**BusWorks® 900MB Series**

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### 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.

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#### 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).

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#### 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 linearity, lead wire compensation, and open circuit or lead break detection are included.

<table>
<thead>
<tr>
<th>Input Type</th>
<th>Alpha</th>
<th>Input Range</th>
<th>Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pt 100 ohm</td>
<td>1.3850</td>
<td>-200 to 850°C</td>
<td>±0.25°C</td>
</tr>
<tr>
<td>Pt 100 ohm</td>
<td>1.3911</td>
<td>-200 to 850°C</td>
<td>±0.25°C</td>
</tr>
<tr>
<td>Ni 120 ohm</td>
<td>1.6762</td>
<td>-80 to 320°C</td>
<td>±0.25°C</td>
</tr>
<tr>
<td>Cu 10 ohm</td>
<td>1.4272</td>
<td>-200 to 260°C</td>
<td>±1.00°C</td>
</tr>
</tbody>
</table>

**Resolution**

<table>
<thead>
<tr>
<th>Input Type</th>
<th>Alpha</th>
<th>Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pt 100 ohm</td>
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<tr>
<td>Cu 10 ohm</td>
<td>1.4272</td>
<td>0.2°C</td>
</tr>
</tbody>
</table>

**Ambient Temperature Effect**
Better than ±0.005% of input span per °C, or ±1.0μV/°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.

**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
- Preset Multiple Register
- Force Multiple Coils
- Force Single Coil
- Read Coil
- Read Slave
- Report Slave ID

**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**
4001-095 USB-to-RS-232 adapter
TBK-802 Optional terminal block kit, barrier strip style, 4 pcs.
TBK-502 Optional terminal block kit, spring clamp style, 4 pcs.
PSSR-VB24 Power supply (24V DC, 2.1A)

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Tel: 248-295-0880 e-mail: sales@acromag.com  www.acromag.com
900MB Series Technical Diagrams

NOTE: ALL DIMENSIONS ARE IN INCHES (MILLIMETERS)

PERSONAL COMPUTER
W/ WINDOWS 95/98 OR NT

CONNECT THE RS-232 SIDE OF CONVERTER TO THE PC

RECEPTACLE SIDE OF CONVERTER

INSTALL MODBUS CONFIGURATION SOFTWARE

CONNECT THE RS-232 SERIAL PORT CONNECTOR AT BACK OF PC

PC RUNNING ACROMAG MODBUS CONFIG SOFTWARE

CAUTION: DO NOT CONNECT THE CABLE DIRECTLY TO THE PC WITHOUT THE CONVERTER, OR DAMAGE TO THE MODULE MAY RESULT.

CONNECT THE RS-485 SIDE OF CONVERTER TO THE CABLE

CABLE 5034-202

CONNECT WIRES AS SHOWN

RS-232 TO RS-485 CONVERTER MODEL 5034-214

900C-SIP COMMUNICATION CONNECTIONS

Refer to the user's manual that came with your module to complete the module's power and I/O connections.
**Modbus I/O**

### 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.

**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**
- 4001-095 USB-to-RS232 adapter
- TBK-802 Optional terminal block kit, barrier strip style, 4 pcs.
- TBK-502 Optional terminal block kit, spring clamp style, 4 pcs.
- PS5R-VB Power supply (24V DC, 2.1A)

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

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**DIGITAL INPUT CONNECTIONS (ACTIVE LOW)**

- RTN
- INP
- EXC

**DIGITAL OUTPUT CONNECTIONS**

- 903MB
- 902MB
- 901MB

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**Acromag**

Tel: 248-295-0880 e-mail: sales@acromag.com www.acromag.com
Model 4001-095  USB-to-Serial Adapter

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.