Modbus/RS-485

BusWorks® Modbus I/O

CE

c(UL)us
LISTED

★★2★★
YEAR
WARRANTY

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
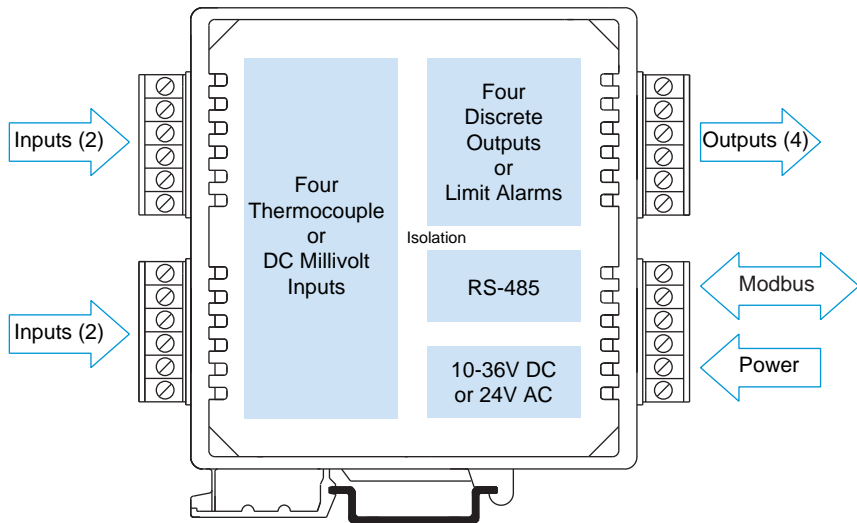
Network Communication
Modbus-RTU high-speed RS-485

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

Inputs (2)

Inputs (2)

Four Thermocouple or DC Millivolt Inputs

Four Discrete Outputs or Limit Alarms

Isolation

RS-485

10-36V DC or 24V AC

Outputs (4)

Modbus

Power

■ 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

Modbus I/O

■ 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-junc-
tion 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)
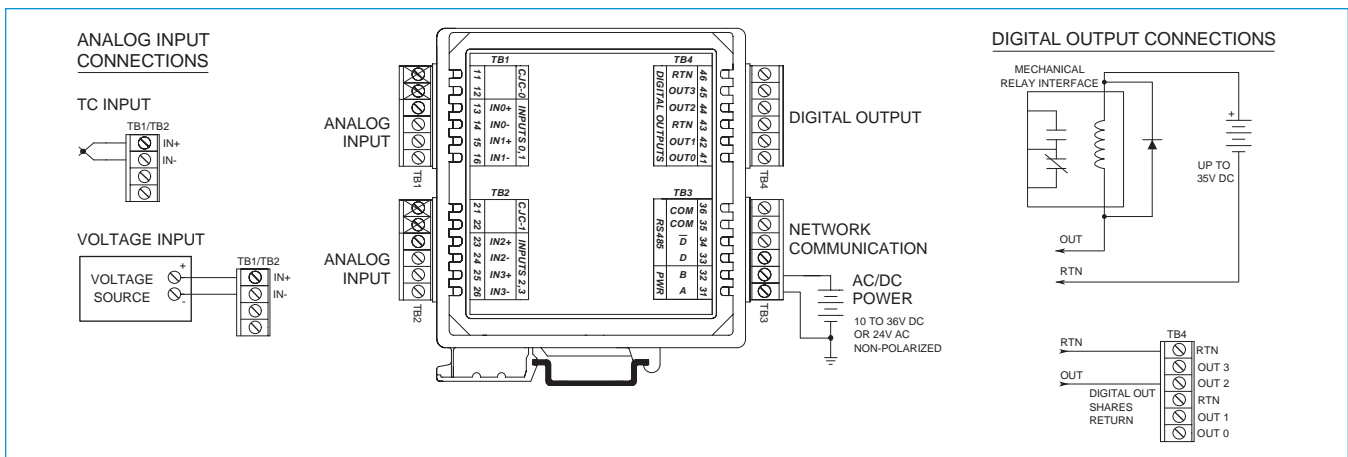
4001-095
USB-to-RS232 adapter

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.
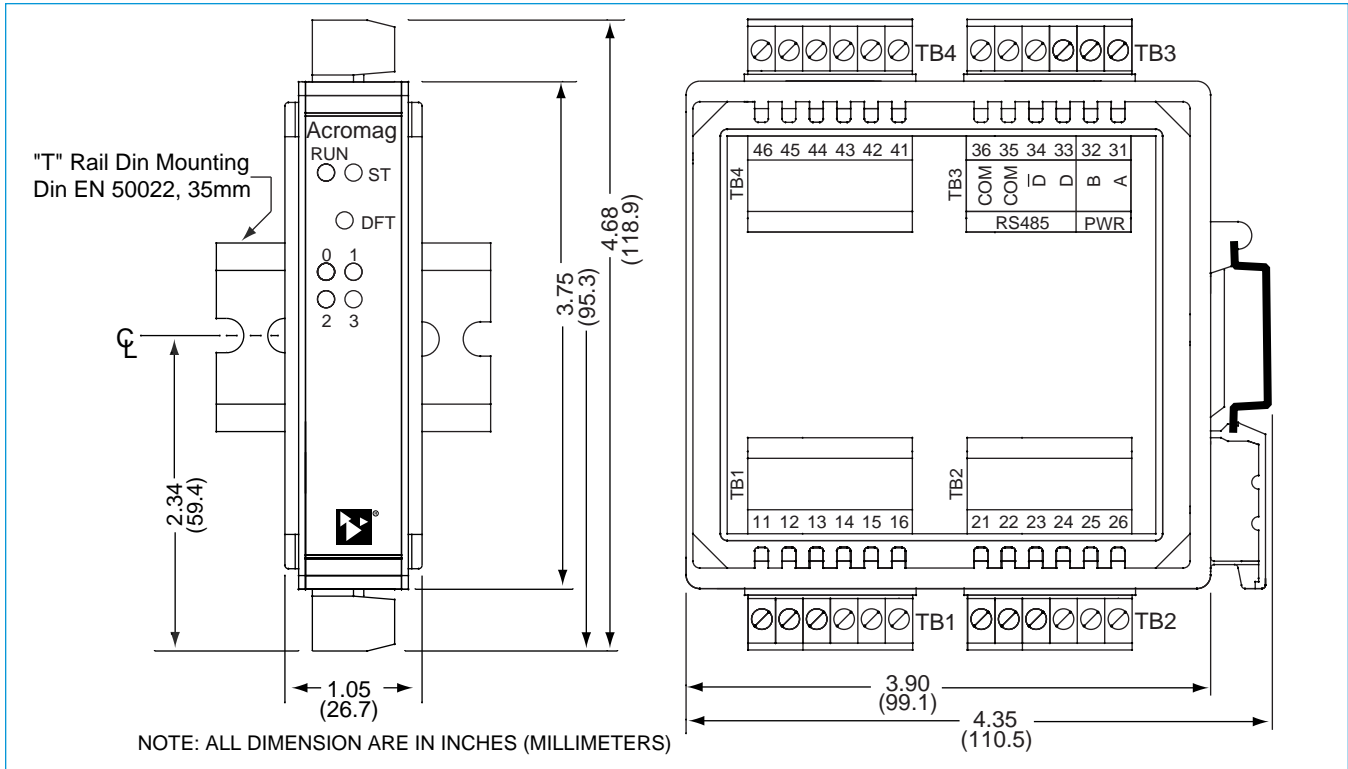(Does not include terminal block for input wiring.)
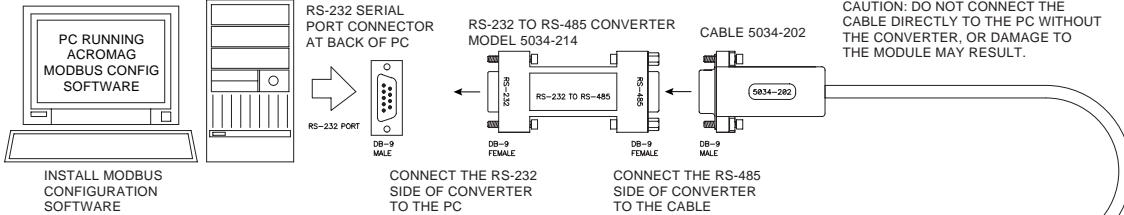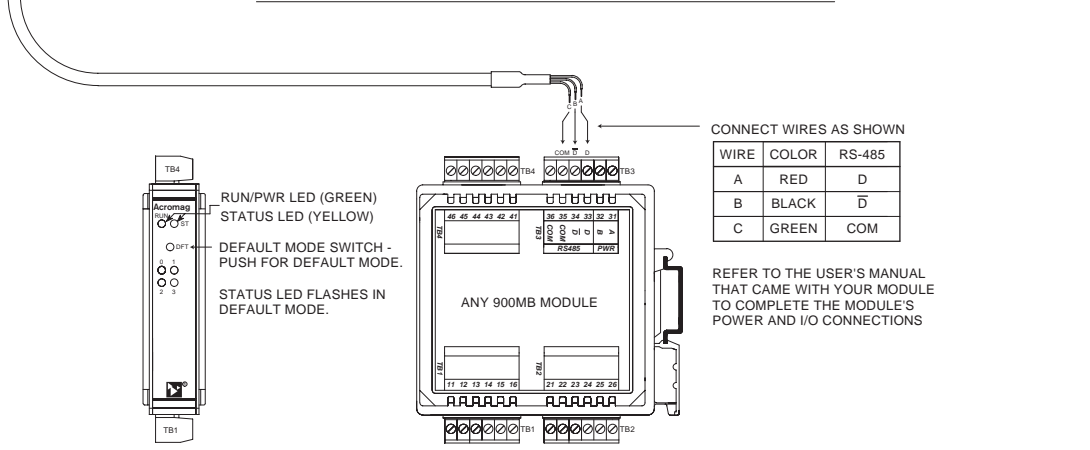
PS5R-VB24
Power supply (24V DC, 2.1A)

900MB Series Technical Diagrams

"T" Rail Din Mounting
Din EN 50022, 35mm

Acromag
RUN
ST
DFT
0 1
2 3

4.68 (118.9)
3.75 (95.3)
2.34 (59.4)

1.05 (26.7)

NOTE: ALL DIMENSION ARE IN INCHES (MILLIMETERS)

TB4   TB3

46 45 44 43 42 41   36 35 34 33 32 31
                     COM COM D̄ D B A
                     RS485   PWR

TB1   TB2

11 12 13 14 15 16   21 22 23 24 25 26

3.90 (99.1)
4.35 (110.5)

PERSONAL COMPUTER
W/ WINDOWS 95/98 OR NT

PC RUNNING
ACROMAG
MODBUS CONFIG
SOFTWARE

RS-232 SERIAL
PORT CONNECTOR
AT BACK OF PC

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

CABLE 5034-202

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

RS–232 PORT

DB–9
MALE

RS–232 TO RS–485

DB–9
FEMALE

DB–9
FEMALE

5034–202

DB–9
MALE

INSTALL MODBUS
CONFIGURATION
SOFTWARE

CONNECT THE RS-232
SIDE OF CONVERTER
TO THE PC

CONNECT THE RS-485
SIDE OF CONVERTER
TO THE CABLE

900C-SIP COMMUNICATION CONNECTIONS

TB4

RUN/PWR LED (GREEN)
STATUS LED (YELLOW)

DEFAULT MODE SWITCH -
PUSH FOR DEFAULT MODE.

STATUS LED FLASHES IN
DEFAULT MODE.

Acromag
RUN   ST
DFT
0 1
2 3

TB1

COM D̄ D

TB4   TB3

46 45 44 43 42 41   36 35 34 33 32 31
                     COM COM D̄ D B A
                     RS485   PWR

ANY 900MB MODULE

TB1   TB2

11 12 13 14 15 16   21 22 23 24 25 26

CONNECT WIRES AS SHOWN

WIRE	COLOR	RS-485
A	RED	D
B	BLACK	D̄
C	GREEN	COM

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

■ 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.