3214°F)	25°C (77°F)	±0.8°C (±1.5°F)
TC Type S	-50 to 1768°C (-58 to 3214°F)	25°C (77°F)	±0.8°C (±1.5°F)
TC Type T	-270 to 400°C (-454 to 752°F)	20°C (68°F)	±0.3°C (±0.5°F)
TC Type U	-200 to 600°C (-328 to 1112°F)	100°C (212°F)	±0.8°C (±1.5°F)
Millivolt	-15 to 115mV DC	3mV	±0.1mV
DC current (4-20mA)	20 to 100mV DC	Requires 5032-850 precision resistor	
Platinum RTD, 100 ohm, alpha = 385, 392	-200 to 850°C (-328 to 1562°F)	10°C (50°F)	±0.14°C (±0.25°F)
Nickel RTD, 120 ohm	-80 to 320°C (-112 to 608°F)	10°C (50°F)	±0.14°C (±0.25°F)
Nickel RTD, 100 ohm	-60 to 250°C (-76 to 482°F)	10°C (50°F)	±0.14°C (±0.25°F)
Copper RTD, 10 ohm	-70 to 150°C (-94 to 302°F)	100°C (212°F)	±0.14°C (±0.25°F)
Resistance	0 to 500 ohm	n/a	±0.06 ohm

■ Output

Output Range

4 to 20mA DC.

Output Accuracy

±0.05% of span.

Output Load Compliance

$R_{LOAD} = (V_{SUPPLY} - 12V) / 23mA$.
500 ohm @ 24V DC supply.

Output Response Time (for input step change)

250mS typical to 98% of final output value.

Output Action

Normal or reverse acting.

Damping

Adjustable from 0 to 32 seconds.

■ Environmental

Ambient Temperature Range (Operating)

Electronics: -40 to 85°C (-40 to 185°F).
Display: -20 to 70°C (-4 to 158°F).

Relative Humidity

5 to 100% non-condensing.

Power Requirements

12 to 42V DC @ 25mA.

Isolation

250V AC (354V DC) continuous isolation between input and output circuits.

Approvals

CE marked.
CSA: Class I; Division 2; Groups A, B, C, D.

EMI/RFI Susceptibility

Less than ±0.5% of reading at 10V/m, 20KHz-1GHz.

Electrical Fast Transient (EFT)

Complies with EN61000-4-4 Level 3 and EN50082-1.

Surge Withstanding Capability (SWC)

Complies with EN61000-4-5 Level 3 and EN50082-1.

Electrostatic Discharge (ESD)

Complies with EN61000-4-2 Level 3 and EN50082-1.

Radiated Emissions

Meets or exceeds EN50081-1 for Class B equipment.

■ Physical

Enclosure

Sealed Lexan® plastic with waterproof potting.

Connectors

Wire Range: AWG #10-24.

Printed Circuit Boards

Military grade FR-4 epoxy glass circuit board.

Shipping Weight

1 pound (0.45 Kg) packed.

■ Ordering Information

Models

151T-0600-C

PC-configured transmitter (no HART protocol).
Default calibration TC Type J thermocouple, input: 40 to 200°F, output: 4 to 20mA unless customer specified

155H-0600-C

HART-configured transmitter, calibration same as above

151C-SIP

Software interface package for 151T-0600. Includes user manual, CD-ROM, PC serial port adapter, cable.

155H-SIP

Software interface package for 155H-0600. Includes user manual, CD-ROM, PC serial port adapter, cable.

ATW-TLD

Plug-in LCD display (compatible with 151T and 155H)

Accessories

5032-850: Precision 5 ohm (4 to 20mA sensing) resistor, 0.1%, 0.75W.

5034-225: USB-to-RS232 adapter

ATW-XPW: Explosion-proof housing

ATW-SSW: NEMA4X stainless steel non-corrosive housing

ATW-DIN: DIN-rail mounting adapter

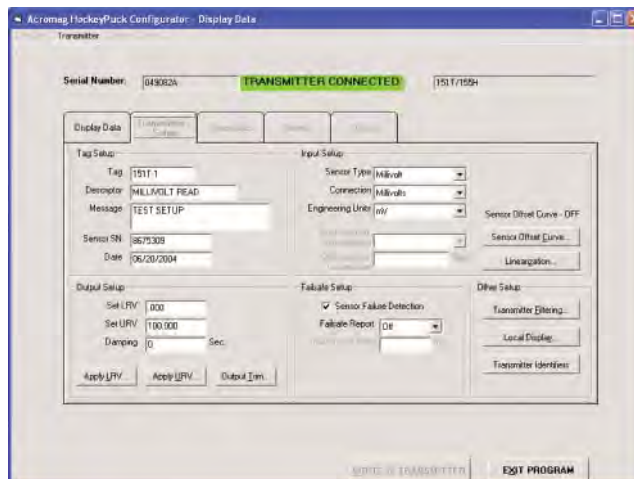
ATW-PM2: 2-inch pipe mount kit for ATW-XPW

8500-613: Configuration User's Manual for use with hand-held 275 HART communicator.

All trademarks are the property of their owners.

Series 151T, 155H Transmitters

Model 151C-SIP, 155H-SIP Configuration Software Interface Package



Configuration Software ♦ USB-to-RS232 Adapter ♦ RS232 Interface Adapter

Description

Acromag's configuration software is the key to the 151T and 155H transmitters' easy-to-use operation. The software employs the friendly Windows® interface with pull-down selection menus and fill-in-the-blank fields to speed you through a few brief configuration screens. No programming is required.

The software interface package for 151T-0600 transmitters includes a user manual, CD-ROM, transmitter-to-DB9 interface adapter, and DB9-to-USB adapter.

The software interface package for 155H-0600 transmitters includes a user manual, CD-ROM, and transmitter-to-DB9 interface adapter.

Software Compatibility

Windows 98, 2000, ME, NT, XP, Vista, 7.

Ordering Information

NOTE: For more information, visit www.acromag.com.

Models

151C-SIP

Software interface package for 151T-0600. Includes user manual, CD, PC serial port adapter (5032-787), and USB adapter (4001-095).

155H-SIP

Software interface package for 155H-0600. Includes user manual, CD, PC serial port adapter (5032-780), and USB adapter (4001-095).

4001-095

USB-to-DB9 serial port (RS232) adapter.

5032-780

PC serial port (RS232) adapter for 155H-0600 Transmitter-to-DB9 connection.

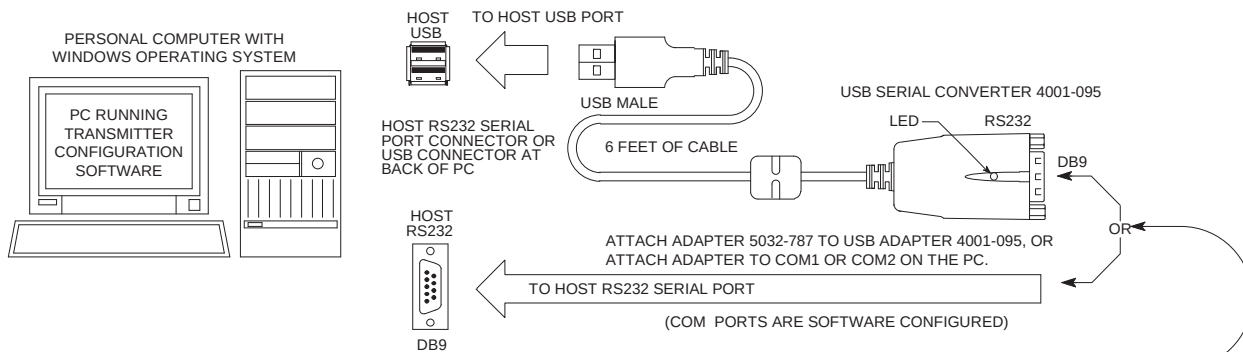
5032-787

PC serial port (RS232) adapter for 151T-0600 Transmitter-to-DB9 connection.

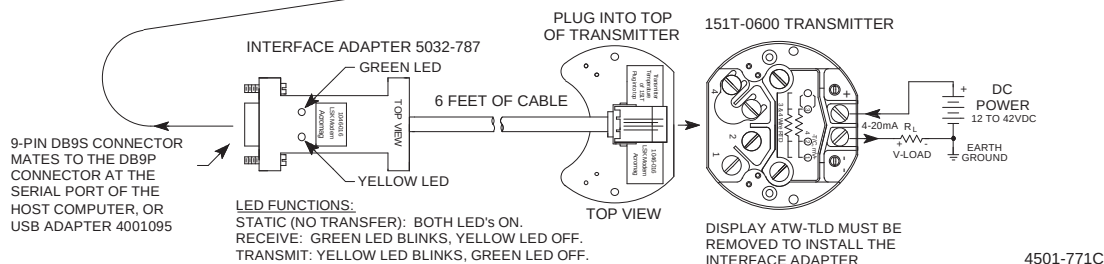
Connection Diagram

See following page.

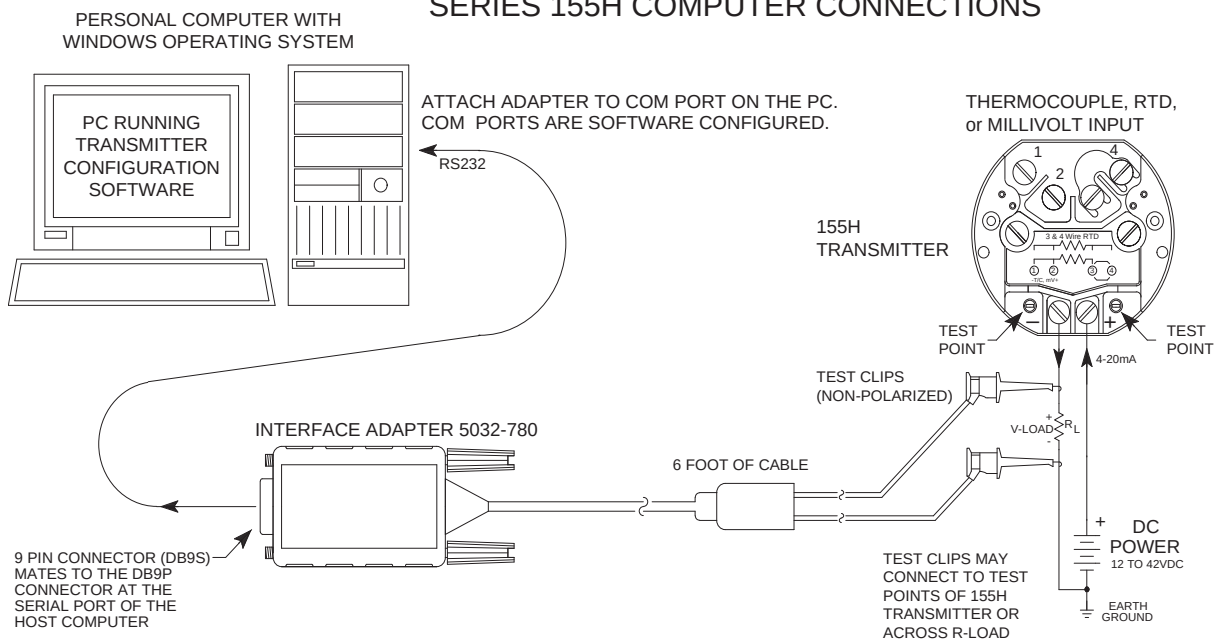
Series 151T, 155H Transmitters



SERIES 151T COMPUTER CONNECTIONS



SERIES 155H COMPUTER CONNECTIONS





Isolated Transmitters



150i Series

DC Current Input

Input Range

4 to 20mA DC

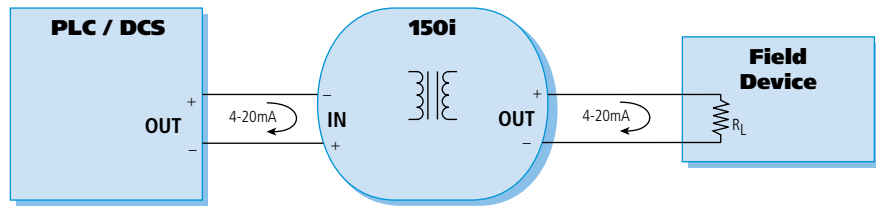
Output Range

4 to 20mA DC

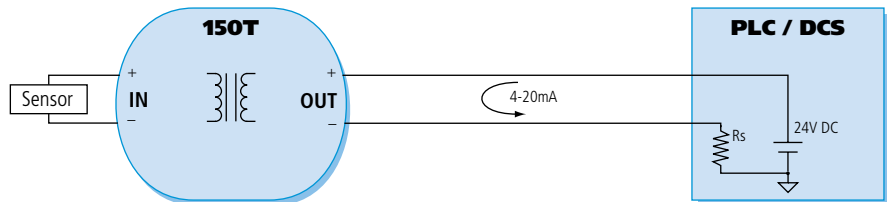
Power requirement

Loop-powered, 4.5V DC + (0.02 x RLOAD)
(power is derived from the input signal current).
10V DC @ 250 ohm output load.

150i Isolator Diagram



150T Isolator Diagram



For more information about the 150T Transmitter, refer to Page 180.

Description

The 150i accepts a process current input and provides an isolated process current output signal. Power is received from the input signal current.

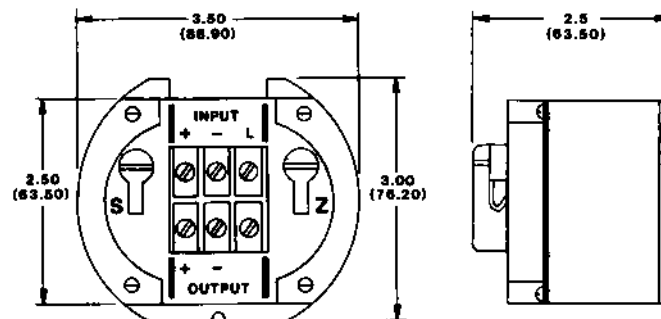
These isolators provide a quick and easy solution for ground loop problems. They are ideal for use with four-wire transmitters to isolate the load from the transmitting device.

Series 150i isolators are ideal for remote or control room mounting. They feature rugged construction and remain stable even in harsh industrial environments.

Special Features

- Excellent accuracy and stability ensure reliable measurements in harsh industrial environments.
- RFI and EMI resistance minimize the effects of noise.
- Isolated inputs prevent ground loops.
- Zero and span adjustment enable precise calibration.

150i Dimensions



Dimensions are in inches (millimeters).



■ Performance

Reference Test Conditions

Input/Output: 4 to 20mA, output load: 250 ohm, 77°F (25°C).

■ Input

Input

4 to 20mA input; input voltage drop is equal to output voltage drop plus (+) the burden voltage. Input current should be limited to less than 50mA.

Voltage Drop (at 20mA). = $4.8V + 0.02A \times R_{LOAD}$

■ Output

Output

4 to 20mA DC output, into 10 to 300 ohms.

Accuracy

±0.05% of output span. Error includes combined effects of isolator repeatability, hysteresis, terminal point linearity and adjustment resolution.

Output Ripple

Less than 0.1% of span.

Response Time

For a step input the output reaches 98% of output span in 200ms typical.

Load resistance effect

Less than ±0.004% of output span per 10 ohm change.

■ Power

External Power

Power to operate the loop-isolator is derived from the input signal loop.

■ Environmental

Isolation

Input and Output circuits are isolated from each other for common-mode voltages up to 250V AC or 354V DC off ground on a continuous basis (will withstand 1500V AC dielectric strength test for 1 minute without breakdown), complies with test requirements outlined in ANSI C39.5-1974 for the voltage rating specified.

Ambient Temperature Range

-15 to 185°F (-25 to 85°C).

Ambient Temperature Effect

Less than ±0.01% of span per °F (±0.018% per °C).

Noise Rejection

Common Mode: 118 dB at 60 Hz 250 ohm unbalance, typical.

RFI Resistance

Less than ±0.5% of output span with RFI field strengths up to 10V/meter at frequencies of 27, 151 and 467 MHz. Designed to comply with SAMA PMC 33.1 (1978) Class 2-abc.

EMI Resistance

Less than ±0.25% of output span effect with switching solenoids or commutator motors.

Surge Withstand Capability (SWC)

Input/Output terminations rated per ANSI/IEEE C37.90-1978. Unit is tested to a standardized test waveform that is representative of surges (high frequency transient electrical interference), observed in actual installations.

■ Physical

Case

Self-extinguishing polypropylene UL94 V-O, recognized by CSA, color blue.

Printed Circuit Boards

Military grade FR-4 epoxy glass circuit board.

Connections

Barrier-type terminal strip using No. 6 screw & clamp plates. Wire range 12-26 AWG.

Environmental Protection

Water resistant enclosures, PC Boards are coated with fungus resistant acrylic conformal coating. Gasket material: silicon rubber.

Mounting Position Effect

Position insensitive.

Shipping Weight

One (1) pound (0.45 kg.) packed.

■ Ordering Information

Transmitter Model

150i-20-i-20

Transmitter, DC current input.

Accessories

Power supplies

See Power Supplies on Page 199.

150T-N4

NEMA 4 enclosure, water-tight.

150T-N12

NEMA 12 enclosure, oil-tight.

150T-XJSM-WM

150T-XJSM-PM

Explosion-proof enclosure (-WM for wall-mount or -PM w/pipe-mount hardware).

150T-SM-3.5

150T-SM-24

Mounting rail, 3.5" (holds one 150T) or 24" long.

150T-MSM

Metal surface mounting bracket.

150T-DRA

DIN rail adapter.



Isolated Transmitters



150T Series DC Current, Voltage, and Millivolt Input

Input Ranges

DC Current:
0 to 100mA DC

DC Voltage:
0 to 100V DC

Millivolt:
0 to 55mV DC

Output Range

4 to 20mA DC

Power requirement

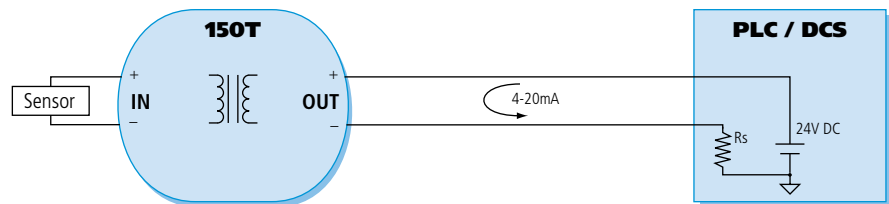
12 to 50V DC, loop-powered

Approvals

-M models only.

CSA: Class I; Division 2; Groups A, B, C, D

150T Loop-Powered Transmitter



Description

These loop-powered transmitters convert DC voltage or current inputs to proportional process current output signals. The output and power share the same pair of wires.

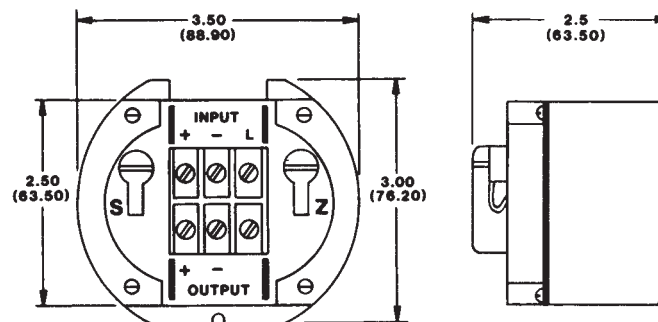
These two-wire transmitters deliver outstanding performance and a broad range of flexibility.

Series 150T transmitters are ideal for remote or control room mounting. They feature rugged construction and remain stable even in harsh industrial environments.

Special Features

- Excellent accuracy and stability ensure reliable measurements in harsh industrial environments.
- RFI and EMI resistance minimize the effects of noise.
- Isolated inputs prevent ground loops.
- Wide range zero and span adjustment enable precise calibration.

150T Dimensions



Dimensions are in inches (millimeters).



■ Performance

Reference Test Conditions

Input: 0-10mV with 100 ohm resistive source.

Output: 4-20mA into 500 ohm load.

Ambient temperature: 77°F (25°C).

Power supply: 24V DC supply.

■ Input

Input Ranges

Input span and zero are full range adjustable.

-CDC: Customer-specified DC current up to 100mA.

-VDC: Customer-specified DC voltage up to 100V.

-M: Span: 5 to 55mV Zero: -5 to 25mV

-SM: Span: 2 to 5mV Zero: -5 to 25mV

■ Output

Output Range

4-20mA DC output linear with input voltage signal.

Output Limits (approximate)

3.8mA DC to 30mA DC

Output Ripple

Less than 0.5% of maximum output span. Can be reduced to less than 0.1% by adding a 1µF capacitor across the load resistor.

Current Drive Capability

$R_{LOAD} (max.) = (V_{SUPPLY} - 12V) / 20mA$.

At $V_{SUPPLY} = 24V$, $R_{LOAD} = 0$ to 600 ohms

Load Resistance Effect

Less than +0.005% of output span for 100 ohm change.

Accuracy

±0.1% of calibrated span or 0.01 mV, whichever is greater. The error includes combined effects of transmitter repeatability, hysteresis, and terminal point linearity, and adjustment resolution. Does not include sensor error.

Response Time

For a step input, the output reaches 98% of output span in 300ms, typical.

■ Power

Power Supply Range

External loop power supply required: minimum 12V DC, maximum 50V DC. Under no circumstances must the DC supply ever exceed 100 volts peak instantaneously. Unit has reverse polarity protection.

Power Supply Effect

DC Volts: +0.001% of output span per volt DC.
60/120 Hz ripple: ±0.01% of span per volt peak to peak of power supply ripple.

■ Environmental

Ambient Temperature Range

-15 to 185°F (-25 to 85°C)

Ambient Temperature Effect

Less than ±0.01% of output span per °F (±0.018% per °C) over ambient temperature range for reference test conditions; ±0.025% of output span per °F (±0.045% per °C) for narrow span units at 5mV span. (Specification includes the combined effects of zero and span over temperature.)

Isolation

Input circuit is electrically isolated from output/ power circuits allowing the input to operate at up to 250V AC or 354V DC off ground on a continuous basis (will withstand 1500V AC dielectric strength test for one minute without breakdown). Complies with test requirements outlined in ANSI C39.5-1974 for the voltage rating specified.

RFI Resistance

Less than ±0.5% of output span with RFI field strengths up to 10V/meter at frequencies of 27, 151 and 467 MHz.

EMI Resistance

Less than ±0.25% of output span effect with switching solenoids or commutator motors.

Noise Rejection

Common Mode: 130dB at 60 Hz, 100 ohm unbalance, typical.

Normal Mode: 30dB at 60 Hz, 100 ohm source, typical.

Surge Withstand Capability (SWC)

Input/Output terminations rated per ANSI/IEEE C37.90-1978. Unit is tested to a standardized test waveform that is representative of surges (high frequency transient electrical interference), observed in actual installations.

■ Physical

Case

Self-extinguishing polypropylene UL94 V-O, recognized by CSA, color blue.

Printed Circuit Boards

Military grade FR-4 epoxy glass circuit board.

Connections

Barrier-type terminal strip using No. 6 screw & clamp plates. Wire range 12-26 AWG.

Environmental Protection

Water resistant enclosures, PC Boards are coated with fungus resistant acrylic conformal coating. Gasket material: silicon rubber.

Mounting Position Effect

Position insensitive.

Shipping Weight

One (1) pound (0.45 kg.) packed.

■ Ordering Information

Transmitter Models

150T-CDC-i-20-C-4164

Transmitter, DC current input.

Unit requires factory calibration.

Specify ranges on order.

150T-VDC-i-20-C-4165

Transmitter, DC voltage input.

Unit requires factory calibration.

Specify ranges on order.

150T-M-i-20

Transmitter, millivolt input.

To add factory calibration, append "-C" to end of model number. Specify ranges on order.

For agency approval, add "CSA-" prefix to model number (e.g. CSA-150T-M-i-20).

150T-SM-i-20-C

Transmitter, narrow span millivolt input.

Unit requires factory calibration.

Specify ranges on order.

Accessories

Power supplies

See Power Supplies on Page 199.

150T-N4

NEMA 4 enclosure, water-tight.

150T-N12

NEMA 12 enclosure, oil-tight.

150T-XJSM-WM

150T-XJSM-PM

Explosion-proof enclosure (-WM for wall-mount or -PM w/pipe-mount hardware).

150T-SM-3.5

150T-SM-24

Mounting rail, 3.5" (holds one 150T) or 24" long.

150T-MSM

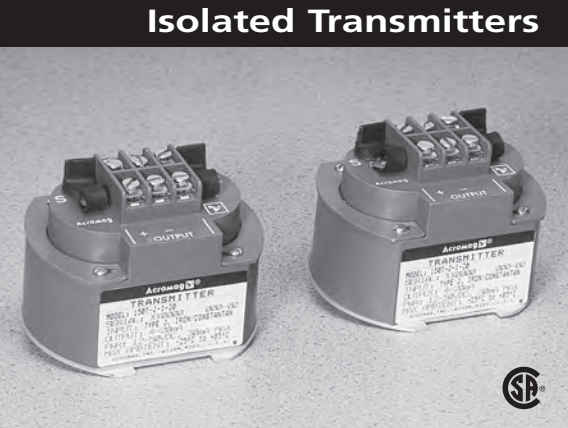
Metal surface mounting bracket.

150T-DRA

DIN rail adapter.



Isolated Transmitters



150T Series Thermocouple Input

Input Ranges

Thermocouple types J, K, T, R, S, E, B

Output Range

4 to 20mA DC

Power requirement

12 to 50V DC, loop-powered

Approvals (CSA)

Int. Safe (Class I, Div. 1); Haz. Loc. (Class I, Div. 2)

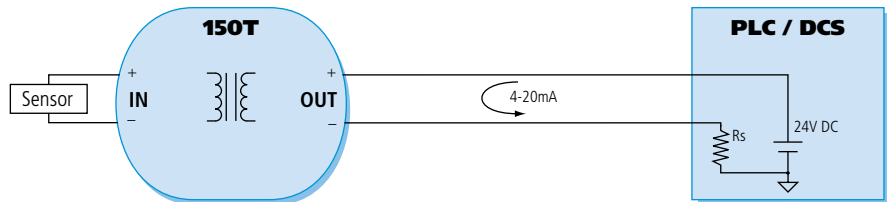
Description

These loop-powered transmitters convert thermocouple inputs to process current output signals. The output is linear to the millivolt signal generated by the thermocouple sensor. Output and power share the same pair of wires.

These two-wire transmitters deliver outstanding performance and a broad range of flexibility. Superior temperature performance is achieved by compensating for the temperature difference at the reference junction. Acromag's technique approximates the curve of the signal at the reference junction to deliver better accuracy than competitive units using linear compensation. The result is less drift and better accuracy.

Series 150T transmitters are ideal for remote or control room mounting. They feature rugged construction and remain stable even in harsh industrial environments.

150T Loop-Powered Transmitter



Special Features

- Excellent accuracy and stability ensure reliable measurements in harsh industrial environments.
- RFI and EMI resistance minimize the effects of noise.
- Isolated inputs prevent ground loops.
- Wide range zero and span adjustment enable precise calibration.
- Isolated inputs prevent ground loops.
- Thermocouple reference junction compensation reduces temperature drift and correct nonlinearity.
- Thermocouple break detection indicates open circuit failures with field-selectable upscale/downscale operation.

Performance

Reference Test Conditions

Input: 0-10mV with 100 ohm resistive source.

Output: 4-20mA into 500 ohm load.

Ambient temperature: 77°F (25°C).

Power supply: 24V DC supply.

Input

Input Range

Input span and zero are full range adjustable. Narrow span units ("S" prefix) handle 2-5mV spans with range factory calibrated to customer specifications.

-J (TC Type J):

Span: 100 to 760°C (180 to 1368°F)

Zero: -100 to 450°C (-148 to 842°F)

-K (TC Type K):

Span: 100 to 1200°C (180 to 2160°F)

Zero: -100 to 600°C (-148 to 1112°F)

-T (TC Type T):

Span: 150 to 400°C (270 to 720°F)

Zero: -150 to 300°C (-238 to 572°F)

-E (TC Type E):

Span: 100 to 700°C (180 to 1260°F)

Zero: -100 to 350°C (-148 to 662°F)

-R (TC Type R):

Span: 550 to 1750°C (990 to 3150°F)

Zero: 0 to 1200°C (32 to 2192°F)

-S (TC Type S):

Span: 550 to 1750°C (990 to 3150°F)

Zero: 0 to 1200°C (32 to 2192°F)

-B (TC Type B):

Span: 1000 to 1820°C (1800 to 3276°F)

Zero: 0 to 1000°C (32 to 2192°F)

Input Impedance

100K ohm at 10mV span; input current, +100nA, typical, includes thermocouple break detection current.

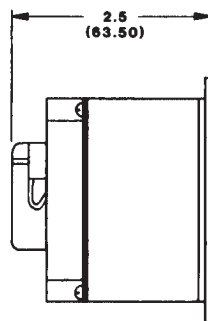
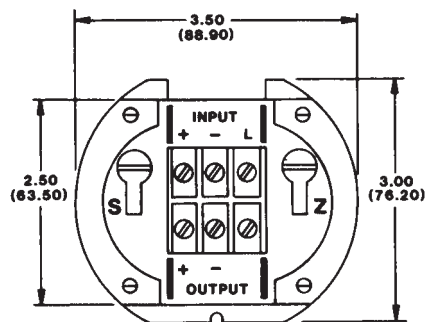
TC Reference Junction Compensation

Standard on all units and functional over entire operating temperature range. Includes unique circuitry to correct for reference junction non-linearity over ambient temperature.

Thermocouple Break Detection

Upscale or downscale, jumper selectable.

150T Dimensions



Dimensions are in inches (millimeters).



■ Performance (continued)

■ Output

Output Range

4-20mA DC output linear with input voltage signal.

Output Limits (approximate)

3.8mA DC to 30mA DC

Output Ripple

Less than 0.5% of maximum output span. Can be reduced to less than 0.1% by adding a 1µF capacitor across the load resistor.

Current Drive Capability

$R_{LOAD} (max.) = (V_{SUPPLY} - 12V)/20mA$.

At $V_{SUPPLY} = 24V$, $R_{LOAD} = 0$ to 600 ohms

Load Resistance Effect

Less than 0.005% of output span for 100 ohm change.

Accuracy

±0.1% of calibrated span or 0.01 mV, whichever is greater. The error includes combined effects of transmitter repeatability, hysteresis, and terminal point linearity (conformity instead of linearity for thermocouple input), and adjustment resolution. Does not include sensor error.

Response Time

For a step input, the output reaches 98% of output span in 300ms, typical.

■ Power

Power Supply

External loop power supply required: minimum 12V DC, maximum 50V DC. Under no circumstances must the DC supply ever exceed 100 volts peak instantaneously. Unit has reverse polarity protection.

Power Supply Effect

DC Volts: +0.001% of output span per volt DC.
60/120 Hz ripple: ±0.01% of span per volt peak to peak of power supply ripple.

■ Environmental

Ambient Temperature Range

-15 to 185°F (-25 to 85°C)

Ambient Temperature Effect

Less than ±0.01% of output span per °F (±0.018% per °C) over ambient temperature range for reference test conditions; ±0.025% of output span per °F (±0.045% per °C) for narrow span units at 5mV span. (Specification includes combined effects of zero and span over temperature, and reference junction errors.)

Isolation

Input circuit is electrically isolated from output/ power circuits allowing the input to operate at up to 250V AC or 354V DC off ground on a continuous basis (will withstand 1500V AC dielectric strength test for one minute without breakdown). Complies with test requirements outlined in ANSI C39.5-1974 for the voltage rating specified.

Noise Rejection

Common Mode: 130dB at 60 Hz, 100 ohm unbalance, typical.

Normal Mode: 30dB at 60 Hz, 100 ohm source, typical.

RFI Resistance

Less than ±0.5% of output span with RFI field strengths up to 10V/meter at frequencies of 27, 151 and 467 MHz.

EMI Resistance

Less than ±0.25% of output span effect with switching solenoids or commutator motors.

Surge Withstand Capability (SWC)

Input/Output terminations rated per ANSI/IEEE C37.90-1978. Unit is tested to a standardized test waveform that is representative of surges (high frequency transient electrical interference), observed in actual installations.

Approvals (CSA)

Intrinsically Safe

Class I; Division 1; Groups A, B, C, D.

Hazardous Location

Class I; Division 2; Groups A, B, C, D.

■ Physical

Case

Self-extinguishing polypropylene UL94 V-0, recognized by CSA, color blue.

Printed Circuit Boards

Military grade FR-4 epoxy glass circuit board.

Connections

Barrier-type terminal strip using No. 6 screw & clamp plates. Wire range 12-26 AWG.

Environmental Protection

Water resistant enclosures, PC Boards are coated with fungus resistant acrylic conformal coating. Gasket material: silicon rubber.

Mounting Position Effect

Position insensitive.

Shipping Weight

One (1) pound (0.45 kg.) packed.

■ Ordering Information

Transmitter Models

NOTE 1: To add factory calibration, append "-C" to end of model number. Specify ranges on order.

NOTE 2: For agency approval, add "CSA-" prefix to model number (e.g. CSA-150T-J-I-20).

150T-J-I-20

150T-SJ-I-20-C* (for 90°C spans or smaller)

Transmitter, TC Type J input.

150T-K-I-20

150T-SK-I-20-C* (for 120°C spans or smaller)

Transmitter, TC Type K input.

150T-T-I-20

150T-ST-I-20-C* (for 115°C spans or smaller)

Transmitter, TC Type T input.

150T-R-I-20

150T-SR-I-20-C* (for 550°C spans or smaller)

Transmitter, TC Type R input.

150T-S-I-20

150T-SS-I-20-C* (for 575°C spans or smaller)

Transmitter, TC Type S input.

150T-E-I-20

150T-SE-I-20-C* (for 80°C spans or smaller)

Transmitter, TC Type E input.

150T-B-I-20

150T-SB-I-20-C* (for 1000°C spans or smaller)

Transmitter, TC Type B input.

Ordering Notes:

* Transmitters with narrow span input require factory calibration (-C suffix is already included in model number). Specify ranges on order.

Accessories

Power supplies

See Power Supplies on Page 199.

150T-N4

NEMA 4 enclosure, water-tight.

150T-N12

NEMA 12 enclosure, oil-tight.

150T-XJSM-WM

150T-XJSM-PM

Explosion-proof enclosure (-WM for wall-mount or -PM w/pipe-mount hardware).

150T-SM-3.5

150T-SM-24

Mounting rail, 3.5" (holds one 150T) or 24" long.

150T-MSM

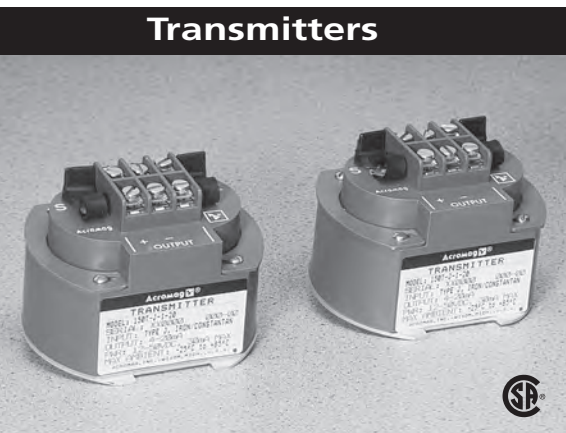
Metal surface mounting bracket.

150T-DRA

DIN rail adapter.



Transmitters



150T Series

RTD Input

Input Ranges

- 100 ohm Platinum (385/392) RTD (2, 3, or 4-wire connection)
- 10 ohm Copper RTD (2 or 3-wire)
- Differential RTD (two 100 ohm Pt-385/392 RTDs, 4-wire)

Output Range

4 to 20mA DC

Power requirement

12 to 50V DC, loop-powered

Approvals

CSA

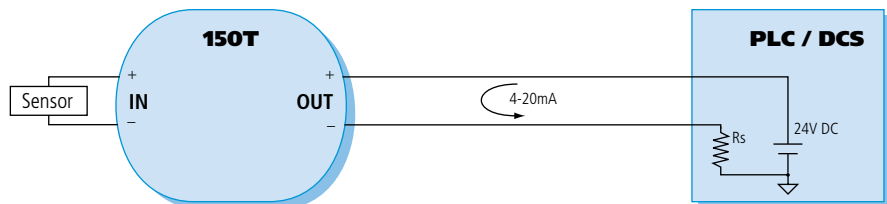
Intrinsically Safe

Class I; Division 1; Groups A, B, C, D

Hazardous Location

Class I; Division 2; Groups A, B, C, D

150T Loop-Powered Transmitter



Description

These loop-powered transmitters convert low level sensor inputs to proportional process current output signals. The output and power share the same pair of wires.

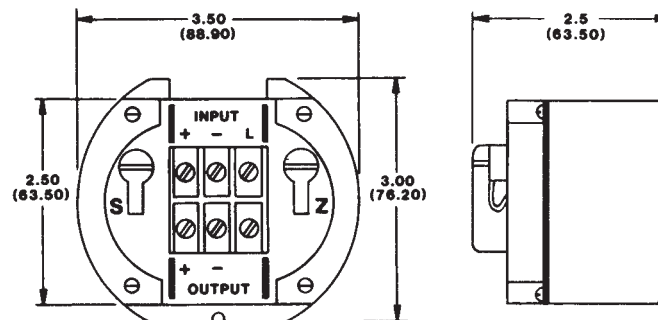
Units are not isolated. Input sensor must be isolated from ground if the output circuit is grounded.

These two-wire transmitters deliver outstanding performance and a broad range of flexibility for remote or control room mounting. They feature rugged construction and remain stable even in harsh industrial environments.

Special Features

- Excellent accuracy and stability ensure reliable measurements in harsh industrial environments.
- RFI and EMI resistance minimize the effects of noise.
- Wide range zero and span adjustment enable precise calibration.
- RTD signal linearization improves accuracy and reduces drift.
- RTD break detection indicates open RTD failures with field-selectable upscale/downscale operation (downscale only for differential RTD input).
- RTD lead wire compensation eliminates the effect of the wire's resistance.

150T Dimensions



Dimensions are in inches (millimeters).



Single RTD Input Models

The following specifications are for single RTD input models. Specifications for differential input models are listed on the next page.

Performance

Reference Test Conditions

-RBP:

Input: 100 ohm, 3-wire Platinum, 0-100°C, (Alpha = 0.00385);

Output: 4-20mA into 500 ohm load;

-RBC:

Input: 10 ohm, 3-wire Copper (9.035 ohms at 0°C), 0 to 100°C;

Output: 4-20mA into 500 ohm load

Ambient temperature: 77°F (25°C)

Power supply: 24V DC supply.

Input

Input range

-RBP: 100 ohm Platinum Resistance Temperature Sensor (RTD), 2, 3, or 4 wire connection. Standard calibration is based on the international R vs. T curve having an alpha of 0.00385 ohms/ohm/°C (Pt-385). Unit can also be calibrated for sensors having an alpha of 0.003925 ohms/ohm/°C (Pt-392). Excitation current is 1.0mA DC. The span and zero adjustment is a function of the RTD range code. Note: Linearization is maintained for any calibration within defined range.

-RBC: 10 ohm Copper Resistance Temperature Sensor (RTD), 2 or 3 wire connection. Standard calibration is based on a Copper RTD, 9.035 ohms at 0°C. Maximum excitation is 2.0mA DC. The span and zero adjustment range is a function of the RTD range code. Note: Copper sensor is linear between -50°C and 150°C per manufacturers tables.

Linearization

The unit linearizes the RTD signal to provide an output signal that represents the percent of span value of the measured temperature.

RTD Break Detection

Standard units shipped with upscale detection; jumper J1 out. If unit is ordered with downscale detection, J1 will be installed.

Lead Wire Compensation

-RBP: Zero shift is less than 0.01% per ohm of lead resistance, for up to 10 ohms per leg, with a total maximum shift of 0.1%.

-RBC: Zero shift is less than 0.05% per ohm of lead resistance, for up to 10 ohms per leg, with a total maximum shift of 0.5%.

Output

Output Range

4-20mA DC output.

Output Limits (approximate)

3.8mA DC to 30mA DC

Output Ripple

Less than ±0.05% of maximum output span.

Current Drive Capability

$R_{LOAD} (max.) = (V_{SUPPLY} - 12V) / 20mA$.

At $V_{SUPPLY} = 24V$, $R_{LOAD} = 0$ to 600 ohms

Load Resistance Effect

+25mA, typical. Less than ±0.005% of output span for 100 ohm change.

Accuracy

Includes combined effects of transmitter repeatability, hysteresis, terminal point linearity and adjustment resolution. Does not include sensor error.

-RBP: ±0.1% of calibrated span or ±0.1°C whichever is greater for spans up to 720°F (400°C); ±0.25% of calibrated span for spans greater than 720°F (400°C).

-RBC: ±0.25% of calibrated span or ±0.25°C whichever is greater.

Response Time

For a step input the output reaches 98% of output span in 350ms, typical.

Bandwidth

-3dB at 3 Hz, typical

Power

Power Supply

External loop power supply required, minimum 12V DC, maximum 50V DC. Unit has reverse polarity protection.

Power Supply Effect

DC Volts: ±0.001% of output span per volt DC.
60/120 Hz ripple: ±0.01% of span per volt peak to peak of power supply ripple.

Environmental

Ambient Temperature Range

-15 to 185°F (-25 to 85°C)

Ambient Temperature Effect (Combined effects of zero and span over temperature)

-RBP: Less than ±0.01% of output span per °F (±0.018% per °C) over ambient temperature range for reference test conditions.

-RBC: Less than ±0.025% of output span per °F (±0.045% per °C) over ambient temperature range for reference test conditions.

Isolation

No input circuit isolation, input sensor must be isolated from ground if the output circuit is grounded.

EMI Resistance

Less than ±0.25% of output span effect with switching solenoids or commutator motors.

Noise Rejection:

Common Mode: Not applicable; non-isolated.

Normal Mode: 26dB at 60 Hz, 100 ohm source; 20dB at 60 Hz, 10 ohm source.

RFI Resistance

Less than ±0.5% of output span with RFI field strengths up to 10V/meter at frequencies of 27, 151 and 467 MHz.

Surge Withstand Capability (SWC)

Input/Output terminations rated per ANSI/IEEE C37.90-1978. Unit is tested to a standardized test waveform that is representative of surges (high frequency transient electrical interference), observed in actual installations.

Approvals (CSA)

Intrinsically Safe

Class I; Division 1; Groups A, B, C, D.

Hazardous Location

Class I; Division 2; Groups A, B, C, D.

Physical

Case

Self-extinguishing polypropylene UL94 V-O, recognized by CSA, color blue.

Printed Circuit Boards

Military grade FR-4 epoxy glass circuit board.

Connections

Barrier-type terminal strip using No. 6 screw & clamp plates. Wire range 12-26 AWG.

Environmental Protection

Water resistant enclosures, PC Boards are coated with fungus resistant acrylic conformal coating. Gasket material: silicon rubber.

Mounting Position Effect

Position insensitive.

Shipping Weight

One (1) pound (0.45 kg.) packed.



Differential RTD Input Models

The following specifications are for differential RTD input models. Specifications for single input models are listed on the previous page.

Performance

Reference Test Conditions

Input: RTD Hot (RTD-1), maximum differential temperature span per range code, RTD Cold (RTD-2) 0°C, 2-wire Platinum Resistance Bulbs (Alpha = 0.00385), equal lead lengths;
Output: 4 to 20 mA into 500 ohm load.
Ambient temperature: 77°F (25°C)
Power supply: 24V DC.

Input

Input Ranges

Two RTDs; for best accuracy, use matched RTDs.

-DRP: 100 ohm Platinum Resistance Temperature Sensor (RTD), 2, or 4 wire (Compensating Loop), standard calibration is based on the international R vs. T curve having an alpha of 0.00385 ohms/ohm/°C (Pt-385). Unit can also be calibrated for sensors having an alpha of 0.003925 ohms/ohm/°C (Pt-392). The span and zero adjustment is a function of the RTD range code.

Range Code

Differential Input Span, field adjustable. Cold sensor range -100 to 400°C. (-150 to 750°F).

-TRB: Span 10 to 25°C (20 to 50°F)
-TRA: Span 25 to 50°C (50 to 100°F)
-TR1: Span 50 to 100°C (100 to 200°F)
-TR2: Span 100 to 200°C (200 to 400°F)

NOTE: Zero adjustment: 0 to 50% of span, allows output to be set anywhere from 4 mA to 12 mA when RTD 1 equals RTD 2.

Linearization

The unit linearizes the differential RTD signal to provide an output signal that represents the percent of span value of the measured differential temperature.

Lead Wire Compensation

A. Two Wire RTDs: No lead compensation, equal lead lengths to both RTDs recommended.

B. Four Wire RTD (compensating loop type): Zero shift less than 0.01% per ohm lead resistance each leg, per RTD sensor. Lead resistance, 10 ohms maximum per leg, with a total maximum shift of ±0.1%.

RTD Break Detection

RTD-1: Inherent upscale break detection.

RTD-2: Inherent downscale break detection.

Output

Output

4 to 20 mA DC output

Output Limits (approximate)

3.8 mA DC to 30 mA DC.

Output Ripple

Less than ±0.05% of maximum output span.

Current Drive Capability

$R_{LOAD} (max.) = (V_{SUPPLY} - 12V)/20mA$.

At $V_{SUPPLY} = 24V$, $R_{LOAD} = 0$ to 600 ohms

Load Resistance Effect

Less than +0.005% of output span for 100 ohm change.

Accuracy

For a specific temperature span calibration and for measured temperatures above (-)100°C, see range codes below.

-TRB: = ±0.18°F (±0.10°C)

-TRA: = ±0.18°F (±0.10°C)

-TR1: = ±0.45°F (±0.25°C)

-TR2: = ±0.90°F (±0.50°C)

A. Accuracy includes combined effects of transmitter repeatability, hysteresis, terminal point linearity and adjustment resolution. Does not include sensor error.

B. Due to non-linearity of the RTD temperature vs resistance curve, a constant temperature span results in different resistance spans over the temp. range of the RTD. The unit should be calibrated in the area of interest.

Response Time

For a step input the output reaches 98% of output span in 350 ms, typical.

Bandwidth

-3 dB at 3 Hz, typical.

Power

Power

External loop power supply required, minimum 12V DC, maximum 50V DC. Unit has reverse polarity protection.

Power Supply Effect

DC Volts: ±0.001% of output span per volt DC.
60/120 Hz ripple: ±0.01% of span per volt peak to peak of power supply ripple.

Environmental

Ambient Temperature Range

-15 to 185°F (-25 to 85°C).

Ambient Temperature Effect

Performance includes combined effect of zero and span over ambient temperature range and reference test conditions.

-TRB: Less than ±0.02% of output span per °F (±0.036%/°C).

-TRA, -TR1, -TR2: Less than ±0.01% of output span per °F (±0.018%/°C).

Isolation

No input circuit isolation, input sensor must be isolated from ground if the output circuit is grounded.

RFI Resistance

Less than ±0.5% of output span with RFI field strengths up to 10V/meter at frequencies of 27, 151 and 467 MHz.

EMI Resistance

Less than ±0.25% of output span effect with switching solenoids or commutator motors.

Noise Rejection

Common Mode: Not applicable; non-isolated.

Normal Mode: 26 dB at 60 Hz, 100 ohm source.

Surge Withstand Capability (SWC)

Input/Output terminations rated per ANSI/IEEE C37.90-1978. Unit is tested to a standardized test waveform that is representative of surges (high frequency transient electrical interference), observed in actual installations.

Approvals (CSA)

Intrinsically Safe

Class I; Division 1; Groups A, B, C, D.

Hazardous Location

Class I; Division 2; Groups A, B, C, D.

Physical

Case

Self-extinguishing polypropylene UL94 V-O, recognized by CSA, color blue.

Printed Circuit Boards

Military grade FR-4 epoxy glass circuit board.

Connections

Barrier-type terminal strip using No. 6 screw & clamp plates. Wire range 12-26 AWG.

Environmental Protection

Water resistant enclosures, PC Boards are coated with fungus resistant acrylic conformal coating. Gasket material: silicon rubber.

Mounting Position Effect

Position insensitive.

Shipping Weight

One (1) pound (0.45 kg.) packed.



Transmitters



150T Series

Pot/Slidewire Input

Input Range

100 ohm to 10K ohm 3-wire pot or slidewire,
span: 25 to 100% of slidewire resistance
zero: 0 to 75% of slidewire resistance

Output Range

4 to 20mA DC

Power requirement

12 to 50V DC, loop-powered

Approvals

CSA

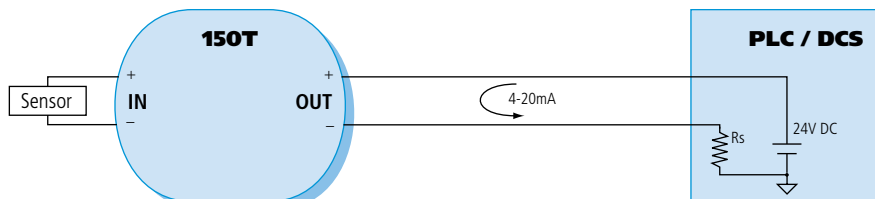
Intrinsically Safe

Class I; Division 1; Groups A, B, C, D

Hazardous Location

Class I; Division 2; Groups A, B, C, D

150T Loop-Powered Transmitter



Description

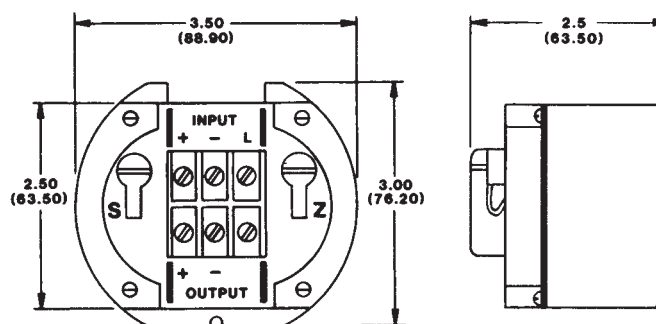
These loop-powered transmitters convert sensor inputs to proportional process current output signals. The output and power share the same pair of wires.

These two-wire transmitters deliver outstanding performance and a broad range of flexibility. They are ideal for remote or control room mounting. They feature rugged construction and remain stable even in harsh industrial environments.

Special Features

- Excellent accuracy and stability ensure reliable measurements in harsh industrial environments.
- RFI and EMI resistance minimize the effects of noise.
- Wide range zero and span adjustment enable precise calibration.

150T Dimensions



Dimensions are in inches (millimeters).



■ Performance

Reference Test Conditions

Input: 100 ohm slidewire with a 100 ohm span;
Output 4 to 20 mA into 500 ohm load;
Ambient temperature: 77°F (25°C);
Power supply: 24V DC supply.

■ Input

Input Range

100 ohm to 10,000 ohm three-wire potentiometer or slidewire.

Zero Adjustment

0 to 75% of slidewire resistance.

Span Adjustment

25 to 100% of slidewire resistance.

Excitation

0.2V DC nominal, constant voltage;
current limited, 3.0 mA nominal.

■ Output

Output Range

4 to 20 mA DC output, linear with input voltage signal.

Output Limits (Approximate)

3.8 mA DC to 30 mA DC.

Output Ripple

Less than $\pm 0.05\%$ of maximum output span.

Current Drive Capability

$R_{LOAD} (max.) = (V_{SUPPLY} - 12V)/20mA$.
At $V_{SUPPLY} = 24V$, $R_{LOAD} = 0$ to 600 ohms

Load Resistance Effect

Less than $\pm 0.005\%$ of output span for 100 ohm change.

Accuracy

$\pm 0.1\%$ of calibrated span. Includes combined effects of transmitter repeatability, hysteresis, terminal point linearity and adjustment resolution. Does not include sensor error.

Response Time

For a step input the output reaches 98% of output span in 300mS, typical.

Bandwidth

-3 dB at 3 Hz, typical.

■ Power

Power Supply

External loop power supply required, minimum 12V DC, maximum 50V DC. Unit has reverse polarity protection.

Power Supply Effect

DC Volts: $\pm 0.001\%$ of output span per volt DC.
60/120 Hz ripple: $\pm 0.01\%$ of span per volt peak to peak of power supply ripple.

■ Environmental

Ambient Temperature Range

-15 to 185°F (-25 to 85°C).

Ambient Temperature Effect

(Combined effects of zero and span over temperature). Less than $\pm 0.01\%$ of output span per °F ($\pm 0.018\%$ per °C) over ambient temperature range for reference test conditions.

Isolation

No input circuit isolation, input sensor must be isolated from ground if the output circuit is grounded.

RFI Resistance

Less than $\pm 0.5\%$ of output span with RFI field strengths up to 10V/meter at frequencies of 27, 151 and 467 MHz.

EMI Resistance

Less than $\pm 0.25\%$ of output span effect with switching solenoids or commutator motors.

Noise Rejection

Common Mode: Not applicable, non-isolated.
Normal Mode: 26 dB at 60 Hz, 100 ohm source.

Surge Withstand Capability (SWC)

Input/Output terminations rated per ANSI/IEEE C37.90-1978. Unit is tested to a standardized test waveform that is representative of surges (high frequency transient electrical interference), observed in actual installations.

Approvals (CSA, FM)

Intrinsically Safe
Class I; Division 1; Groups A, B, C, D.
Hazardous Location
Class I; Division 2; Groups A, B, C, D.

■ Physical

Case

Self-extinguishing polypropylene UL94 V-O, recognized by CSA, color blue.

Printed Circuit Boards

Military grade FR-4 epoxy glass circuit board.

Connections

Barrier-type terminal strip using No. 6 screw & clamp plates. Wire range 12-26 AWG.

Environmental Protection

Water resistant enclosures, PC Boards are coated with fungus resistant acrylic conformal coating. Gasket material: silicon rubber.

Mounting Position Effect

Position insensitive.

Shipping Weight

One (1) pound (0.45 kg.) packed.

■ Ordering Information

Transmitter Model

NOTE 1: Factory calibration not available on this unit.

NOTE 2: For agency approval, add "CSA-" prefix to model number (e.g. CSA-150T-P-X-20).

150T-P-X-20

Transmitter, pot/slidewire input, nonisolated.

Accessories

Power supplies

See Power Supplies on Page 199.

150T-N4

NEMA 4 enclosure, water-tight.

150T-N12

NEMA 12 enclosure, oil-tight.

150T-XJSM-WM

150T-XJSM-PM

Explosion-proof enclosure (-WM for wall-mount or -PM w/pipe-mount hardware).

150T-SM-3.5

150T-SM-24

Mounting rail, 3.5" (holds one 150T) or 24" long.

150T-MSM

Metal surface mounting bracket.

150T-DRA

DIN rail adapter.



Isolated Transmitters



150T Series

Frequency Input

Input Ranges

Frequency,
span ranges from 25Hz to 25.6KHz,
field-selectable
(span: adjustable over entire range selected)
(zero: 0 to 20% of full scale frequency for
range selected),
direct coupled input ($\pm 25\text{mV}$ to 100V RMS)

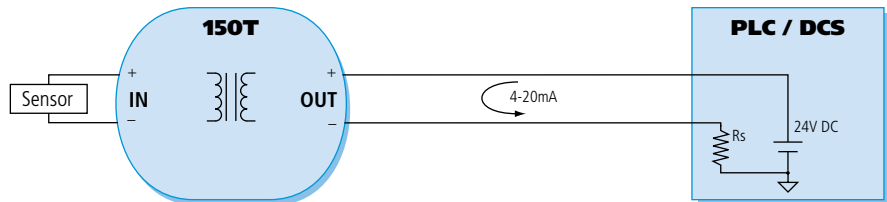
Output Range

4 to 20mA DC

Power requirement

12 to 50V DC, loop-powered

150T Loop-Powered Transmitter



Description

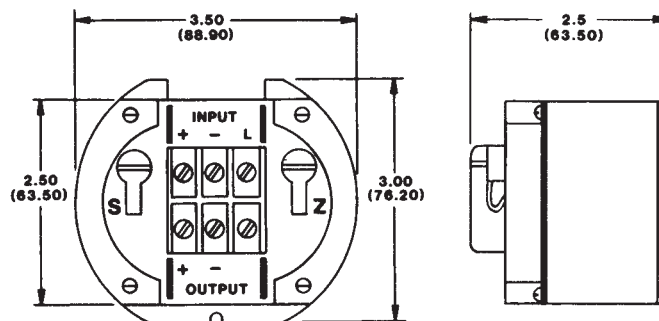
These loop-powered transmitters accept periodic or pulse waveform signals such as those originating from tachometers, magnetic transducers, and turbine flow meters, and provide a proportional process current output signal. The output and power share the same pair of wires.

150T two-wire transmitters deliver outstanding performance and a broad range of flexibility. They are ideal for remote or control room mounting. They feature rugged construction and remain stable even in harsh industrial environments.

Special Features

- Excellent accuracy and stability ensure reliable measurements in harsh industrial environments.
- RFI and EMI resistance minimize the effects of noise.
- Isolated inputs prevent ground loops.
- Wide range zero and span adjustment enable precise calibration.

150T Dimensions



Dimensions are in inches (millimeters).



■ Performance

Reference Test Conditions

Input: 0-12.8K Hz, 100 ohm resistive source; Output 4-20mA into 500 ohm load;
Ambient temperature: 77°F (25°C);
Power supply: 24V DC supply

■ Input

Input Range

0 to 25,600 Hz; input impedance 20,000 ohms min..

Input Span Ranges

A: 25 to 50 Hz	F: 800 to 1600 Hz
B: 50 to 100 Hz	G: 1600 to 3200 Hz
C: 100 to 200 Hz	H: 3200 to 6400 Hz
D: 200 to 400 Hz	I: 6400 to 12800 Hz
E: 400 to 800 Hz	J: 12,800 to 25,600 Hz

Span

The input span is continuously adjustable over the preselected input span range.

Zero

The minimum input frequency for any range, can be from 0-20% of the full-scale frequency.

Input Amplitude

Bipolar input from ± 25 mV to 100V rms using the zero-volt threshold or unipolar input from 0 to 2V to 100V rms using the 1.5V threshold level.

Input Threshold (Switching Level)

0V, ± 1.5 V; shunt selectable. 0V threshold is used for bipolar (zero crossing) inputs; 1.5V DC nominal threshold is used for unipolar (non-zero crossing) inputs.

Bipolar: 0V DC Threshold (nominal)
Unipolar: 1.5V DC Threshold (nominal)

Input Hysteresis

50mV, fixed.

Input Excitation

Excitation for contact closure or open collector transistor switching can be field configured. Nominal excitation/pull-up is 5V through 33,000 ohms (150 μ A, nominal). Must be used with 1.5V threshold level.

■ Output

Output Range

4-20mA DC output.

Output Limits (approximate)

3.8mA DC to 30mA DC.

Output Ripple

Less than 0.5% of maximum output span for inputs from 10-100% of full-scale.

Current Drive Capability

$R_{LOAD} (max.) = (V_{SUPPLY} - 12V)/20mA.$
At $V_{SUPPLY} = 24V$, $R_{LOAD} = 0$ to 600 ohms

Load Resistance Effect

Less than $\pm 0.005\%$ of output span for 100 ohm change.

Accuracy

$\pm 0.1\%$ of calibrated span. Includes combined effects of transmitter repeatability, hysteresis, terminal point linearity and adjustment resolution.

Response Time

Shunt block selection of the filter networks results in different response times. Unit ships with 0.4 second response filter. To maintain low output ripple for each frequency range, use recommended filter. For a step change in the input, the nominal response time for a 98% change of the output span is specified below.

Range A thru J: 8.0 sec response time (98%)

Range C thru J: 5.0 sec response time (98%)

Range D thru J: 0.4 sec response time (98%)

■ Power

Power Supply

External loop power supply required, minimum 12V DC, maximum 50V DC. Under no circumstances must the DC supply ever exceed 100 volts peak instantaneously. Unit has reverse polarity protection.

Power Supply Effect

DC Volts: $\pm 0.001\%$ of output span per volt DC.
60/120 Hz ripple: $\pm 0.01\%$ of span per volt peak to peak of power supply ripple.

■ Environmental

Ambient Temperature Range

-15 to 185°F (-25 to 85°C).

Ambient Temperature Effect

Less than $\pm 0.01\%$ of output span per °F ($\pm 0.018\%$ per °C) over ambient transmitter range for reference test conditions. Includes combined effects of zero and span over temperature.

Isolation

Input circuit is electrically isolated from output/ power circuits allowing the input to operate at up to 250V AC or 354V DC off ground on a continuous basis (will withstand 1500V AC dielectric strength test for one (1) minute without breakdown). Complies with test requirements outlined in ANSI C39.5-1974 for the voltage rating specified.

RFI Resistance

Less than $\pm 0.5\%$ of output span with RFI field strengths up to 10V/meter at frequencies of 27, 151 and 467 MHz.

EMI Resistance

Less than $\pm 0.25\%$ of output span effect with switching solenoids or commutator motors.

Noise Rejection

Common Mode: 120dB, 60 Hz, 100 ohm unbalance.
Normal Mode: Not applicable.

Surge Withstand Capability (SWC)

Input/Output terminations rated per ANSI/IEEE C37.90-1978. Unit is tested to a standardized test waveform that is representative of surges (high frequency transient electrical interference), observed in actual installations.

■ Physical

Case

Self-extinguishing polypropylene UL94 V-O, recognized by CSA, color blue.

Printed Circuit Boards

Military grade FR-4 epoxy glass circuit board.

Connections

Barrier-type terminal strip using No. 6 screw & clamp plates. Wire range 12-26 AWG.

Environmental Protection

Water resistant enclosures, PC Boards are coated with fungus resistant acrylic conformal coating. Gasket material: silicon rubber.

Mounting Position Effect

Position insensitive.

Shipping Weight

One (1) pound (0.45 kg.) packed.

■ Ordering Information

Transmitter Model

150T-FQ-I-20

Transmitter, frequency input.

To add factory calibration, append "-C" to end of model number. Specify ranges on order.

Accessories

Power supplies

See Power Supplies on Page 199.

150T-N4

NEMA 4 enclosure, water-tight.

150T-N12

NEMA 12 enclosure, oil-tight.

150T-XJSM-WM

150T-XJSM-PM

Explosion-proof enclosure (-WM for wall-mount or -PM w/pipe-mount hardware).

150T-SM-3.5

150T-SM-24

Mounting rail, 3.5" (holds one 150T) or 24" long.

150T-MSM

Metal surface mounting bracket.

150T-DRA

DIN rail adapter.



Isolated Transmitters



150T Series

AC Current Input

Input Ranges

- AC current,
0 to 5A AC, 50/60Hz

For AC voltage inputs, please see 250T-VAC on Page 166.

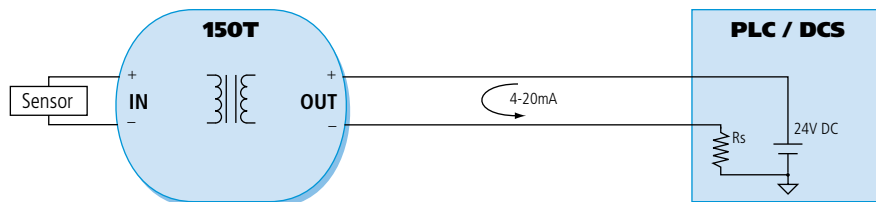
Output Range

4 to 20mA DC

Power requirement

12 to 50V DC, loop-powered

150T Loop-Powered Transmitter



Description

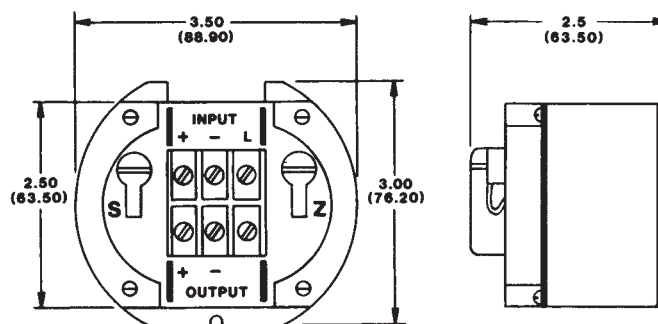
These loop-powered transmitters convert sensor inputs to proportional process current output signals. The output and power share the same pair of wires.

150T two-wire transmitters deliver outstanding performance and a broad range of flexibility. They are ideal for remote or control room mounting. They feature rugged construction and remain stable even in harsh industrial environments.

Special Features

- Excellent accuracy and stability ensure reliable measurements in harsh industrial environments.
- RFI and EMI resistance minimize the effects of noise.
- Isolated inputs prevent ground loops.
- Wide range zero and span adjustment enable precise calibration.

150T Dimensions



Dimensions are in inches (millimeters).



■ Performance

Reference Test Conditions

-CAC input: 0 to 5 Amps, 60 Hz.

-VAC input: 0 to 150 volts AC, 60 Hz.

Output: 4 to 20 mA into 500 ohm load.

Ambient temperature: 77°F(25°C).

Power supply: 24V DC supply.

■ Input

Input Range

0 to 5 amps AC, 50/60 Hz nominal. Withstands 100 ampere overload for 0.01 second, a 50 ampere overload for 0.1 second and a 25 ampere overload for 1 second. Input span range is 2 to 5 amperes; zero range is 0 to 3 amperes, full scale maximum is 5 amperes. Input impedance is 0.03 ohms; burden is 0.15 volt-amperes.

■ Output

Output Range

4 to 20 mA DC output,
linear with input voltage signal.

Output Limits (Approximate)

3.8 mA DC to 30 mA DC.

Output Ripple

Less than $\pm 0.05\%$ of maximum output span.

Current Drive Capability

$R_{LOAD} (max.) = (V_{SUPPLY} - 12V)/20mA$.

At $V_{SUPPLY} = 24V$, $R_{LOAD} = 0$ to 600 ohms

Load Resistance Effect

Less than $\pm 0.005\%$ of output span for 100 ohm change.

Accuracy

$\pm 0.5\%$ of calibrated span. Includes combined effects of transmitter repeatability, hysteresis, terminal point linearity and adjustment resolution.

Response Time

For a step input the output reaches 98% span in 500ms, typical.

■ Power

Power Supply

External loop power supply required, minimum 12V DC, maximum 50V DC. Unit has reverse polarity protection.

Power Supply Effect

DC Volts: $\pm 0.001\%$ of output span per volt DC.
60/120Hz ripple: $\pm 0.01\%$ of span per volt peak to peak of power supply ripple.

■ Environmental

Ambient Temperature Range

-15 to 185°F (-25 to 85°C).

Ambient Temperature Effect

(Combined effects of zero and span over temperature). Less than $\pm 0.01\%$ of output span per °F ($\pm 0.018\%$ per °C) over ambient temperature range for reference test conditions.

Isolation

Input circuit is electrically isolated from output/ power circuits allowing the input to operate at up to 250V AC or 354V DC off ground on a continuous basis (will withstand 1500V AC dielectric strength test for 1 minute without breakdown), complies with test requirements outlined in ANSI C39.5-1974 for the voltage rating specified.

RFI Resistance

Less than $\pm 0.5\%$ of output span with RFI field strengths up to 10V/meter at frequencies of 27, 151 and 467 MHz.

EMI Resistance

Less than $\pm 0.25\%$ of output span effect with switching solenoids or commutator motors.

Noise Rejection

Common Mode: 120 dB at 60 Hz, 1 ohm unbalance, typical.

Normal Mode: Not applicable.

Surge Withstand Capability (SWC)

Input/Output terminations rated per ANSI/IEEE C37.90-1978. Unit is tested to a standardized test waveform that is representative of surges, (high frequency transient electrical interference) observed in actual installations.

■ Physical

Case

Self-extinguishing polypropylene UL94 V-O, recognized by CSA, color blue.

Printed Circuit Boards

Military grade FR-4 epoxy glass circuit board.

Connections

Barrier-type terminal strip using No. 6 screw & clamp plates. Wire range 12-26 AWG.

Environmental Protection

Water resistant enclosures, PC Boards are coated with fungus resistant acrylic conformal coating. Gasket material: silicon rubber.

Mounting Position Effect

Position insensitive.

Shipping Weight

One (1) pound (0.45 kg.) packed.

■ Ordering Information

Transmitter Models

150T-CAC-I-20-C

Transmitter, AC current input.
Unit includes factory calibration.

For AC voltage input, see 250T-VAC on page 166.

Accessories

Power supplies

See Power Supplies on Page 199.

150T-N4

NEMA 4 enclosure, water-tight.

150T-N12

NEMA 12 enclosure, oil-tight.

150T-XJSM-WM

150T-XJSM-PM

Explosion-proof enclosure (-WM for wall-mount or -PM w/pipe-mount hardware).

150T-SM-3.5

150T-SM-24

Mounting rail, 3.5" (holds one 150T) or 24" long.

150T-MSM

Metal surface mounting bracket.

150T-DRA

DIN rail adapter.



Power Supplies: PS5R-S Series

PS5R-S Slim Line Universal Power Supplies



24 HR STOCK ITEM
2 YEAR WARRANTY



Universal Input Power ♦ 10W to 240W Power Range ♦ Compact Design ♦ Worldwide Approvals

Description

Models

PS5R-SB05: 10W power supply, 22.5mm wide
 PS5R-SB12: 15W power supply, 22.5mm wide
 PS5R-SB24: 15W power supply, 22.5mm wide
 PS5R-SC12: 30W power supply, 36mm wide
 PS5R-SC24: 30W power supply, 36mm wide
 PS5R-SD24: 60W power supply, 36mm wide
 PS5R-SE24: 90W power supply, 46mm wide
 PS5R-SF24: 120W power supply, 50mm wide
 PS5R-SG24: 240W power supply, 80mm wide

Input Power Requirement

Universal Input

85 to 264V AC

100 to 370V DC (10W to 90W units)

100 to 350V DC (120W and 240W units)

Output

5V DC, 12V DC, or 24V DC

PS5R-S Slim Line models give you all the power of a traditional power supply in only half the space. They feature universal voltage inputs and all the convenient features you've come to expect. Use them in tight spaces or save valuable DIN rail space while still filling your requirements for power. With nine models available, it's easy to find the one that's right for your application!

The PS5R-S Slim Line series has worldwide approvals. It is UL508 listed and approved for Class I Div 2 hazardous locations. The 10W, 15W, 30W and 60W models are also NEC Class 2 rated, while the 120W and 240W even comply with SEMI F47 sag immunity requirements.

For accessibility and convenience, the PS5R-S series has spring-up screw terminals, fused inputs and overload protection. They are DIN Rail or direct surface mountable. No derating means you save money, space and time. You get the power you need; the way you need it.



Finger-safe spring-up screw terminals

Key Features & Benefits

- Lightweight and compact size
- Universal Input (85-264V AC / 100-370V DC)
- Worldwide approvals: CE, UL/cUL, TÜV
 - UL 1604, Class 1, Div 2, Groups ABCD hazardous locations (all units)
 - UL 508 (all units)
 - UL 13010, NEC Class 2 (10W – 60W only)
 - EN50178:1997
 - LVD: EN60950:2000
 - EMC: Directive EN61204-3:2000 (EMI: Class B, EMS: Industrial)
- Power factor correction (EN61000-3-2) (60W to 240W only)
- Meets SEMI F47 sag immunity (120W and 240W only)
- Over-current protection, auto reset
- Over-voltage protection, shut down
- Output voltage adjust (+ / -10%)
- Unique spring-up finger-safe terminals, IP20
- DIN rail or surface mount

Acromag
 THE LEADER IN INDUSTRIAL I/O

Tel: 248-295-0880 ■ Fax: 248-624-9234 ■ sales@acromag.com ■ www.acromag.com ■ 30765 S Wixom Rd, Wixom, MI 48393 USA



Power Supplies: PS5R-S Series

Easy-to-use

Fast and Easy Installation

IDEC power supplies can quickly snap onto a DIN rail with built-in DIN rail clips that require no additional brackets. They can also be directly mounted on a panel, which means installation is a snap.

IP20 Finger-safe, Spring-up Screw Terminals

Don't worry about losing screws or getting an inadvertent shock from a terminal. The terminals are captive spring-up screws, which makes using them as easy as pushing a screw down and tightening it. They are shock and vibration resistant, and work with ring lugs, fork connectors or stripped wire connections. The terminals are rated IP20 (when tightened) meaning they are recessed to keep fingers and objects from touching the input contacts.

Universal AC/DC Inputs

The power inputs have a range of 85-264V AC to 100-350V DC, and automatically adjust to the correct input power. This makes PS5R-S power supplies suitable for use anywhere in the world.

Output Voltage Adjustment

The output voltage can be easily adjusted within $\pm 10\%$ of the rated voltage.

DC Low Indicator

(15W, 120W & 240W only)

The indicator turns on when the output voltage drops below 80% of the rated value. This assists in troubleshooting power supply problems.

DC ON Indicator

The indicator turns on when the unit is powered up. This is a convenient way to know when the power supply is receiving power.

Reliable Operation

High-performance Output

With very low output ripples of less than 1% peak to peak, the 120W and 240W power supplies are some of the best in the industry. The 240W power supply also has the convenience of two output terminals.

Power Factor Correction (EN61000-3-2)

(60W, 90W, 120W & 240W only)

Power factor correction has also been included to minimize harmonic distortion, resulting in a longer operating life and increased reliability.

Overload Protection

All PS5R-S power supplies are designed with over-current and over-voltage protection to eliminate power supply or equipment damage. With over-current protection, the output voltage automatically drops to zero due to excessive current. When the load returns to a normal level, normal output voltage is restored. With over-voltage protection, the power shuts down when an over-voltage occurs. Only a manual reset can turn the power back on.

Long Life Expectancy

PS5R-S power supplies are very reliable, with a life expectancy of 70,000 hrs. (minimum) or longer, depending on usage.

Ventilation Grill

Provides cooling for the power supply and prevents small objects from falling into the power supply circuitry.

Safety Approvals

SEMI F47

(for 120W & 240W only)

The semiconductor industry requires SEMI F47 approved equipment for use in semiconductor fabrication machinery. The EIAC Corp. is a third party agency and a global leader in conducting voltage sag testing on semiconductor equipment. They certified the 120W and 240W to the SEMI F47 standard.

Class I, Div. 2, Groups ABCD (UL 1604)

All PS5R-S Slim Line power supplies are approved for use in Class I, Div. 2 environments. They can be used in hazardous locations where flammable liquids, gases, and vapors exist or are normally confined within closed containers.

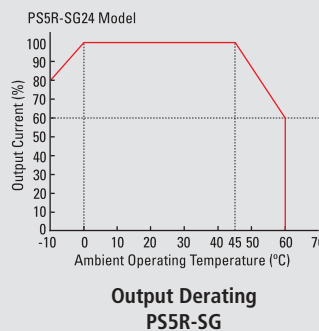
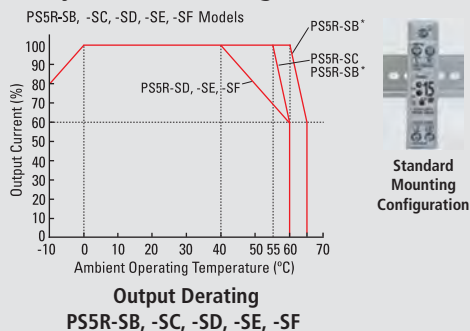
NEC Class 2 (UL 1310)

The 10W, 15W, 30W and 60W PS5R-S Slim Line power supplies are listed according to UL1310, making them compliant to the NEC (National Electric Code) Class 2 rating. For UL1310, the output of the power supplies must be less than 100V AC (under all conditions), have electric shock protection and meet the National Fire Protection Association standards.

SELV (Safety Extra Low Voltage)

All PS5R-S power supplies are SELV compliant. For safety purposes, regulatory agencies defined the highest voltage a person can sustain, without causing any injury, at approximately 30V AC or 42.4V DC.

Safety Charts - Derating Curves



All Slim Line power supplies are listed to UL508, which allows operation at 100% capacity inside a panel. This eliminates the need to use oversize power supplies or utilize two power supplies derated at 50% of their rated output.

The charts above show that the PS5R-S 10W and 15W (at 60°C), 30W/60W/90W (at 55°C), 120W (at 40°C), and 240W (at 45°C) meet the ambient temperature required by UL508 and EN60950 standards to operate at an output current of 100%. The output current starts to derate beyond the required temperature.

* Use lower derating curve for -SB units when using non-standard (rotated) mounting configurations.



Power Supplies: PS5R-S Series

Performance Specifications

Input

Input Voltage (single-phase, 2-wire)

85 to 264V AC, 105 to 370V DC (10W - 90W units)
85 to 264V AC, 105 to 350V DC (120W, 240W units).

Input Current (maximum)

PS5R-SB05, PS5R-SB12, PS5R-SB24:
0.45A at 100V AC, 0.3A at 200V AC.

PS5R-SC12, PS5R-SC24:

0.9A at 100V AC, 0.6A at 200V AC.

PS5R-SD24:

1.7A at 100V AC, 1.0A at 200V AC.

PS5R-SE24:

2.3A at 100V AC, 1.4A at 200V AC.

PS5R-SF24:

1.8A at 100V AC, 1.0A at 200V AC.

PS5R-SG24:

3.5A at 100V AC, 1.7A at 200V AC.

Internal Fuse Rating

PS5R-SB05, PS5R-SB12, PS5R-SB24: 2A.

PS5R-SC12, PS5R-SC24, PS5R-SD24: 3.15A.

PS5R-SE24, PS5R-SF24: 4A.

PS5R-SG24: 6.3A.

Inrush Current (cold start)

50A maximum (at 200V AC).

Leakage Current (at no load)

PS5R-SB05, PS5R-SB12, PS5R-SB24 :
132V AC: 0.38mA max.; 264V AC: 0.75mA max.

PS5R-SC12, PS5R-SC24, PS5R-SD24, PS5R-SE24:
0.75mA maximum.

PS5R-SF24, PS5R-SG24:

1mA maximum.

Typical Efficiency

PS5R-SB05, PS5R-SB12, PS5R-SB24:
69% at 5V DC, 75% at 12VDC, 79% at 24V DC.

PS5R-SC12, PS5R-SC24:

78% at 12V DC, 80% at 24V DC.

PS5R-SD24: 83% at 24V DC.

PS5R-SE24: 82% at 24V DC.

PSR5-SF24, PS5R-SG24: 84% at 24V DC.

Output

Output Voltage and Current Ratings

See derating curve charts on previous page.

PS5R-SB05, PS5R-SB12, PS5R-SB24:

2.0A at 5V DC, 1.2A at 12V DC, 0.65A at 24V DC.

PS5R-SC12, PS5R-SC24:

2.5A at 12V DC, 1.3A at 24V DC.

PS5R-SD24: 2.5A at 24V DC.

PS5R-SE24: 3.75A at 24V DC.

PSR5-SF24: 5A at 24V DC.

PS5R-SG24: 10A at 24V DC.

Voltage Adjustment

±10% (V. ADJ control on front).

Output Holding Time

20ms minimum (at rated input and output).

Starting Time

PS5R-SB05, PS5R-SB12, PS5R-SB24: 200ms maximum.

PSR5-SF24: 650ms maximum.

PS5R-SG24: 500ms maximum.

Rise Time

All units except PSR5-SF24, PS5R-SG24:
100ms maximum (at rated input and output).

PSR5-SF24, PS5R-SG24: 200ms maximum.

Line Regulation

0.4% maximum

Load Regulation

All units except PS5R-SG24: 1.5% maximum.

PS5R-SG24: 0.8% maximum.

Temperature Regulation

0.05% °C maximum.

Ripple Voltage

All units except PSR5-SF24, PS5R-SG24:
2% peak-to-peak maximum (including noise).

PSR5-SF24, PS5R-SG24:

1% peak-to-peak maximum (including noise).

Over-current Protection

PS5R-SB05, PS5R-SB12, PS5R-SB24:
105% or more, auto reset

PS5R-SC12, PS5R-SC24, PS5R-SD24:
105% or more, auto reset

PS5R-SE24: 105 to 130%, auto reset

PS5R-SF24, PS5R-SG24: 103 to 110%, auto reset

Over-voltage Protection

120% minimum shutdown.

Environmental

Dielectric Strength

Between input and ground: 2000V AC, 1 minute.

Between input and output: 3000V AC, 1 minute.

Between output and ground: 500V AC, 1 minute.

Insulation Resistance

100M ohms min. between input and output terminals.

Operating Temperature

See derating curve charts on previous page.

PS5R-SB05, PS5R-SB12, PS5R-SB24:

-10 to 65°C (14 to 149°F)

All other units: -10 to 60°C (14 to 140°F)

Storage Temperature

-25 to 75°C (-13 to 167°F)

Operating Humidity

20 to 90% relative humidity (no condensation)

Vibration Resistance

10 to 55Hz frequency, 0.375mm amplitude.

Shock Resistance

300m/S², (30G) 3 times each in 6 axes.

Physical

Dimensions and Weight

See dimension diagrams on next page.

Terminal Screw

M3.5 Phillips head screw (screw terminal type).

IP Protection

IP20 finger-safe.

LED Indicators

Operation: Green.

Voltage low: Amber (10W, 15W, 120W, 240W only).

Approvals

EMC: EN61204-3 (EMI: Class B, EMS: Industrial),

c-UL (CSA 22.2 No. 14), UL1604, UL508,

LVD: EN60950, EN50178

Ordering Information

Models

PS5R-SB05

Power supply, 10W, 2.0A at 5V DC

PS5R-SB12

Power supply, 15W, 1.2A at 12V DC

PS5R-SB24

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

PS5R-SC12

Power supply, 30W, 2.5A at 12V DC

PS5R-SC24

Power supply, 30W, 1.3A at 24V DC

PS5R-SD24

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

PS5R-SE24

Power supply, 90W, 3.75A at 24V DC

PS5R-SF24

Power supply, 120W, 5A at 24V DC

PS5R-SG24

Power supply, 240W, 10A at 24V DC

Accessories

PS9Z-5R1B

Panel mounting bracket for model PS5R-SB

PS9Z-5R2B

Panel mounting bracket for model PS5R-SB
(flat side mounting)

PS9Z-5R1C

Panel mounting bracket for models PS5R-SB, PS5R-SD

PS9Z-5R1G

Panel mounting bracket for models PS5R-SF, PS5R-SG

BNL5

Din rail end stop, small

BNL6

Din rail end stop, medium

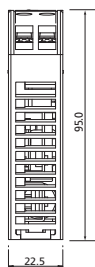
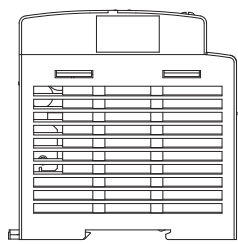
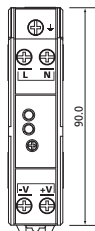


Power Supplies: PS5R-S Series

Dimensions

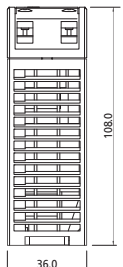
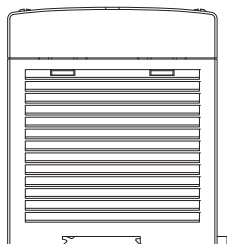
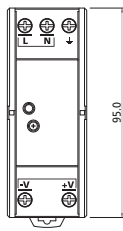
PS5R-SB

Height 90mm (3.54")
Width 22.5mm (0.89")
Depth 95mm (3.74")
Weight 0.16kg (0.35lb.)



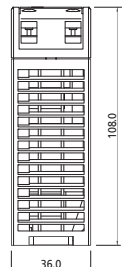
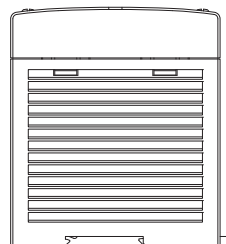
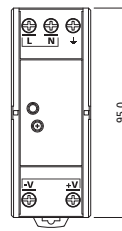
PS5R-SC

Height 95.0mm (3.74")
Width 36.0mm (1.42")
Depth 108.0mm (4.25")
Weight 0.25kg (0.55lb.)



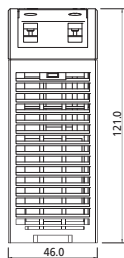
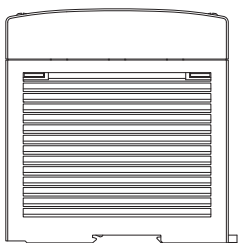
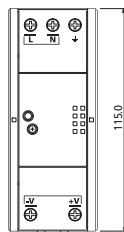
PS5R-SD

Height 95.0mm (3.74")
Width 36.0mm (1.42")
Depth 108.0mm (4.25")
Weight 0.29kg (0.63lb.)



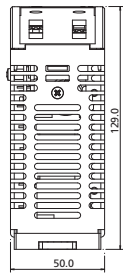
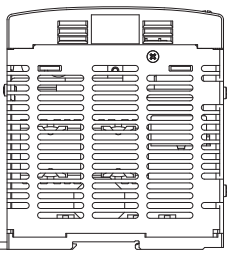
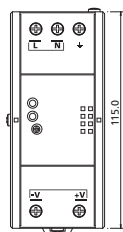
PS5R-SE

Height 115.0mm (4.53")
Width 46.0mm (1.81")
Depth 121.0mm (4.77")
Weight 0.44kg (0.97lb.)



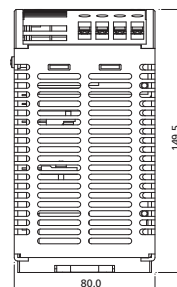
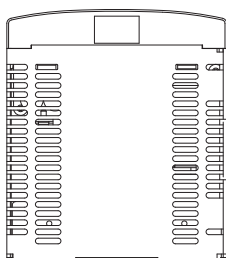
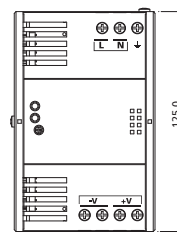
PS5R-SF

Height 115.0mm (4.53")
Width 50.0mm (1.97")
Depth 129.0mm (5.08")
Weight 0.63kg (1.39lb.)



PS5R-SG

Height 125.0mm (4.92")
Width 80.0mm (3.15")
Depth 149.5mm (5.89")
Weight 1.00kg (2.20lb.)





Using Acromag's AC current sensor Model 5020-350

Many Acromag instruments with DC current input can be used in conjunction with an external AC Current Sensor to precondition an AC current input signal. This sensor is a highly accurate toroidal instrument transformer that converts an AC current signal to a safe, low-level, DC milliamper signal (0 to 11.17mA).

The transmitters only accept the isolated low-level signal produced by the AC current sensing transformer and cannot be connected directly to the source of AC power without damage or safety risk. The AC Current Sensor is fully insulated and designed for mounting near the source of the AC current. The input AC current range is a simple function of the number of turns placed on the AC Current Sensor (see the table below). The benefits to using an external sensor (external from the transmitter) include the following:

■ Low losses:

It is not practical to run AC currents over long distances because of significant resistance voltage drops at high currents. The low-level DC milliamper signal output from the AC Current Sensor can be transmitted safely over long distances, allowing the transmitter to be remotely located from the AC power wiring.

■ Safety:

The AC Current Sensor's output leads can be open or short circuited and these conditions do not affect the AC current loop or cause damage to the sensor. Likewise, the wires connecting the AC Current Sensor to the transmitter can be easily removed from the transmitter's input terminals without concern or hazard.

■ Ease of Calibration:

The AC current input range can be easily scaled in the field by simply changing the number of primary turns at the sensor, with no additional calibration required. That is, the AC current input span is a simple function of the number of primary turns placed on the AC Current Sensor and sensor/transmitter calibration is not affected by this. Refer to Applications "A" & "B" of the diagrams on the next page.



Acromag's Flat Pack transmitters are shown with the AC current sensor toroidal transformer.

Sensor Primary Turns	AC Current Input Range	Sensor Output (red/black wires)
1	0 to 20 Amps AC	0 to 11.17mA DC
2	0 to 10 Amps AC	0 to 11.17mA DC
4	0 to 5 Amps AC	0 to 11.17mA DC
10	0 to 2 Amps AC	0 to 11.17mA DC
20	0 to 1 Amps AC	0 to 11.17mA DC

The AC Current Sensor is isolated and can be used in AC circuits up to 250V AC, 50 or 60 Hz. It is designed to be mounted at the source of the AC current to be measured. The transmitter can be located remotely from the AC signal and wired using small gauge wire. The sensor's output wires can be shorted, open-circuited, or removed from the transmitter's input terminals, without hazard to personnel or the AC Current Sensor.

DANGER:

If the AC Current Sensor is used with an AC Current Transformer (C.T.), disconnect power to the C.T., or short the output of the C.T., before removing the wire going through the AC Current Sensor. If this is not done, an open circuited C.T. will generate high voltages (hazardous) and possible C.T. damage.

The output wires of the sensor are polarized: the Red wire is (+) plus and the Black wire is (-) minus. Normally, these output wires are attached to one end of a cable (user supplied) and the other end connects to the transmitter's input. Connect the Current Sensor output leads to the transmitter input by connecting Red (+) to the transmitter's plus (+) terminal, and Black (-) to the transmitter's minus (-) terminal. Proper polarity must be observed.

WARNING:

The input to the module can only come from the AC Current Sensor output wires (red/black). If AC current is directly attached to the transmitter's input terminals, the transmitter will be destroyed and safety compromised.

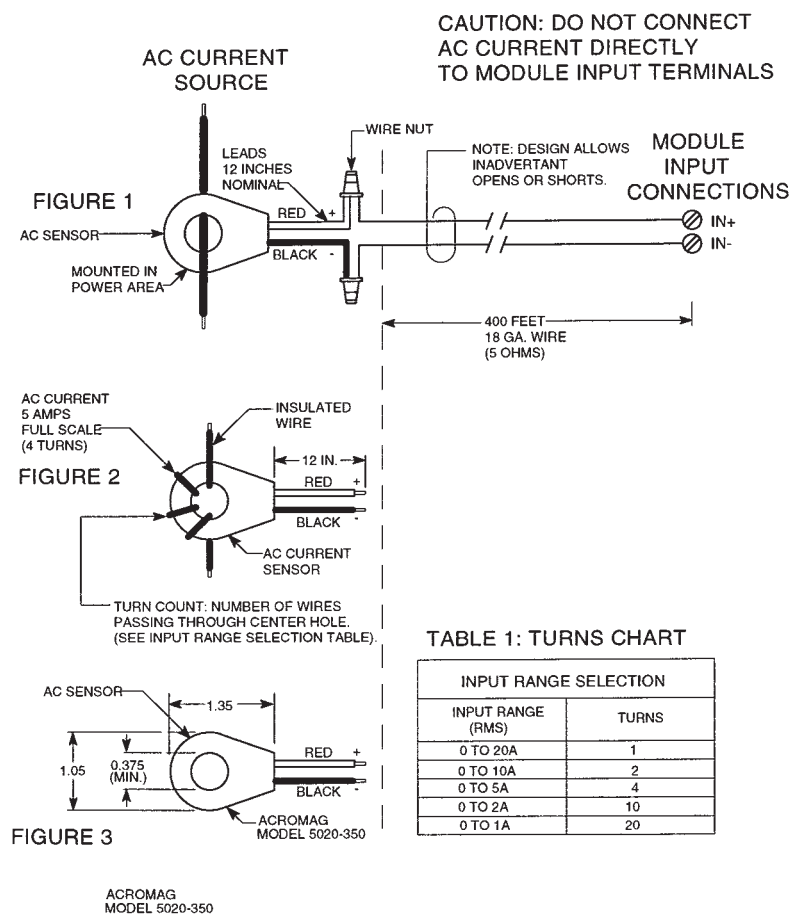
For most applications, it is recommended that the minus (-) transmitter input terminal be connected to an earth ground. The connections between the AC Current Sensor would be floating if not grounded. Grounding eliminates the risk of high common-mode voltages from showing up on the wires and reduces noise pickup.

Supported Products

- IntelliPack Series Transmitters and Alarms
- 610T Series Isolated Transmitters
- ACR Series Isolated Transmitters
- Flat Pack 250T/350T/450T Series Transmitters and 361A/461A Series Alarms
- SmartPack Series LonWorks® I/O Modules



Dimensions and Electrical Connections

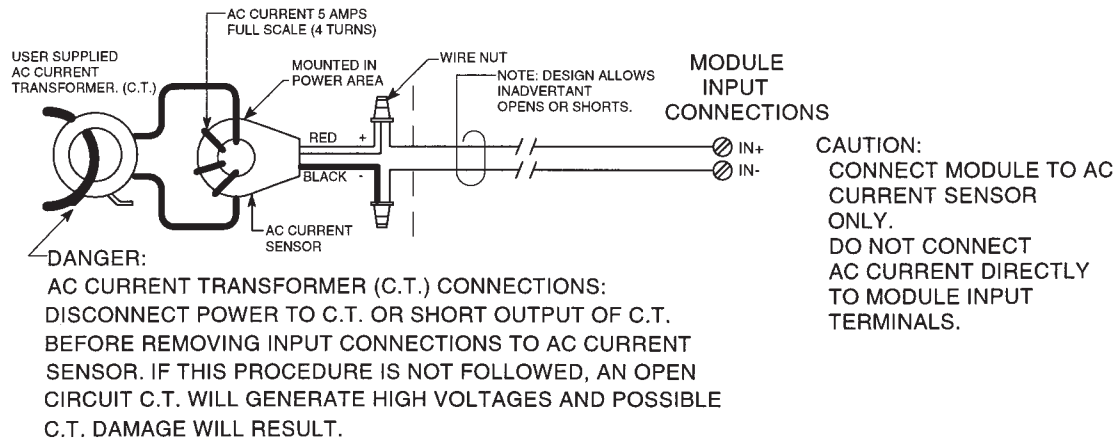


THIS SENSOR IS USED WITH VARIOUS ACROMAG INPUT MODULES - PLEASE REFERENCE THE USER'S MANUAL FOR THE MODULE FOR ADDITIONAL INFORMATION.

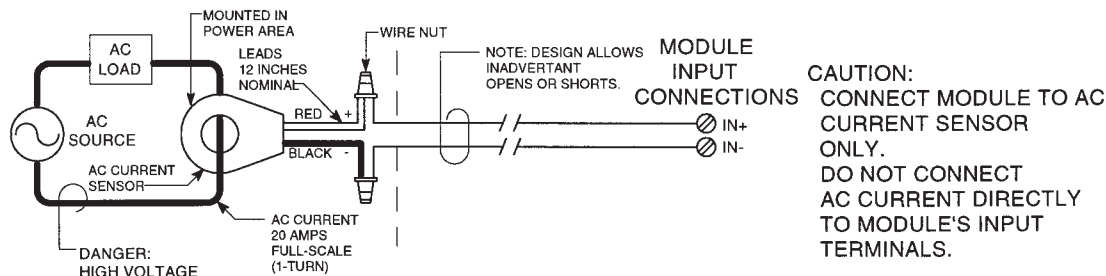


Application Examples

APPLICATION EXAMPLE A: AC CURRENT TRANSFORMER (C.T.)



APPLICATION EXAMPLE B: 115V/230VAC ELECTRICAL CIRCUIT



MODEL 5020-350 AC CURRENT SENSOR ELECTRICAL CONNECTIONS



Additional Services

Special Testing, Inspections, or Modifications

If you require special handling procedures such as a source or other special inspection, crating, packaging, overseas documentation, certificates of origin, packing for special shipment, drawings, modifications, or other extra services, please contact the Factory in Wixom, Michigan for a quotation.

Fungus-Resistant Humiseal Protective Coating

Some Acromag millivolt/thermocouple input model types are supplied with a fungus-resistant humiseal protective coating. To order additional or special humiseal coating on any item, contact factory for pricing. Specify "humiseal coating" on order and include the service charge per item.

Plastic (Mylar) or Stainless Steel Tagging

Plastic (mylar) tagging of units is available at no extra charge. Specify tagging information on order (25 character limit). Stainless steel tagging is available for some products at extra charge. Contact factory for details. In most cases, the stainless steel tags are supplied "unaffixed" so users can mount tags on packaging as desired.

International Certification

European CE Mark Approved Products

IntelliPack 800 Series signal conditioners
600 Series isolated transmitters
151T/155H Series Transmitters
250T-FQ1 Transmitter
900EN Series I/O Modules
900MB Series I/O Modules
900PB Series I/O Modules
APM Series Panel Meter
A5B Series I/O modules
EIS Series Ethernet Switches
PS5R power supplies

Please call Acromag for a list of currently approved products.

International Standards Guidelines

The following partial list of standards represents Acromag's design guidelines for Internationally approved products. This list is a design guideline and does not imply that all products comply with these levels. A review of each individual product's performance specifications will verify applied standards and test levels.

EMC directive 89/336/EEC
Low Voltage directive 73/23/EEC
European Norm EN50082-1: 1992
European Norm EN55022: 1995
EN61000-4-2 ESD Level 3: 1995
EN61000-4-3 EMC Level 3: 1995
EN61000-4-4 EFT Level 3: 1995
EN61000-4-5 Surge Level 2: 1995
EN61010: Electrical Equipment Safety Requirements: 1990

Consult factory for latest approvals and changes.

Underwriters Laboratories Certification

The following products are UL and cUL listed.

General product safety approval
(UL3121 and EN61010):

600 Series isolated transmitters
IntelliPack 800 Series
900EN Series I/O Modules & Switches
900MB Series I/O Modules
900PB Series I/O Modules
APM Series Panel Meter
EIS Series Ethernet Switches

Class I; Division 2; Groups A, B, C, D
(UL508 and UL1604):

600 Series isolated transmitters
(except 611T & 612T)
892M, 894M
900EN Series I/O Modules & Switches
900MB Series I/O Modules
900PB Series I/O Modules

EtherNet/IP Conformance Tested

900EN Series I/O Modules

Modbus TCP/IP Conformance Tested

900EN Series I/O Modules

Profibus Nutzerorganization

900PB Series I/O Modules



CSA Certification

Many Acromag products are available with Canadian Standards Association (CSA) Certification.

Certifications are based on CSA standard C22.2 No. 147-1987.

Class I; Division 1; Groups A, B, C, D

Units are shipped separate from any optional enclosure.

150T Transmitter approved input types:

Thermocouples	Copper RTD
Platinum RTD	Slidewire
Differential RTD	

250T Transmitter approved input types:

Thermocouples
Platinum RTD
Copper RTD

Class I; Division 2; Groups A, B, C, D

Units are shipped separate from any optional enclosure.

150T Transmitter approved input types:

Thermocouple	Copper RTD
Millivolts	Differential Pt RTD
Platinum RTD	Slidewire

151T/155H Transmitters:

All input types approved.

250T Transmitter approved input types:

Thermocouple	Frequency
Millivolts	DC Current
Platinum RTD	DC Voltage
Copper RTD	

270i Isolator is approved.

All A5B I/O Modules are approved.

CSA Nonhazardous Location

Units are shipped separately from any optional enclosure.

250T Transmitter input types:

Thermocouple	Frequency
Millivolts	DC Current
Platinum RTD	DC Voltage
Copper RTD	

260A Alarms are approved.

270i Isolator is approved.

CSA Explosion Proof Rating

Class I; Division 1; Groups B, C, D

Class II; Division 1; Groups E, F, G

Units are shipped installed in required enclosure.

250T Transmitter approved input types:

Thermocouple	Frequency
Millivolts	DC Current
Platinum RTD	DC Voltage
Copper RTD	

260A Alarms are approved.

270i Isolator is approved.

ATEX Approval

-25°C to +60°C

972EN Ethernet Modules

-25°C to +70°C

951EN/952EN Ethernet Modules

961EN/962EN Ethernet Modules

963EN/964EN Ethernet Modules

965EN Ethernet Modules

966EN Ethernet Modules

973EN Ethernet Modules

981EN/982EN/983EN Ethernet Modules

900EN Ethernet Switch

 II 3 G
EX nA T4 -25°C <Ta < +70°C
TUVNA 07ATEX7145X

FM Certification

Factory Mutual (FM) Approval is available for certain products. Contact factory before ordering for further information on equipment that is available with FM Approval.

The products below are approved by Factory Mutual Research with the following classifications.

FM Approvals

Class I; Division 2; Groups A, B, C, D

151T/155H Transmitters:

All input types approved.

A5B I/O Modules.

FM Explosion-Proof Approvals

Class I; Division 1; Groups C, D

Class II; Division 1; Groups E, G

Class III



Notes



Terms and Conditions

Placing an Order

Orders are placed with local Acromag Sales and Engineering Representative or directly with our factory headquarters in Wixom, Michigan, USA via Internet, letter, telephone, or facsimile. Your order should include the complete Acromag model number, any options, quantity desired, shipping and billing addresses, purchase order number, and desired method of shipment. Standard delivery is stock to three weeks, typical. Please request the shipping date(s) that you need. Please include your name, telephone, and facsimile numbers so we can contact you in case we have any questions. Upon receipt and acceptance by Acromag, you will receive a prompt confirmation of your order.

Prices

Prices for Acromag products are shown in price lists and literature. Additionally, prices may be specified on a current quotation or other written agreement with the Acromag factory. These agreements must be in force at the time of acceptance, and order confirmation by Acromag's Factory. Quotations from our Sales and Engineering Representatives are for "estimating purposes only" until confirmed by the Acromag Factory.

PLEASE NOTE: Quoted prices do not include shipping charges, or insurance in transit. Additionally, they do not include sales, use, excise, or other taxes and charges that may be imposed. Such charges are subject to an increase equal in amount to any amounts Acromag is required to collect or pay upon the sale or delivery of the items purchased. Errors are subject to correction. Published prices and specifications are subject to change without notice. Formal factory quotations are normally firm for 30 days, unless otherwise specified.

Credit Terms

Credit terms are granted at the sole discretion of Acromag, and full payment is due Net 30-days after the invoice date. Unless credit has been approved in advance, buyer agrees to accept delivery and pay cash on or prior to delivery. Invoices are issued when goods are delivered to the carrier. Invoices not paid within thirty days of the invoice date will bear interest at 1.5 percent per month (18 percent per annum) on the unpaid balance from the date of delivery to the date of actual payment. Shipping charges are added from point of origin: which is F.O.B. the Acromag factory in Wixom, Michigan, USA.

Credit Cards

Visa, Mastercard, and American Express cards are accepted.

Delivery

Delivery dates are given as best estimates at the time the order is confirmed and accepted, but are not guaranteed. Acromag is not liable for damages resulting from late delivery or due to conditions beyond Acromag's control. The time of delivery is when the equipment is available for pick up by the carrier. In the absence of specific shipping instructions, Acromag will select an appropriate carrier, but such carrier will not be the agent of Acromag, nor will Acromag assume any liability regarding the shipment, including risk of loss or damage to the goods in transit. It is agreed between the buyer and seller that risk and title to the goods passes to the buyer upon delivery by Acromag to the carrier, subject to a purchase money security interest retained by Acromag until payment of the full purchase price to Acromag.

Limited Warranty

Acromag warrants all instruments it manufactures to be free from defects in materials and factory workmanship to the original buyer. This warranty is contingent upon proper use of the equipment, and does not cover equipment that has been modified or has been subjected to abusive physical or electrical stresses. Acromag agrees to repair or replace, at its sole discretion, any instrument that fails to perform as specified within 18 months after date of the original shipment from the factory, or 12 months after the date of installation, whichever date comes first.

Acromag offers a 5 year warranty on many products, effective from the date of shipment from the factory. Contact Acromag for more information. Warranty for items that Acromag purchases from other manufacturers, and resells are limited to the warranty extended to Acromag by their respective manufacturers, and buyer agrees and accepts such limitation, and further agrees to hold Acromag harmless for any claims or damages beyond such limitation.

Limitations of Liability

The above warranty provides the exclusive remedies in lieu of any other warranty, including but not limited to Warranty of Merchantability, Fitness for Particular Purpose, and Fitness for Ordinary Purpose Used or Purpose Intended. Acromag's sole liabilities and Buyer's sole remedies under this agreement are limited as provided in the Warranty by repair, or by replacement, or by refund of the purchase price. Acromag shall not be liable for any direct, indirect, consequential, or incidental damages resulting from defects in any instrument, equipment, product, or service, nor for failure of delivery in whole or in part, nor for injuries resulting from its use or for any other causes.

Substitutions and Modifications

Acromag reserves the right to make substitutions and modifications in the specifications of equipment that do not materially or adversely affect the performance of the equipment.

Changes in Orders

Customer changes in orders, delivery dates, specifications, calibration, cancellations, or other alternations which affect Acromag production, engineering, or scheduling are subject to added charges as determined by Acromag.

Returns

New equipment may be returned within 30 days of shipment with prior factory approval and upon the assignment of a Returned Material Authorization number, RMA number, by Acromag. This number must be clearly shown on the return package(s). RMA numbers are valid for 30 days from date of issue. New items in factory sealed containers which are less than thirty days old after shipment may be returned for credit, less a minimum restocking and testing charge of twenty percent of the list price upon factory approval only, provided the customer pays all shipping and handling charges. Specially ordered, or modified goods, or goods which have been used or have been unpacked from the factory-sealed containers, or goods which have been shipped more than thirty days prior are not returnable.

Packaging and Documentation

All Acromag instruments are placed in anti-static bags and individually packaged in high impact corrugated cardboard containers suitable for domestic shipment or overseas air shipment. Each package contains appropriate instructions including specifications, mounting details, installation and operating instructions, and electrical connections. Please request a quotation for additional instruction sets, reproducible or certified drawings, recommended spare parts lists, special documentation, copies of test documentation, export packaging, and export documentation if required.

Quality

All Acromag products undergo rigid quality control procedures to ensure compliance with our published specifications. Customers are welcome to observe our standard inspection procedures at a nominal charge. Factory inspections requiring special tests, documentation, or procedures not normally part of Acromag's standard procedures, are subject to additional charges.

Service Policy

Units within the warranty period returned for repair, test, and recalibration are serviced at no charge in accordance with the terms of the Acromag warranty policy. The Customer pays all transportation and other charges to the factory.

Units out of warranty returned for repair, test, and/or recalibration are handled on a time and material basis. If requested, or if costs exceed 50% of current list price, Acromag advises the customer prior to making the repairs. Such repairs are performed at the customer's expense. Typical test, recalibration, and repairs are 25% of the instrument's current list price. Transportation charges both ways are at the customer's expense.

Please be sure all returns are shipped with the following information included.

- 1) "Returned Material Authorization," RMA number, clearly shown on each package. Please call Acromag at 248 624-1541 to obtain your RMA number.
- 2) Your company Name with Billing and Shipping Addresses.
- 3) A complete description of problem, or re-calibration data.
- 4) The contact person at your company, with their telephone and facsimile numbers.
- 5) Non-Warranty returns additionally need your Purchase Order Number.

Please pack your returned instruments in their original shipping cartons, or in equivalent strong protective shipping cartons. Please address your package(s) to:

Acromag, Inc., Attn: Repair Dept.
30765 South Wixom Road
PO Box 437
Wixom, MI 48393-7037 USA

Ordering Literature and Documentation

The following items are available at additional charges. Please call the factory or your local Acromag sales representative for more information.

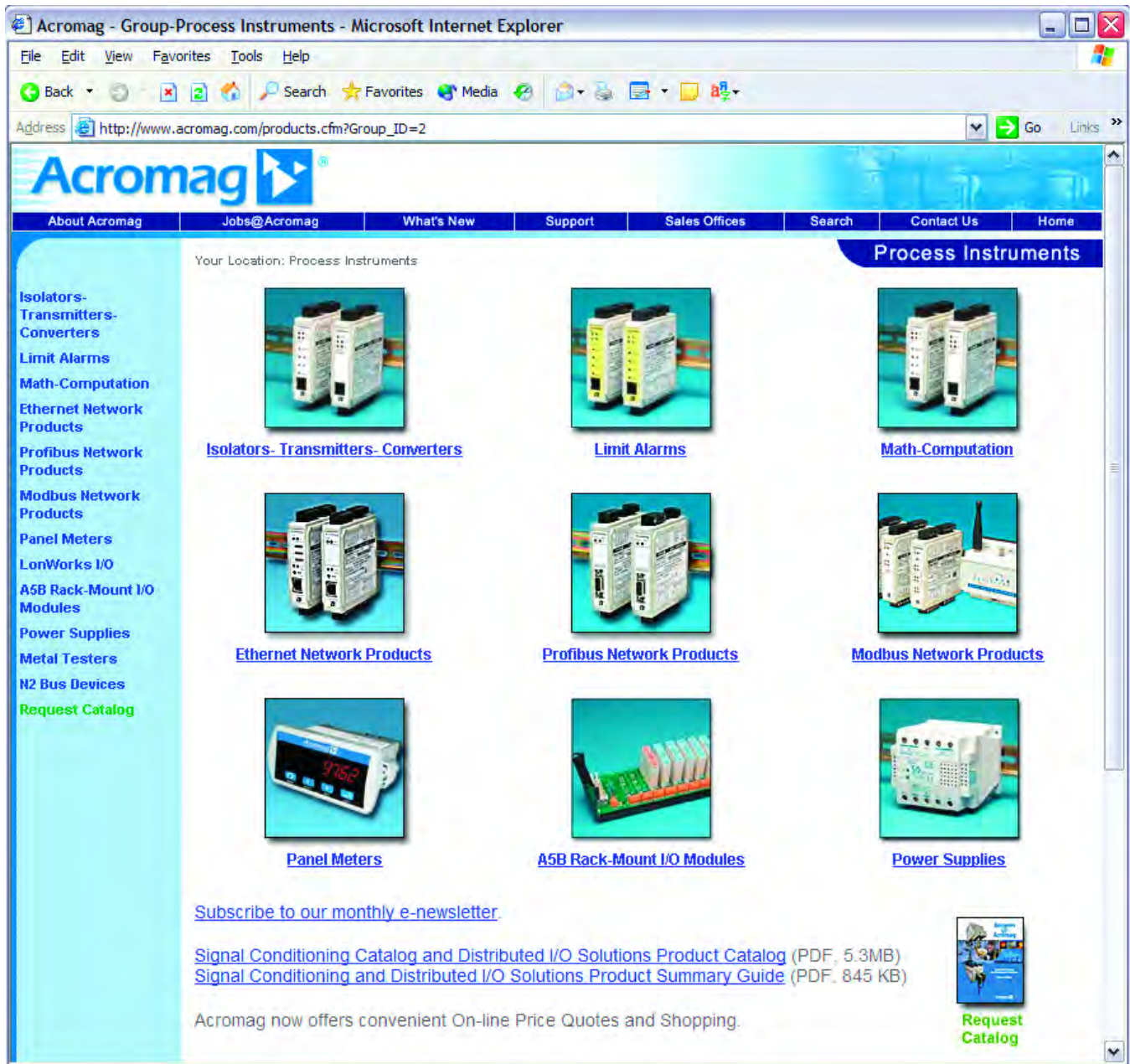
- Instruction booklets
- Certificate of compliance
- Test data certificate
- On-site inspection
- Manufacturing quality audit

Modification of Terms and Conditions

These terms and conditions shall prevail notwithstanding any proposed variation or addition which may be contained in any order or other written document submitted by the buyer for any equipment sold. Any deviations or additions to these terms and conditions must be in writing and are not valid unless confirmed in writing by an authorized officer of Acromag.

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Answers@Acromag



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