# MODBUS-RTU: REMOTE I/O

*These low-cost multi-channel I/O modules are ideal for remote I/O applications with limited space and those requiring a handful of channels in many locations.*


## BusWorks® I/O Modules for Modbus-RTU

Acromag's BusWorks 900MB series is a collection of analog and discrete I/O modules with Modbus-RTU network communication. BusWorks modules are ideal for a wide variety of distributed I/O applications including data acquisition, control, process monitoring, and test & measurement.

Analog input modules accept DC current, voltage, or temperature sensor signals and feature local limit alarm capabilities. Analog output modules provide DC current or voltage signals for local displays, recorders, variable frequency drives, valves, and other equipment.

Discrete I/O modules monitor and/or control on/off status of industrial devices.

Windows® configuration software simplifies module setup with easy selection of input/output ranges, alarm setpoints, and other operating parameters.

All 900MB Modbus I/O modules communicate over a high-speed RS-485 network supporting data transfer rates up to 115K baud.

**Inputs**

- Thermocouple
- RTD/Resistance
- Millivolt
- Frequency
- DC voltage
- DC current
- AC current
- Discrete status

**Outputs**

- DC voltage
- DC current
- Discrete switches or local limit alarms

**Power**

- 10-36V DC
- 24V AC

**Approvals**

- CE, UL/cUL Class I Div 2 Groups ABCD

*For more information, visit our website at www.acromag.com/modbus*

Modbus MEMBER

8401-003

Call 877-214-6267 or 248-295-0880 for technical assistance.

*(This page intentionally left blank.)*

## 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)

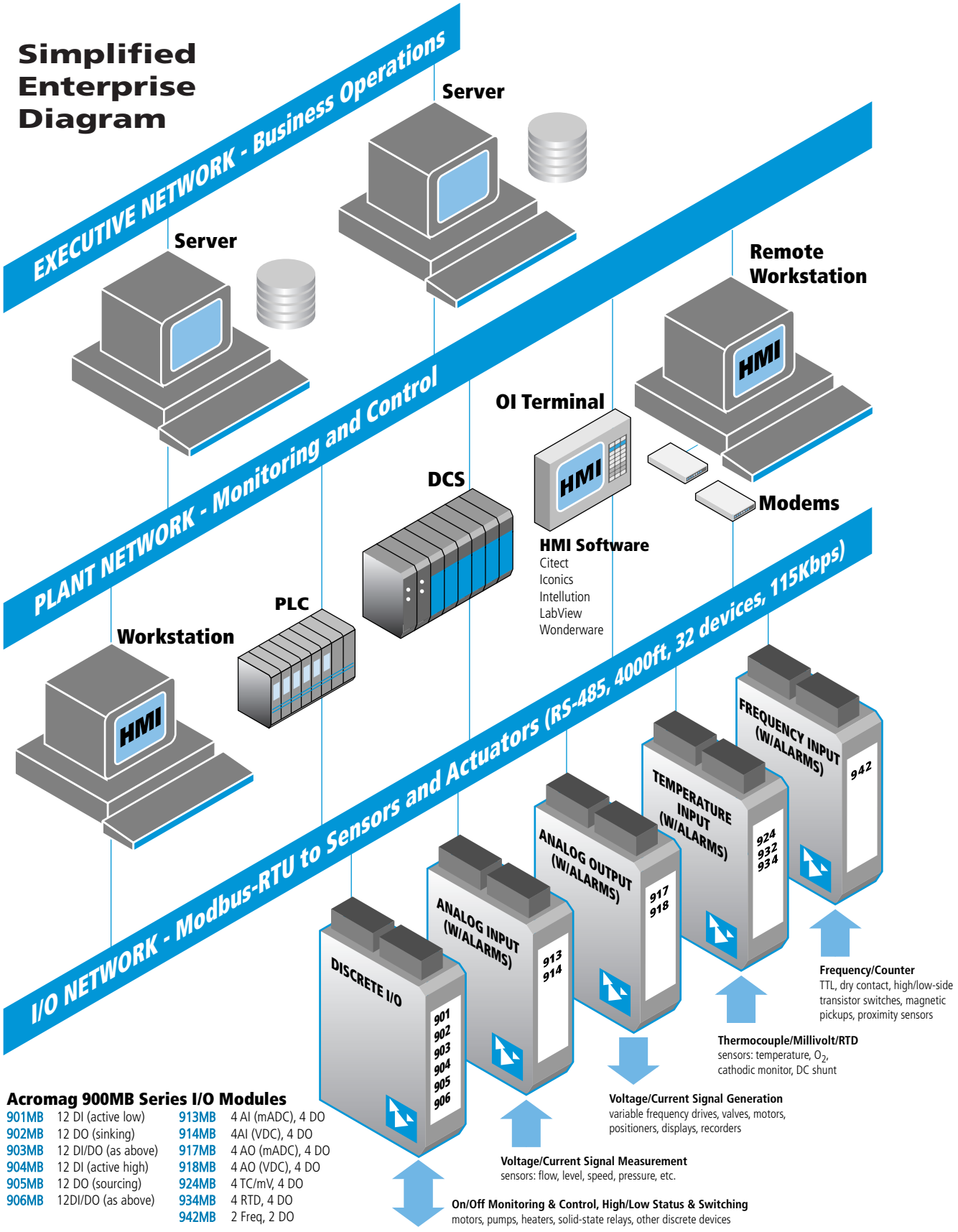
### Functions

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



Acromag THE LEADER IN INDUSTRIAL I/O
Tel: 248-295-0880 e-mail: sales@acromag.com www.acromag.com

# Simplified Enterprise Diagram




**Frequency/Counter**
TTL, dry contact, high/low-side transistor switches, magnetic pickups, proximity sensors

**Thermocouple/Millivolt/RTD**
sensors: temperature, $O_2$, cathodic monitor, DC shunt

**Voltage/Current Signal Generation**
variable frequency drives, valves, motors, positioners, displays, recorders

**Voltage/Current Signal Measurement**
sensors: flow, level, speed, pressure, etc.

**On/Off Monitoring & Control, High/Low Status & Switching**
motors, pumps, heaters, solid-state relays, other discrete devices

## Acromag 900MB Series I/O Modules

| | | | |
|---|---|---|---|
| 901MB | 12 DI (active low) | 913MB | 4 AI (mADC), 4 DO |
| 902MB | 12 DO (sinking) | 914MB | 4AI (VDC), 4 DO |
| 903MB | 12 DI/DO (as above) | 917MB | 4 AO (mADC), 4 DO |
| 904MB | 12 DI (active high) | 918MB | 4 AO (VDC), 4 DO |
| 905MB | 12 DO (sourcing) | 924MB | 4 TC/mV, 4 DO |
| 906MB | 12DI/DO (as above) | 934MB | 4 RTD, 4 DO |
| | | 942MB | 2 Freq, 2 DO |

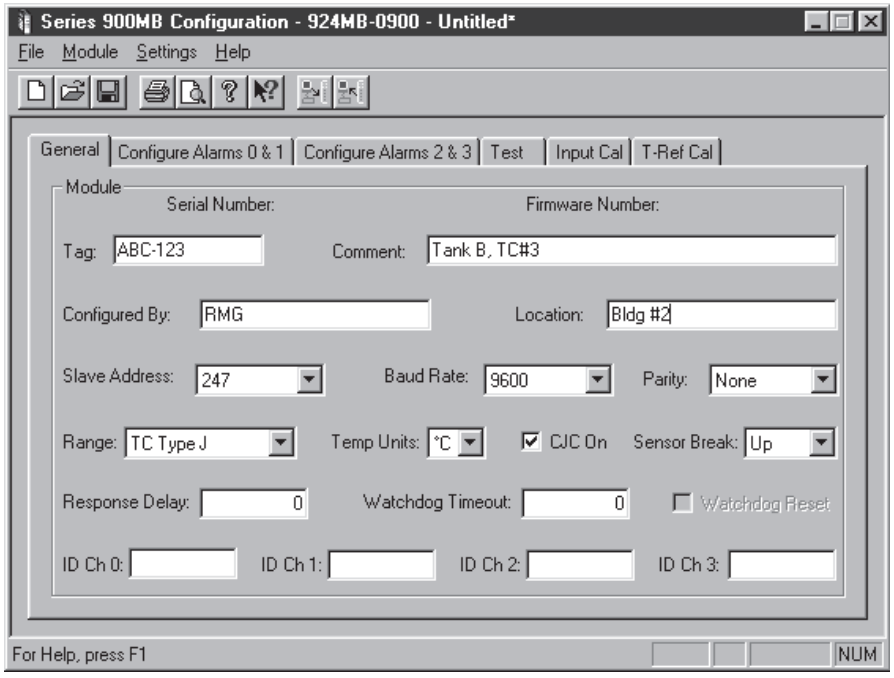
## Software Support

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:

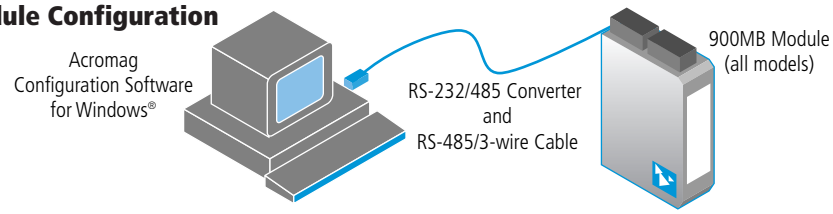
- AB/Rockwell
- Aveva
- General Electric
- Iconics
- National Instruments
- Phoenix Contact
- Schneider
- Wonderware

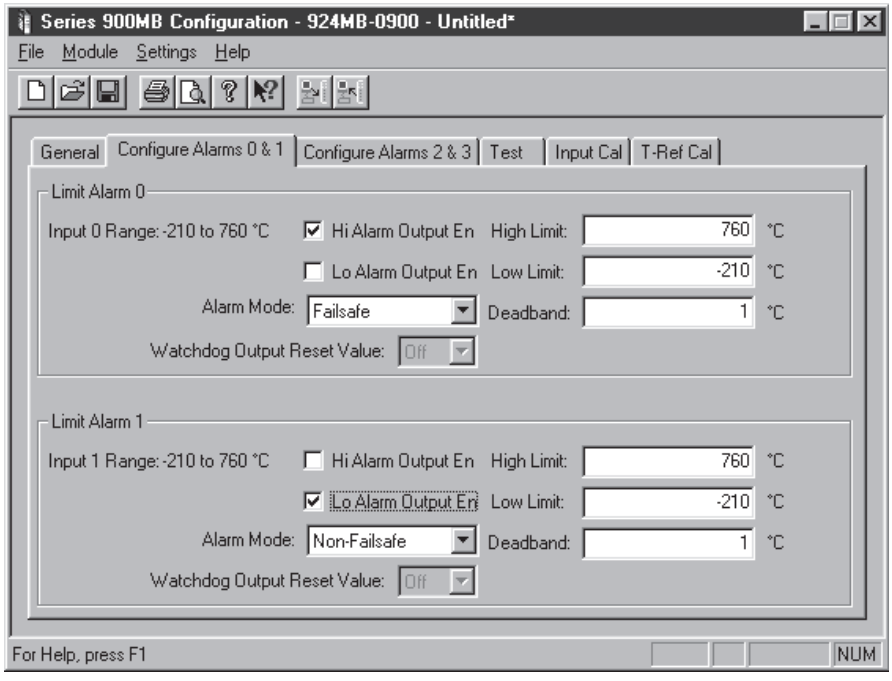
Acromag also offers a configuration utility for faster and easier setup. This software provides an intuitive approach to select configuration options for your application. Familiar Windows pull-down selection menus and fill-in-the-blank fields speed you through a few brief configuration screens. No programming 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.

# 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

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 Isolated RS-232/485 Converter Isolated RS-485 Network Repeater

## Mounting Hardware

Installation is a snap with Acromag accessories.

DIN RAIL Bars
19" Rack-Mount Kit

# 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

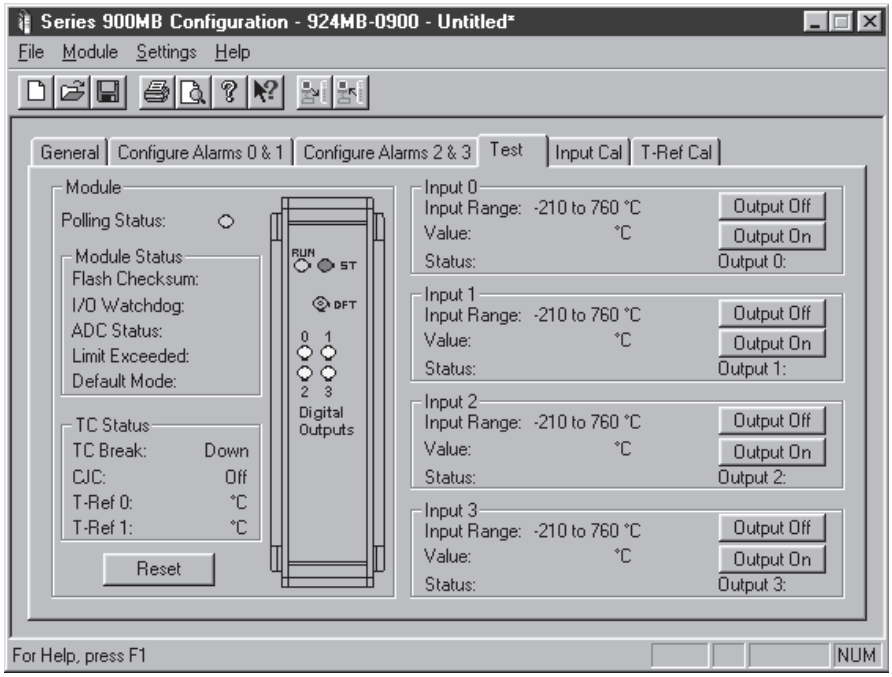
Odd, even, or none. Default setting none.

### 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

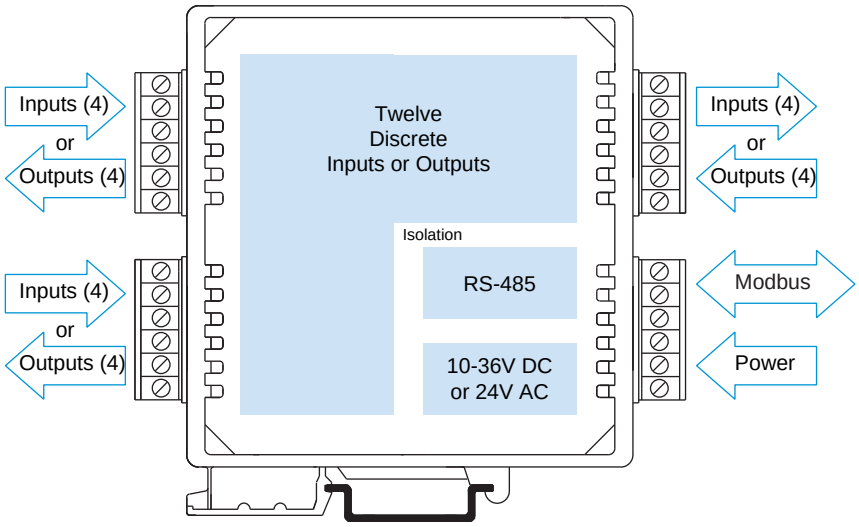
DIN rail mount, Type EN50022; "T" rail (35mm).

### Shipping Weight

1 pound (0.45 Kg) packed.

## Modbus/RS-485

## High-Density Discrete I/O Module




# 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)
O 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.

## 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

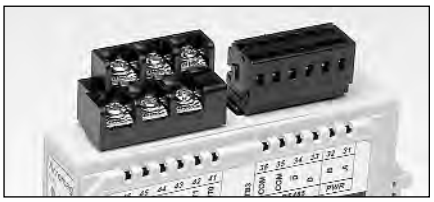
**900C-SIP**
Configuration Software Interface Package (includes software CD-ROM for Windows, RS-232/485 converter, and RS-485/three-wire cable)

**4001-095**
USB-to-RS232 adapter

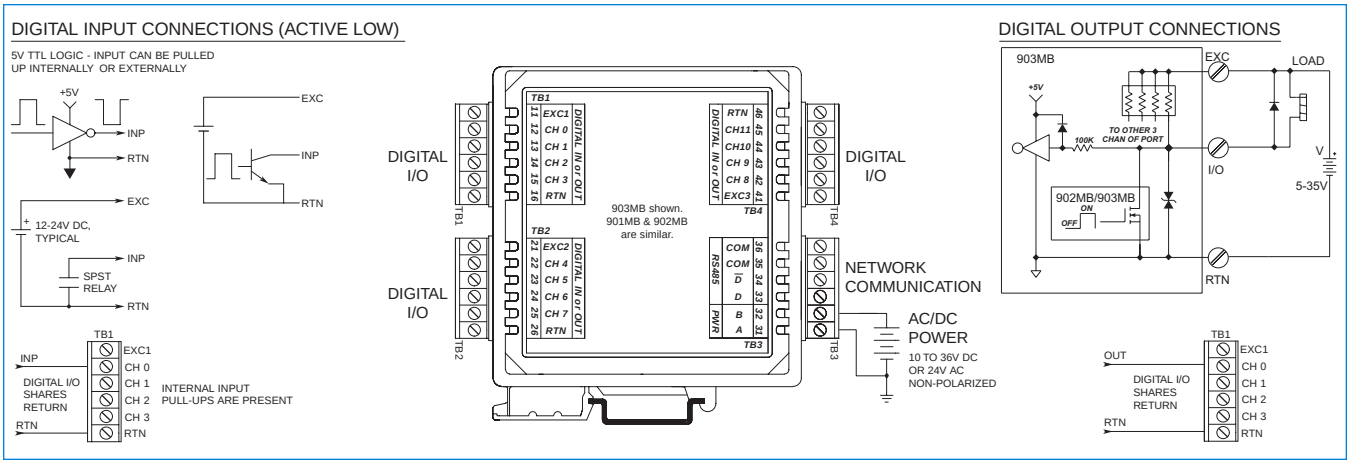
**TBK-B02**
Optional terminal block kit, barrier strip style, 4 pcs.

**TBK-S02**
Optional terminal block kit, spring clamp style, 4 pcs.

**PS5R-VB24**
Power supply (24V DC, 2.1A)



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




Acromag THE LEADER IN INDUSTRIAL I/O
Tel: 248-295-0880 e-mail: sales@acromag.com www.acromag.com

## 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

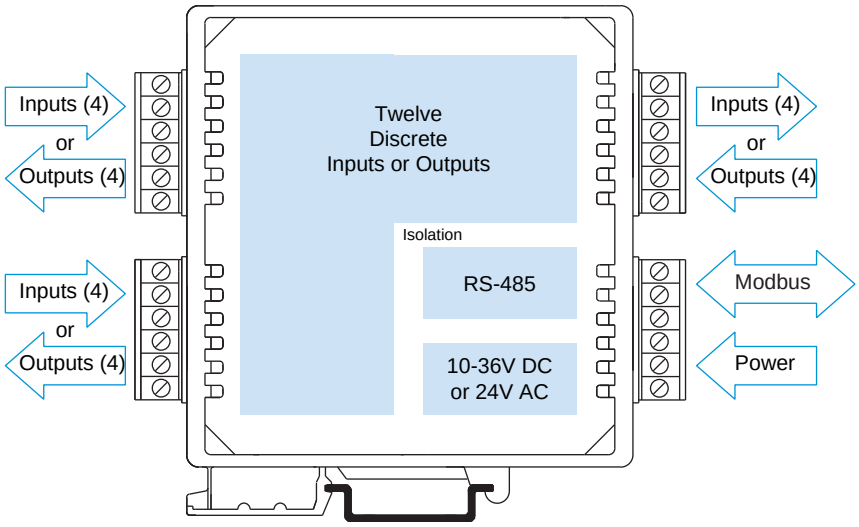
### Output
Twelve output channels (905, 906 models only)
6 to 35V DC

### 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
6 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

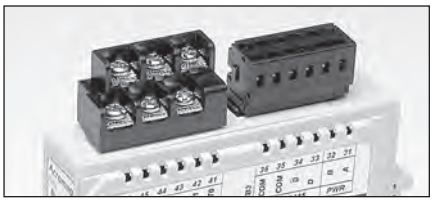
**900C-SIP**
Configuration Software Interface Package (includes software CD-ROM for Windows, RS-232/485 converter, and RS-485/three-wire cable)

**4001-095**
USB-to-RS232 adapter

**TBK-B02**
Optional terminal block kit, barrier strip style, 4 pcs.

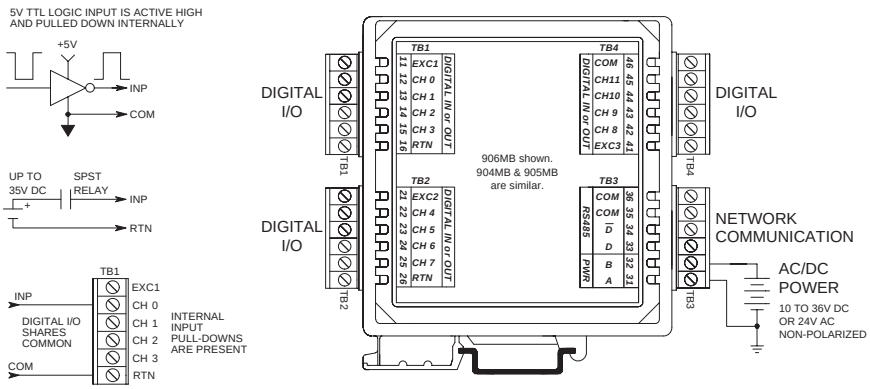
**TBK-S02**
Optional terminal block kit, spring clamp style, 4 pcs.

**PS5R-VB24**
Power supply (24V DC, 2.1A)



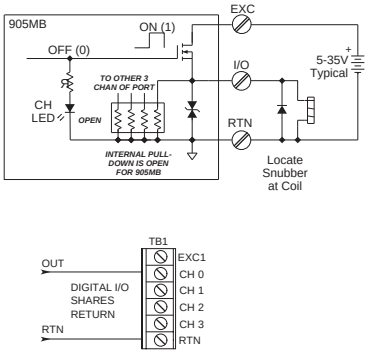
Optional terminal blocks: barrier strip (left) and spring clamp (right). Cage clamp terminal is standard.

DIGITAL INPUT CONNECTIONS (ACTIVE HIGH)




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)

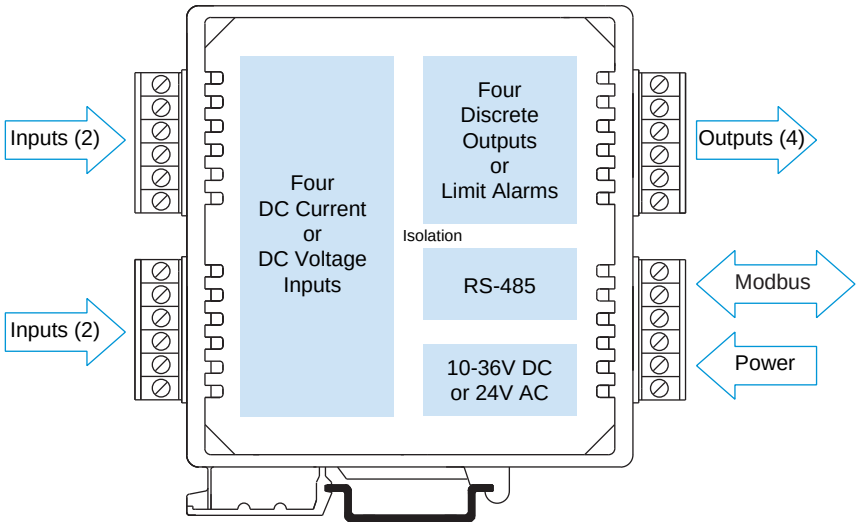
### Output
Four output channels:
Open-drain MOSFETs (1A DC loads)
0 to 35V DC

### 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.

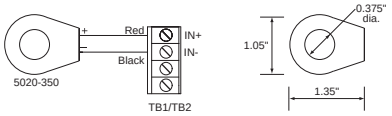
The inputs accommodate wide DC voltage or current ranges. Flexible discrete outputs operate as alarms or on/off controllers. As limit alarms, each discrete output can be configured with high and/or low setpoints exclusively tied to an analog input channel. Alarm trips function without host communication 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 Specifications

### General Input

**Resolution**
0.005% or 1 part in 20,000.

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

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

**Input Conversion Rate**
180ms per channel.

### Current Input (913MB)

**DC Current Input Ranges**
Range user-configured. Range selected applies to all channels.

0 to 1mA, 0 to 20mA, 4 to 20mA,
0 to 11.17mA (for use with 5020-350 AC sensor).

**DC Current Input Resistance**
49.9 ohms.

**DC Current Input Accuracy**
±0.1% of input range.

### Voltage Input (914MB)

**DC Voltage Input Ranges**
Range user-configured. Range selected applies to all channels.

±10V, ±5V, ±2.5V, ±1.25V,
±625mV, ±313mV, ±156mV, ±78mV

**Input Impedance**
110.5K ohms.

**DC Voltage 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.
External voltage source required.

**Output Current Range**
0 to 1A DC continuous for each output.

**Output OFF Leakage Current**
50µA maximum.

**Output ON Resistance**
0.15 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 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.

### 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 (Output) Status
Read Holding Registers
Read Input Registers
Force Single Coil (Output)
Preset Single Register
Force Multiple Coils (Output)
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 or 22 to 26V AC.

**Supply Current**

| Supply | Current Draw |
|---|---|
| 10V DC | 125mA maximum |
| 24V DC | 50mA maximum |
| 24V AC | 100mA 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 ±4V DC.

## Ordering Information

### Models

913MB-0900
914MB-0900
DC current (913MB) or voltage ( 914MB) input module

### Accessories

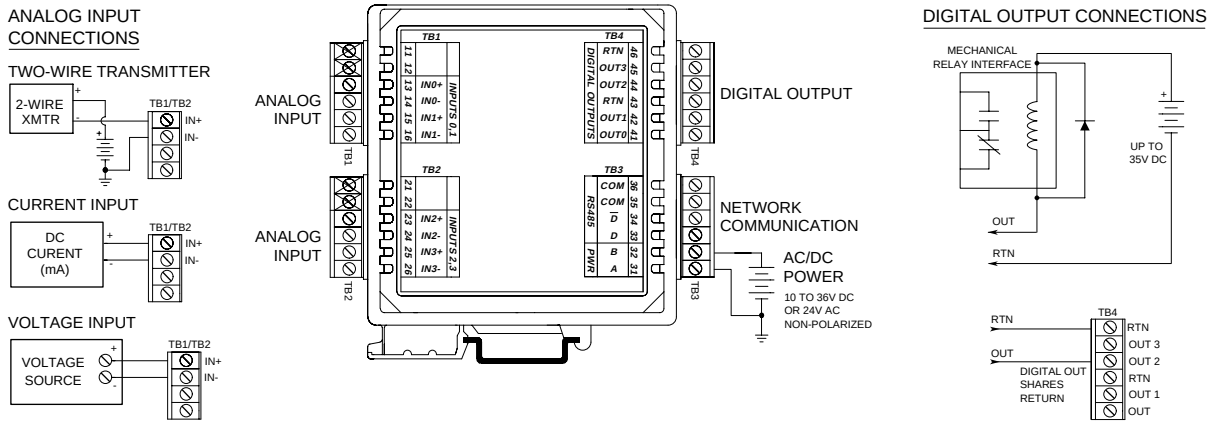
900C-SIP
Configuration Software Interface Package (includes software CD-ROM for Windows, RS-232/485 converter, and RS-485/three-wire cable)

5020-350
AC current sensor for 913MB. One for each channel

TBK-B02
Optional terminal block kit, barrier strip style, 4 pcs.

TBK-S02
Optional terminal block kit, spring clamp style, 4 pcs.

PS5R-VB24
Power supply (24V DC, 2.1A)



## 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

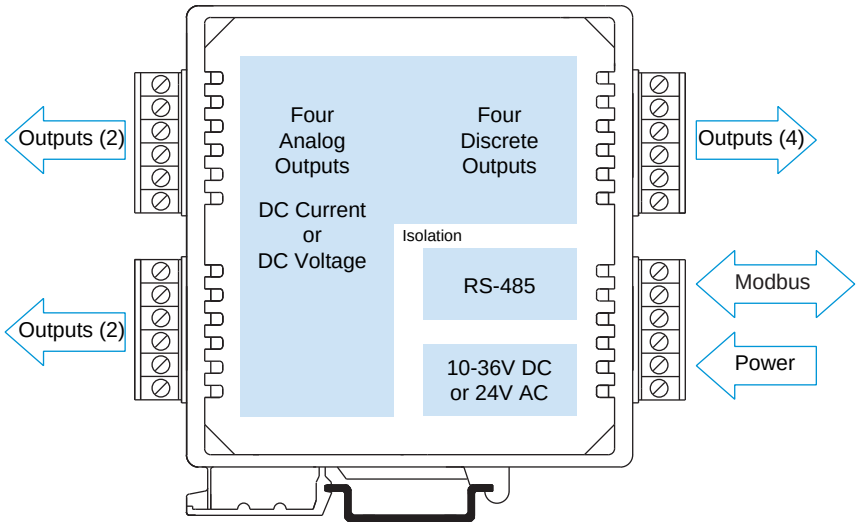
### Discrete Output
Four output channels:
Open-drain MOSFETs (1A DC loads)
0 to 35V DC

### 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

# Performance

## General Analog Output

### Resolution
See current/voltage output specifications for more information.

### Ambient Temperature Effect
Better than ±0.001% of output span per °C, or ±1.0uV/°C, whichever is greater.

### Ambient Temperature
Operation (917MB): -25°C to 60°C* (-13°F to 140°F*).
Operation (918MB): -25°C to 70°C (-13°F to 158°F).
Storage: -40°C to +85°C (-40°F to +185°F).

* Limit 917MB maximum ambient to 50°C (122°F) when using supply voltages less than 15V DC.

## Current Output (917MB)

### DC Current Output Ranges
Range user-configured. Range selected applies to all channels.

| Output Range | Resolution | Accuracy (% span) |
|---|---|---|
| 0 to 1mA | 0.554% | ±2.0% (±0.002mA) |
| 0 to 20mA | 0.028% | ±0.1% (±0.02mA) |
| 4 to 20mA | 0.035% | ±0.1% (±0.02mA) |

### Maximum Output Current
22.5mA DC typical.

### Integral Non-Linearity
±0.1% of span or ±2 LSB typical, whichever is larger, for spans equal to or greater than 16mA.

### Output Compliance
12V minimum, 12.7V typical.

### Output Load Resistance Range
0 to 630 ohms typical.

### Response Time
11ms typical into 500 ohms, for measurement to reach 98% of the final value in response to a step command. Actual response time will vary with load.

## Voltage Output (918MB)

### DC Voltage Output Ranges
Range user-configured. Selection applies to all channels.

| Output Range | Resolution | Accuracy (% span) |
|---|---|---|
| 0 to 1V | 0.274% | ±0.6% (±6mV) |
| 0 to 5V | 0.055% | ±0.1% (±5mV) |
| 0 to 10V | 0.027% | ±0.1% (±10mV) |

### Maximum Output Voltage
11.255V DC typical.

### Integral Non-Linearity
±0.1% of span or ±2 LSB typical, whichever is larger, for spans equal to or greater than 5V.

### Output Current
0 to 10mA DC maximum.

### Output Impedance
1 ohm.

### Output Short Circuit Protection
Included.

### Response Time
110µs rise time typical, 150µs fall time typical, unloaded, for output to reach 98% of the final value in response to a step command. Time varies with load.

## 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 (up to 1A/channel continuous). 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 may 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 (Output) Status
- Read Holding Registers
- Read Input Registers
- Force Single Coil (Output)
- Preset Single Register
- Force Multiple Coils (Output)
- 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 (918MB), 12 to 36V DC (917MB)
22 to 26V AC.

### Supply Current

| Supply | Current Draw (917) | Current Draw (918) |
|---|---|---|
| 10V DC | Not Recommended | 100mA maximum |
| 12V DC | 275mA maximum | 85mA maximum |
| 24V DC | 120mA maximum | 45mA maximum |
| 24V AC | 210mA rms max. | 85mA rms max. |

### Isolation
1500V AC for 60 seconds or 250V AC continuous. 3-way isolation between outputs, network, and power circuits.

# Ordering Information

## Models

**917MB-0900**
**918MB-0900**
DC current (917MB) or voltage (918MB) output module

## Accessories

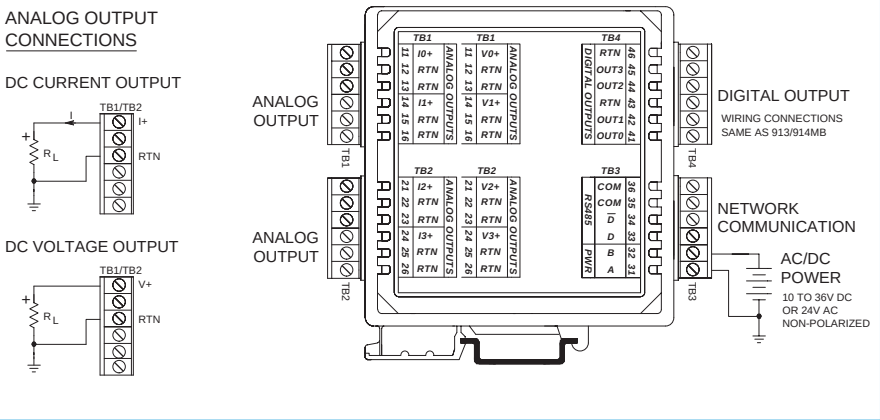
**900C-SIP**
Configuration Software Interface Package (includes software CD-ROM for Windows, RS-232/485 converter, and RS-485/three-wire cable)

**4001-095**
USB-to-RS232 adapter

**TBK-B02**
Optional terminal block kit, barrier strip style, 4 pcs.

**TBK-S02**
Optional terminal block kit, spring clamp style, 4 pcs.

**PS5R-VB24**
Power supply (24V DC, 2.1A)



## 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

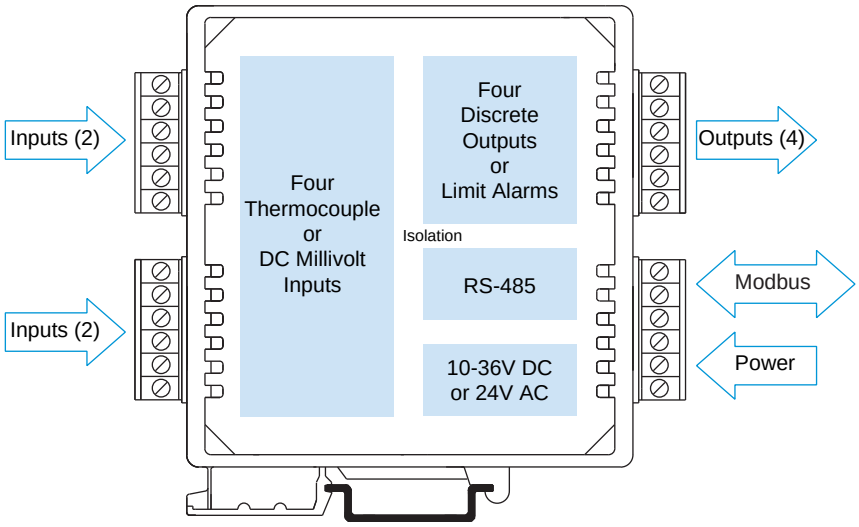
### Output
Four output channels:
Open-drain MOSFETs (1A DC loads)
0 to 35V DC

### 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

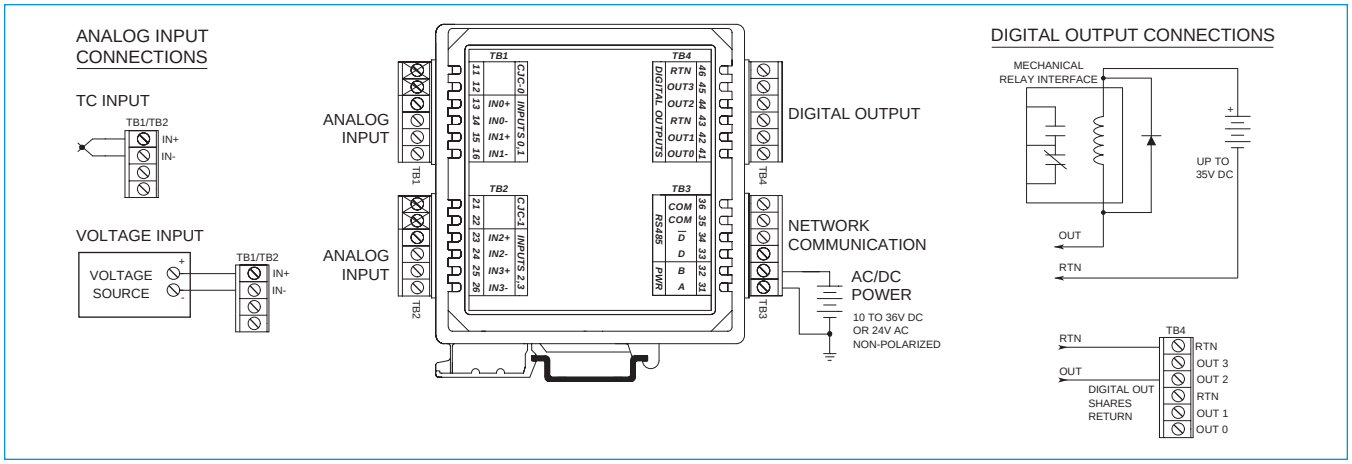
**900C-SIP**
Configuration Software Interface Package (includes software CD-ROM for Windows, RS-232/485 converter, and RS-485/three-wire cable)

**4001-095**
USB-to-RS232 adapter

**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-VB24**
Power supply (24V DC, 2.1A)



## 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)

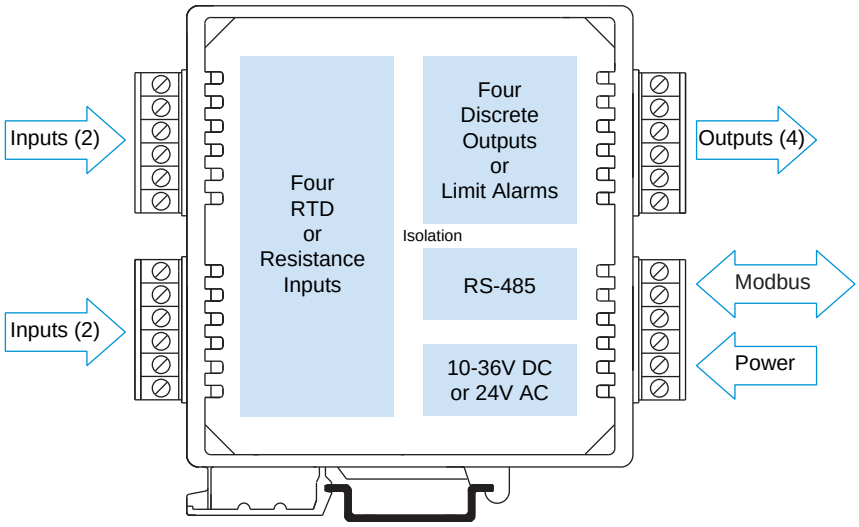
### Output
Solid-state relays, Form A, SPST-NO

### 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 Input Registers
- Preset Single Register
- Force Multiple Coils
- Preset Multiple Register
- 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 (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

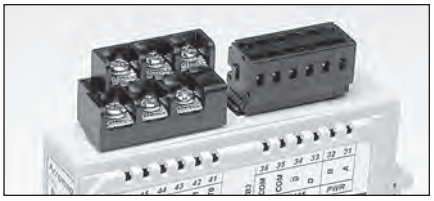
**900C-SIP**
Configuration Software Interface Package (includes software CD-ROM for Windows, RS-232/485 converter, and RS-485/three-wire cable)

**4001-095**
USB-to-RS232 adapter

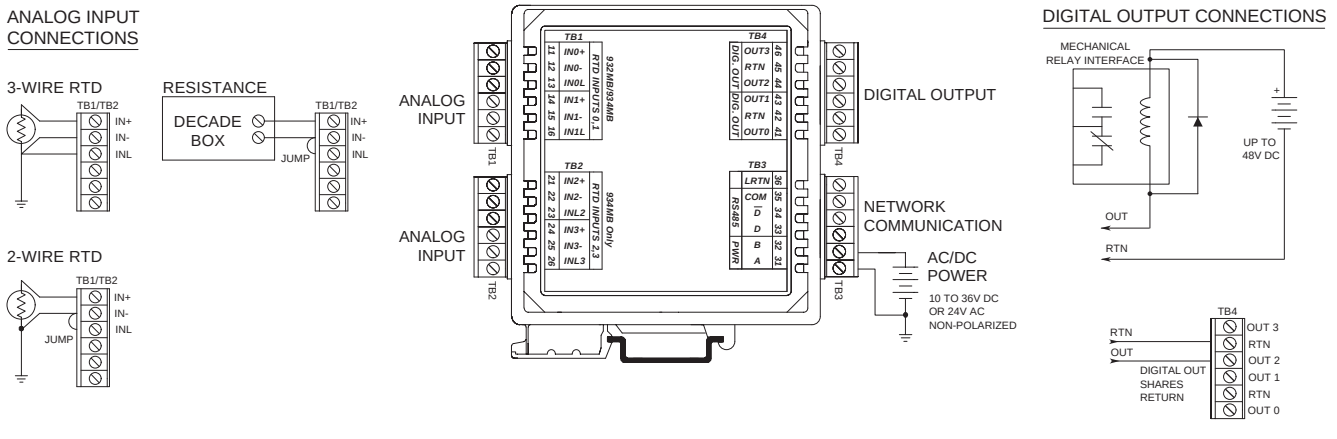
**TBK-B02**
Optional terminal block kit, barrier strip style, 4 pcs.

**TBK-S02**
Optional terminal block kit, spring clamp style, 4 pcs.

**PS5R-VB24**
Power supply (24V DC, 2.1A)



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

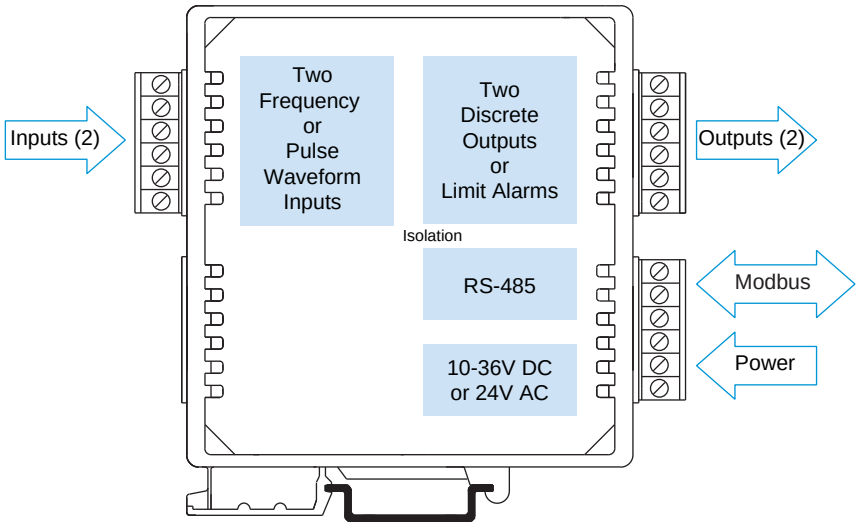
### Output
Two output channels:
Solid-state relays (1A DC loads)
0 to 48V DC

### 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.

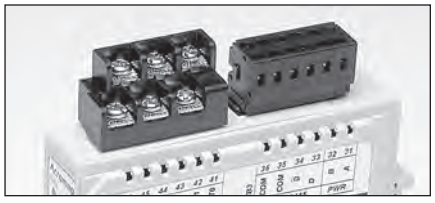
Versatile inputs accommodate many applications using TTL, magnetic pickups, proximity sensors, or a variety of switches (high/low-side transistor, dry contact, open drain, open collector). Bipolar and unipolar waveforms are supported with a selectable input bias that accepts both zero and non-zero crossing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

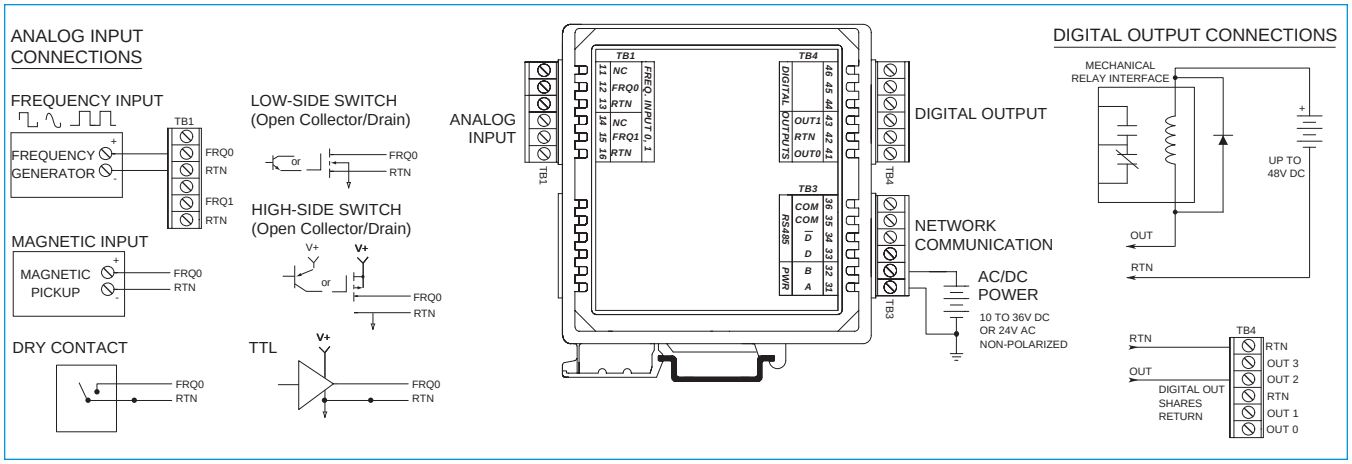
**900C-SIP**
Configuration Software Interface Package (includes software CD-ROM for Windows, RS-232/485 converter, and RS-485/three-wire cable)

**4001-095**
USB-to-RS232 adapter

**TBK-B02**
Optional terminal block kit, barrier strip style, 4 pcs.

**TBK-S02**
Optional terminal block kit, spring clamp style, 4 pcs.

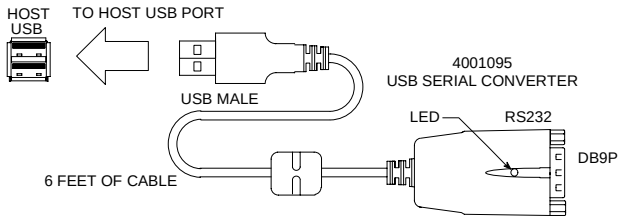
**PS5R-VB24**
Power supply (24V DC, 2.1A)



*(This page intentionally left blank.)*

# Accessories

## Model 4001-095 USB-to-Serial Adapter


Simplifies configuration of Acromag I/O Modules ◆ Enables configuration via USB port

### Description

This device is a USB-to-serial adapter that you can use to communicate with many Acromag I/O products for setup and re-configuration for your application.

### Key Features & Benefits

- Connects to I/O modules via USB (other adapters may be necessary)
- Complete RS232 control signals
- Conforms to USB Specification, Version 1.1
- USB-powered
- Cable length, 6 ft., UL approved

### Performance Specifications

**USB Specification**
Version 1.1

**Data rate**
Up to 115.2Kbps

**Environmental Standards**
RoHS-compliant

**Basic Power Consumption**
150mA

**PC Requirements**
Windows® 7 and newer.

### Ordering Information

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

#### Adapters

4001-095
USB to serial adapter. Includes driver CD and manual.

5030-913
Serial port adapter. DB9S connector to RJ11 jack.

5034-202
RS-485 to 3-wire cable converter and cable, DB-9M to 3 x 12AWG RS-485 cable, 8 ft.

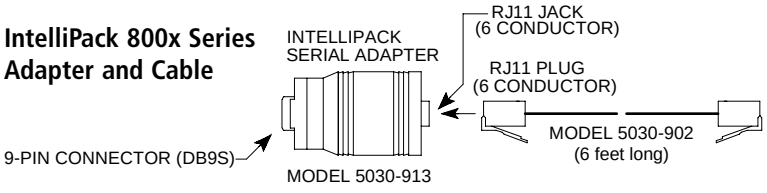
5032-787
RS-232 to 151T transmitter configuration device converter and cable, 6 ft.

5034-214
Non-isolated RS-232 to RS-485 Serial Port Converter, DB-9F to DB-9F.

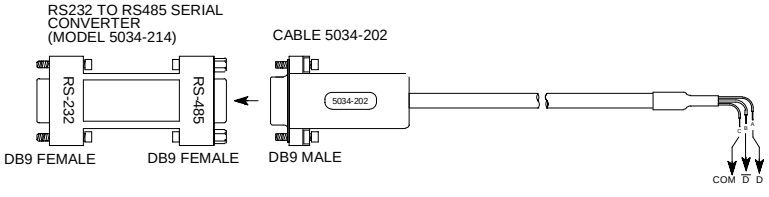
#### Cables

5030-902
Cable. 6 feet long with RJ11 plug at each end.

**IntelliPack 800x Series Adapter and Cable**




**900MB Modbus Series Adapter and Cable**



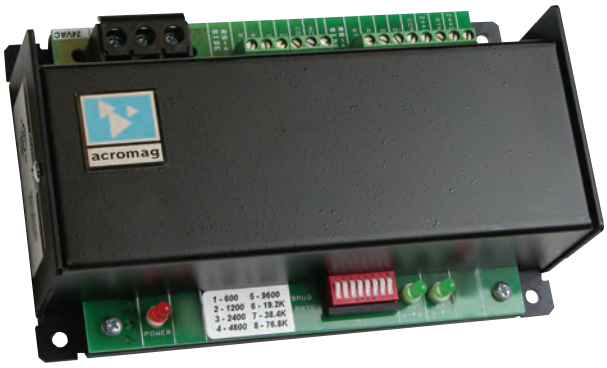

Acromag® THE LEADER IN INDUSTRIAL I/O

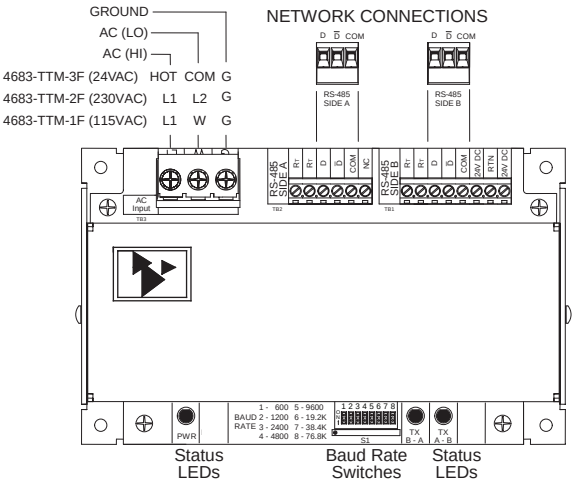
Tel: 248-295-0880 ■ sales@acromag.com ■ www.acromag.com ■ 30765 S Wixom Rd, Wixom, MI 48393 USA

# Network Accessories: 4683 Series

## 4683-TTM RS-485 to RS-485 Network Repeater

c UL us LISTED | 24 HOUR STOCK ITEM | 2 YEAR WARRANTY






For N2 or BACnet MS/TP bus ◆ Drives up to 32 RS-485 devices ◆ Isolates and boosts signal up to 4000 ft.

## Description

### Models

4683-TTM-1F: 115V AC Power
4683-TTM-2F: 230V AC Power
4683-TTM-3F: 24V AC Power

Acromag's RS-485 network repeater device allows users to take full advantage of the RS-485 standard's extended communication distances and multi-dropping capabilities. In addition, these devices offer field selectable End-of-Line Network (EOLN) terminations on both the A and B networks.

Operation is transparent to all devices and no handshaking is required. Up to thirty-two RS-485 devices can be driven. Network repeaters are ready to mount on any base plate. Or, for a harsh environment, it can be installed in a NEMA enclosure of your choice. No enclosure is necessary for use in a laboratory or office. Installation requires mounting, connecting power and cables, and setting the baud rate.

### Approvals

UL/cUL listed:
Energy management equipment

## Key Features & Benefits

- Designed for use with Johnson Controls N2 or BACnet bus
- No handshaking
- No extra control lines
- I/O signal isolation
- Baud rates of 600, 1200, 2400, 4800, 9600, 19.2K, 38.4K, and 76.8K are switch selectable
- Field-selectable end-of-line network terminations on both A and B sides
- Electrical transient protection is provided. This protects the host computer from destructive noise spikes and other transient signals.
- Status LED's indicate transmission direction and power applied.
- 24/115/230V AC power available
- No separate transformer required with 24V AC units (4683-TTM-3F)

## Operation

Model 4683-TTM-xF network repeaters isolate and boost RS-485 signals allowing communication signals to travel another 4000 ft. Each repeater permits the addition of another 32 unit load to a network.

The repeater has two RS-485 "sides" known as the A and B sides. The A side typically connects to the network towards the host and the B side connects to the extended network. Functionally, the A and B sides are equivalent.

Repeaters receive AC power through a 3-screw terminal strip. Transient signal protection is provided on both RS-485 sides.

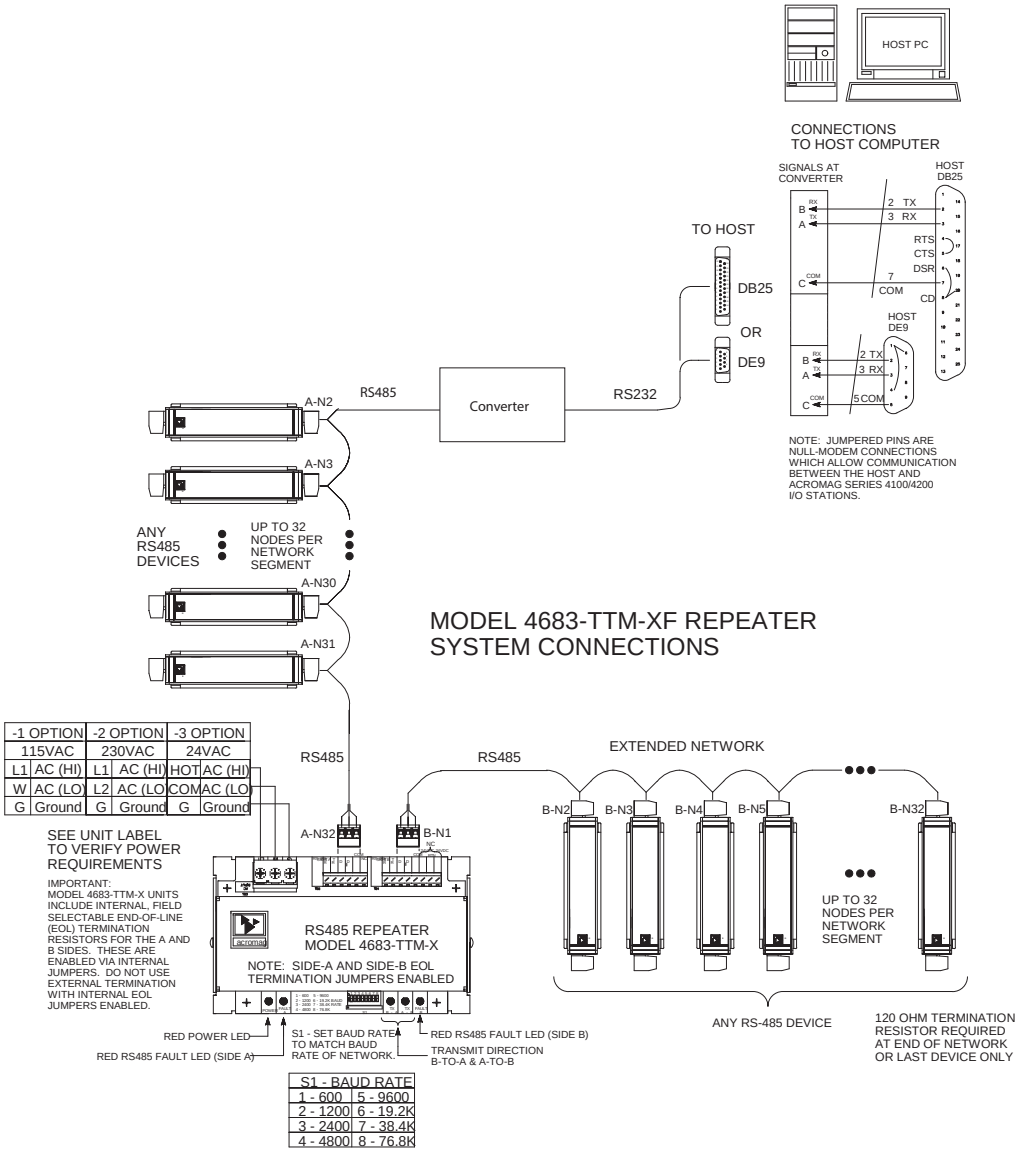
When both RS-485 lines are idle, each side is in receive mode. When a '1' to '0' transition is detected (signifying a start bit) on either side, the opposite side's transmitter is enabled. The transmitter stays enabled for one character's time (based on the baud rate switch setting). The received character is then passed through.


Acromag® THE LEADER IN INDUSTRIAL I/O

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

# Network Accessories: 4683 Series

## 4683-TTM RS-485 to RS-485 Network Repeater

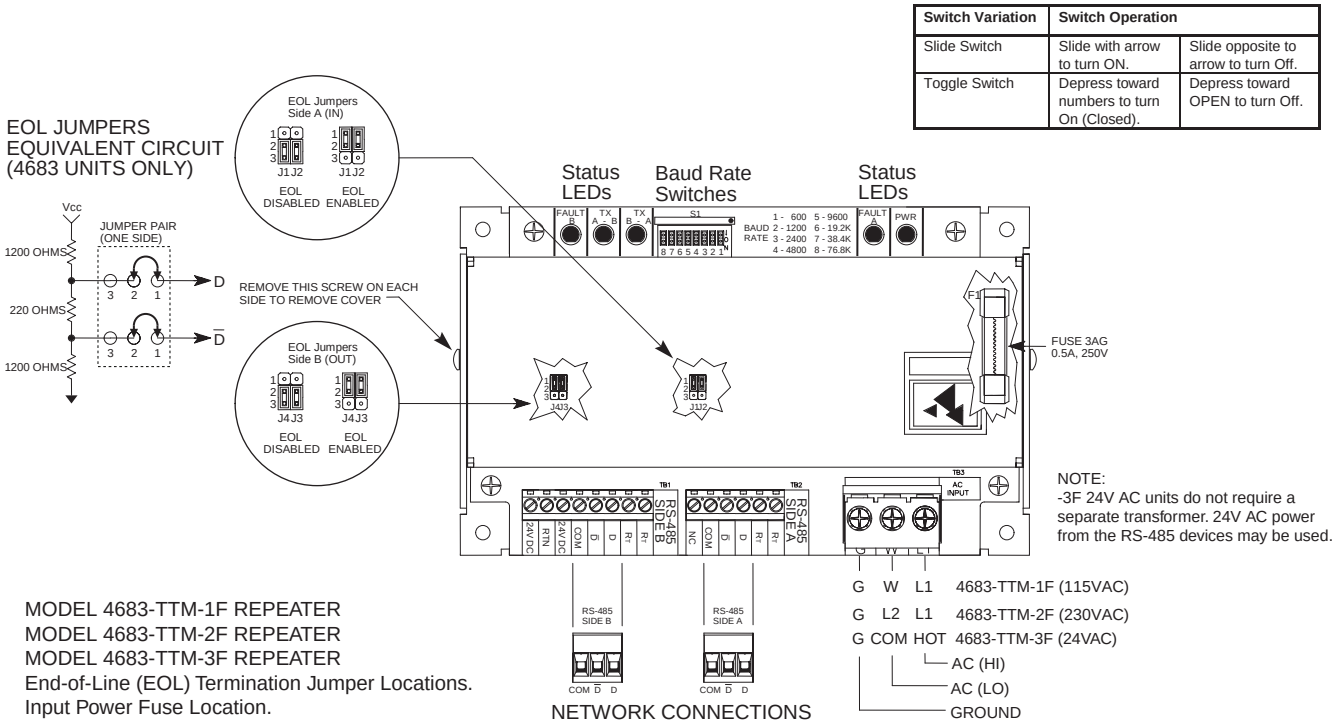



**The station configuration drawing is for general illustration purposes only. Johnson Controls system customers should instead refer to the Metasys® Network Technical Manual for N2 Bus Communication, or the MS/TP Communication Bus Technical Bulletin for wiring connections using the 4683-TTM-xF repeater.**

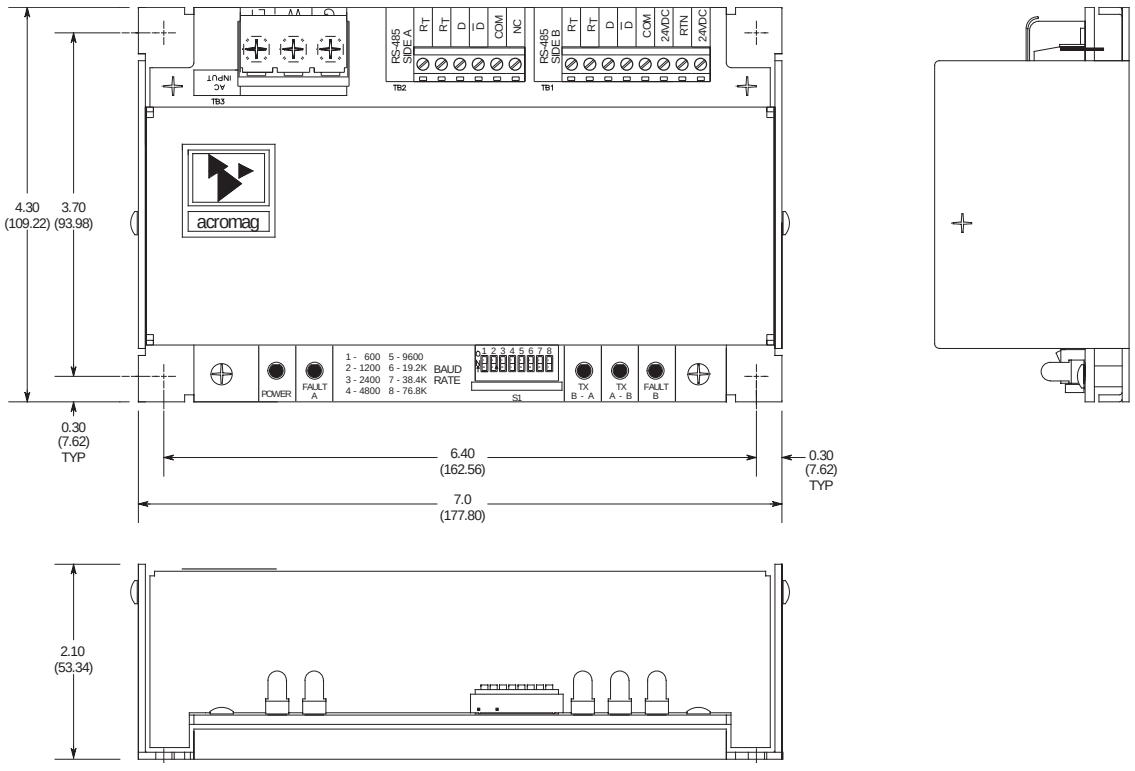
# Network Accessories: 4683 Series

## 4683-TTM RS-485 to RS-485 Network Repeater

| Switch Variation | Switch Operation | |
|---|---|---|
| Slide Switch | Slide with arrow to turn ON. | Slide opposite to arrow to turn Off. |
| Toggle Switch | Depress toward numbers to turn On (Closed). | Depress toward OPEN to turn Off. |




MODEL 4683-TTM-1F REPEATER
MODEL 4683-TTM-2F REPEATER
MODEL 4683-TTM-3F REPEATER
End-of-Line (EOL) Termination Jumper Locations.
Input Power Fuse Location.




ISO9001
AS9100
MADE IN USA

Acromag
THE LEADER IN INDUSTRIAL I/O

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

# Network Accessories: 4683 Series

## 4683-TTM RS-485 to RS-485 Network Repeater

## Performance Specifications

### Communication Specifications

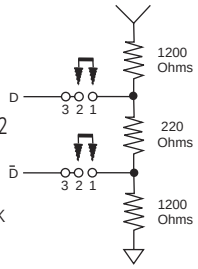
**Baud Rates**
Switch settings on unit for 600, 1200, 2400, 4800, 9600, 19.2K, 38.4K, and 76.8K baud rates. Switch must be in the proper baud rate position for proper operation.

**RS-485 Bus Loading**
One unit load equivalent.

**RS-485 Bus Drive**
Complete RS-485 compliance for up to 32 unit loads (31 unit loads if a repeater is used).

End-of-Line Termination Network

The EOLN termination network is shown on the right and is individually selected on both the A and B sides by a pair of shorting clips. The A-side is controlled by jumper pair J1, J2 and the B-side is controlled by jumper pair J3 and J4.




The EOLN termination network is enabled for the A side or B side when the associated pair of jumpers are positioned over pins 1 and 2. Conversely, the EOLN is disabled (out of the circuit) when the pair jumpers are positioned over pins 2 and 3.

**Duplex**
Half duplex only.

**Data Format**
Ten bits typical (1 start bit, 8 data bits, and 1 stop bit). Other formats are supported.

### Specifications

**Power Line Fuse**
0.5A, 125V, 0.75A, 3AG type.

**Isolation**
Provides galvanic and opto-coupler isolation between RS-485(A), RS-485(B), AC power, and chassis ground. Common mode voltages are permitted up to 250V rms or 354V DC (withstands a 1500V AC dielectric strength test for 1 min. without breakdown) on a continuous basis. Complies with requirements outlined in ANSI C39.5-1974 for voltage ratings specified.

**RFI Resistance**
Withstands an RFI field strength of 10V per meter at 27 Mhz, 151 Mhz, and 467 Mhz with no digital effect, per SAMA PMC 33.1.

**Line Noise Effects**
Field and power line terminals withstand ANSI/IEEE C37.90-1978 Surge Withstanding Capability (SWC) Test with no component failures. Unit is tested to a standardized test waveform that is representative of surges (high-frequency transient electrical interference), observed in actual installations.

**Communications Connections**
Network repeater - both RS-485 connectors use modular terminal blocks with screw clamps. Wire range 14 to 26 AWG.

**Power Wire Connections**
Network repeater terminal block. See label on unit for power to be applied to unit.

**Shipping Weight**
3.0 pounds (1.4 kg) packed per unit

### Environmental

**Operating Temperature**
-25 to 70° C (-13 to 158° F)

**Storage Temperature**
-25 to +85° C (-13 to 185° F)

**Relative Humidity**
0 to 95% RH (noncondensing), up to 40° C (104° F)

**Power**
4683-TTM-1F
115VAC ±10%, 50/60 Hz, 0.05A

4683-TTM-2F
230VAC ±10%, 50/60 Hz, 0.03A

4683-TTM-3F
24VAC ±10%, 50/60 Hz, 0.18A typical

**Approvals**
UL/cUL listed – energy management equipment

## Ordering Information

### Models

4683-TTM-1F
115V ACPower

4683-TTM-2F
230V ACPower

4683-TTM-3F
24V ACPower

### Accessories

See www.acromag.com for more information.

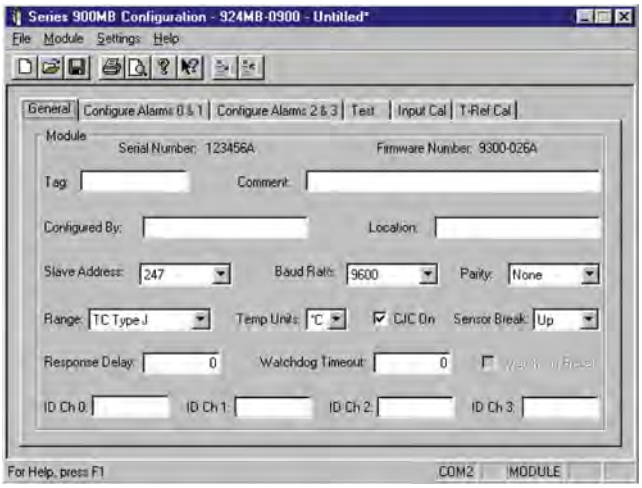
ISO9001
AS9100
MADE IN USA

Acromag
THE LEADER IN INDUSTRIAL I/O

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

# 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® XP or newer.

### 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.
(Doesn't support Windows® XP)

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

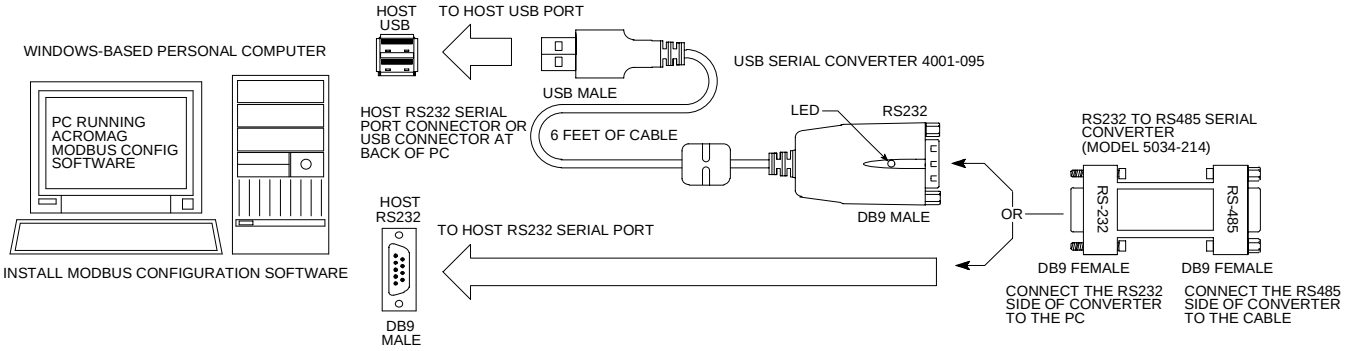
See following page.

Acromag® THE LEADER IN INDUSTRIAL I/O

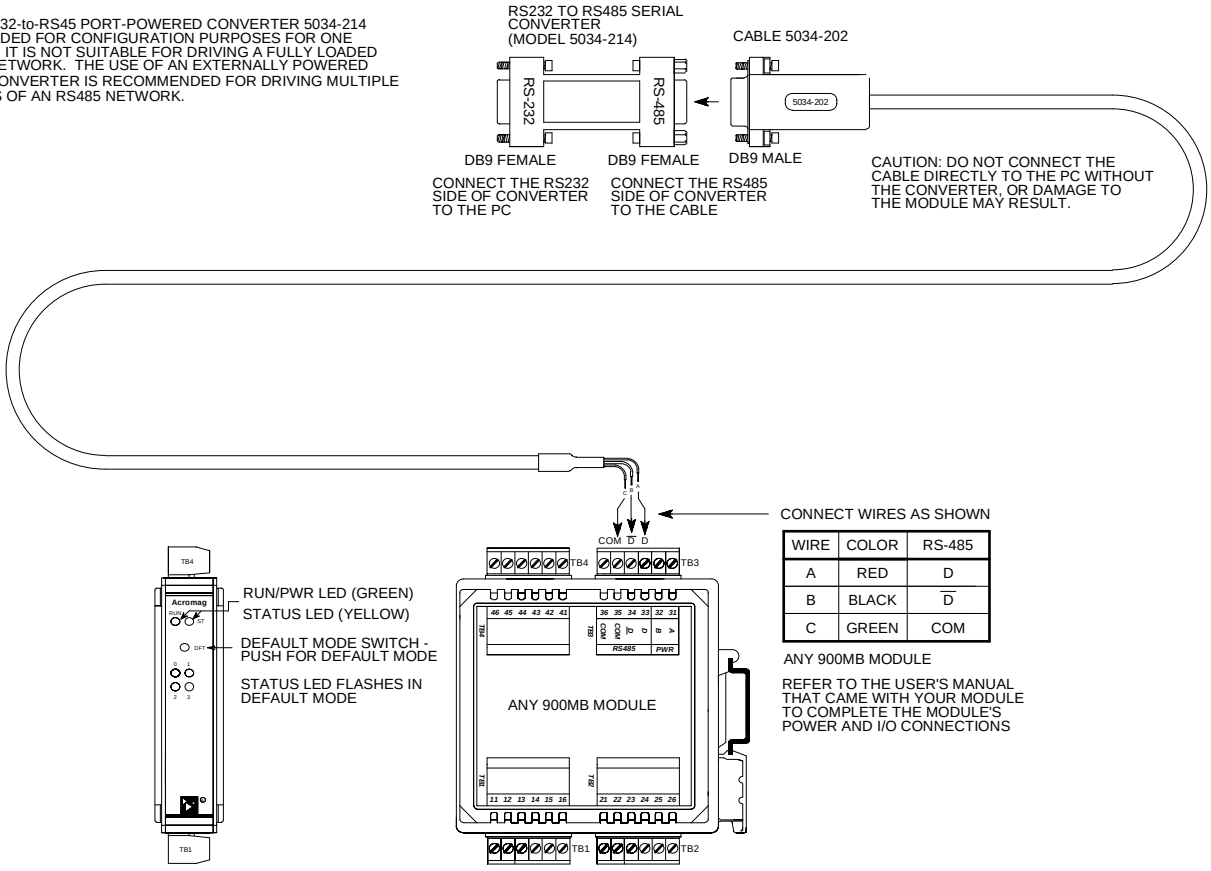
Tel: 877-214-6267 ■ sales@acromag.com ■ www.acromag.com ■ 30765 S Wixom Rd, Wixom, MI 48393 USA

# Series 900MB Modbus RTU I/O

## 900C-SIP COMMUNICATION CONNECTIONS




THE RS232-to-RS45 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.




| WIRE | COLOR | RS-485 |
|---|---|---|
| A | RED | D |
| B | BLACK | $\overline{D}$ |
| C | GREEN | COM |

ANY 900MB MODULE

REFER TO THE USER'S MANUAL THAT CAME WITH YOUR MODULE TO COMPLETE THE MODULE'S POWER AND I/O CONNECTIONS


Acromag
THE LEADER IN INDUSTRIAL I/O

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