Modbus/RS-485

CE
UL cUL LISTED

24HR 5YR

BusWorks® Modbus I/O

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

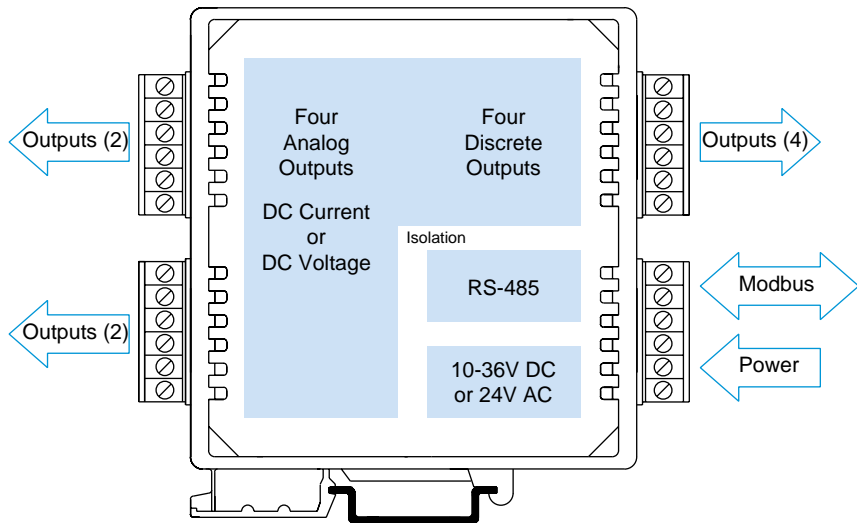### Power Requirement
12 to 36V DC (917MB), 10 to 36V DC (918MB),
24V AC

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

Analog Output Module

Four Analog Outputs — DC Current or DC Voltage
Four Discrete Outputs
Isolation
RS-485
10-36V DC or 24V AC
Outputs (2)
Outputs (2)
Outputs (4)
Modbus
Power

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

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)

5034-225
USB-to-RS232 adapter. See page 41 for more info.

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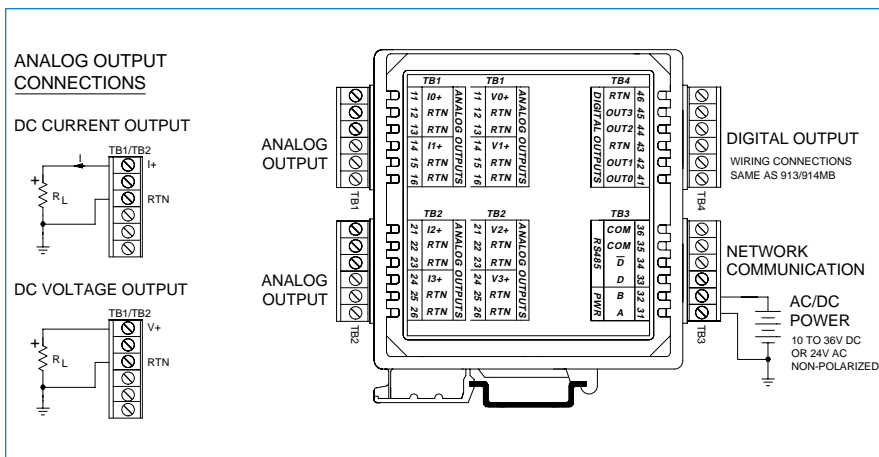Optional terminal block kit, barrier strip style, 4 pcs.

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

PS5R-D24
Power supply (24V DC, 2.1A). See Power Supplies on page 183.

For more information on software, network hardware, and mounting accessories, please see Pages 39-41.

ANALOG OUTPUT CONNECTIONS

DC CURRENT OUTPUT

DC VOLTAGE OUTPUT

ANALOG OUTPUT

ANALOG OUTPUT

DIGITAL OUTPUT
WIRING CONNECTIONS SAME AS 913/914MB

NETWORK COMMUNICATION

AC/DC POWER
10 TO 36V DC OR 24V AC NON-POLARIZED

■ **Accessories**

■ **Configuration Tools**

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

Software Interface Package
See Page 39 for more information.
Includes the following:
- Configuration Software Utility
- Instruction manuals
- Serial port converter
- Interface cable

■ **Network Devices**

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

Universal 50W Power Supply (Page 39)
Isolated RS-232/485 Converter (Page 40)
Isolated RS-485 Network Repeater (Page 40)

■ **Mounting Hardware**
Installation is a snap with Acromag accessories.

DIN RAIL Bars (Page 39)
19" Rack-Mount Kit (Page 39)

■ **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 thermo-plastic UL94 V-2, color beige; general purpose NEMA Type 1 enclosure.

Connectors (Removable Terminal Blocks)
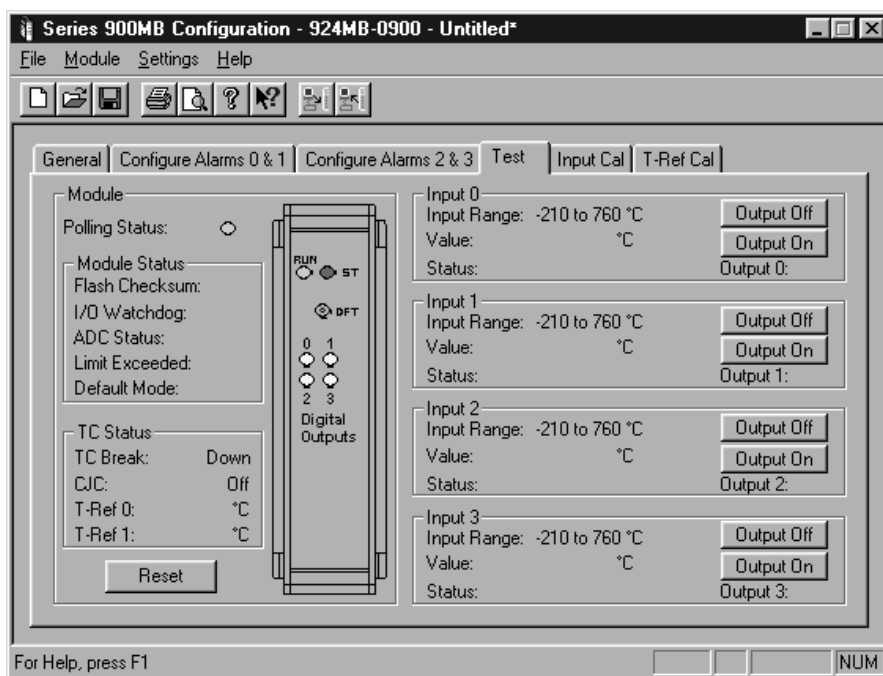Wire Range: AWG #12-24, stranded or solid copper.

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).
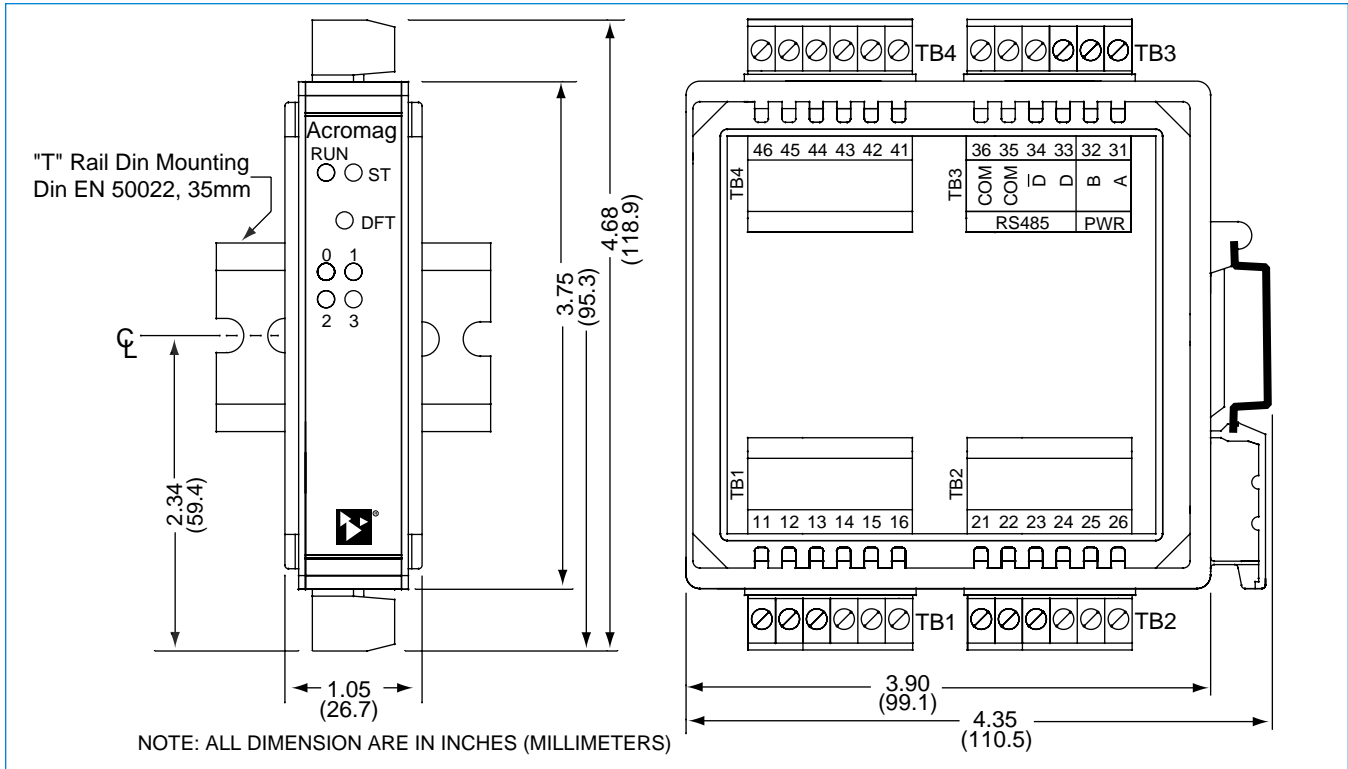
Shipping Weight
1 pound (0.45 Kg) packed.

A test page simplifies diagnostics with a live visual display of the module's input and output values.

900MB Series Technical Diagrams

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

Acromag
RUN
ST
DFT
0 1
2 3

3.75
(95.3)

4.68
(118.9)

2.34
(59.4)

1.05
(26.7)

3.90
(99.1)

4.35
(110.5)

NOTE: ALL DIMENSION ARE IN INCHES (MILLIMETERS)

TB4

TB3

TB4   46 45 44 43 42 41

TB3   36 35 34 33 32 31
      COM COM D̄ D B A
      RS485   PWR

TB1   11 12 13 14 15 16

TB2   21 22 23 24 25 26

TB1

TB2

PERSONAL COMPUTER
W/ WINDOWS 95/98 OR NT

PC RUNNING
ACROMAG
MODBUS CONFIG
SOFTWARE

INSTALL MODBUS
CONFIGURATION
SOFTWARE

RS-232 SERIAL
PORT CONNECTOR
AT BACK OF PC

RS-232 PORT
DB-9
MALE
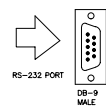
CONNECT THE RS-232
SIDE OF CONVERTER
TO THE PC

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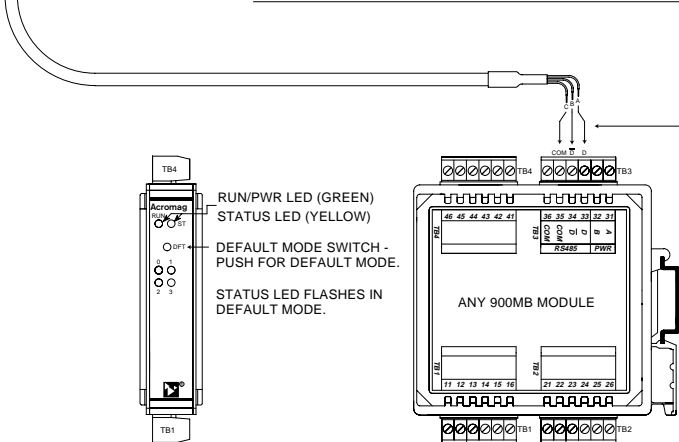
RS-232 TO RS-485

DB-9
FEMALE

DB-9
FEMALE
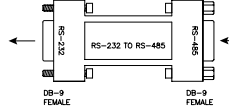
CONNECT THE RS-485
SIDE OF CONVERTER
TO THE CABLE

CABLE 5034-202

5034-202

DB-9
MALE
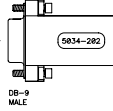
CAUTION: DO NOT CONNECT THE
CABLE DIRECTLY TO THE PC WITHOUT
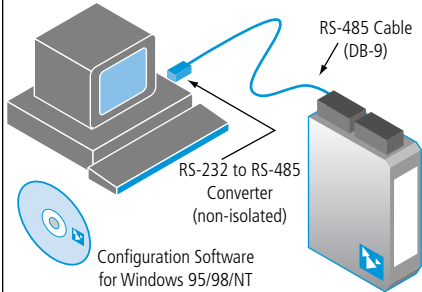THE CONVERTER, OR DAMAGE TO
THE MODULE MAY RESULT.

**USB-to-RS232
Adapter**

Model 5034-225
USB-to-RS232 adapter

Length: 3.15 in (8.0 cm)
Height: 0.80 in (2.03 cm)
Width: 1.75 in (4.44 cm)
Weight: 1.6 oz (45.36 g)

900C-SIP COMMUNICATION CONNECTIONS

TB4

Acromag
RUN ST
DFT
0 1
2 3

TB1

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

DEFAULT MODE SWITCH -
PUSH FOR DEFAULT MODE.

STATUS LED FLASHES IN
DEFAULT MODE.

ANY 900MB MODULE

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

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

BusWorks® Modbus I/O

Configuration Kit

Software Interface Package
Model No. 900C-SIP

RS-485 Cable (DB-9)

RS-232 to RS-485 Converter (non-isolated)

Configuration Software for Windows 95/98/NT

Software Interface Package

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

RS-232/485 Converter (non-isolated)

RS-485 to 3-wire
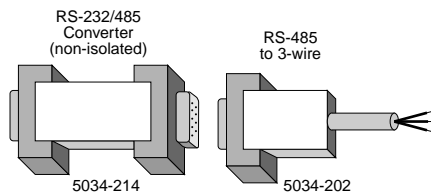
5034-214

5034-202

■ Ordering Information

900C-SIP
Software Interface Package.
Includes Configuration Software (5034-186), Non-isolated RS-232 to RS-485 Serial Port Converter (5034-214), and RS-485 Cable (5034-202).

Items can also be ordered separately below.

5034-186
Configuration Software for Windows (95/98/ME, NT4, 2000) on CD-ROM.

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

5034-202
RS-485 to 3-wire Cable Converter, DB-9M to 3 x 12AWG RS-485 Cable, 8 ft.

Network Power

-V   NC   +V
OUTPUT 24VDC 2.1A

DC ON   50W   -OUTPUT
POWER SUPPLY
V.ADJ   PS5R-D24

INPUT 50/60Hz
100-240VAC 1.15A
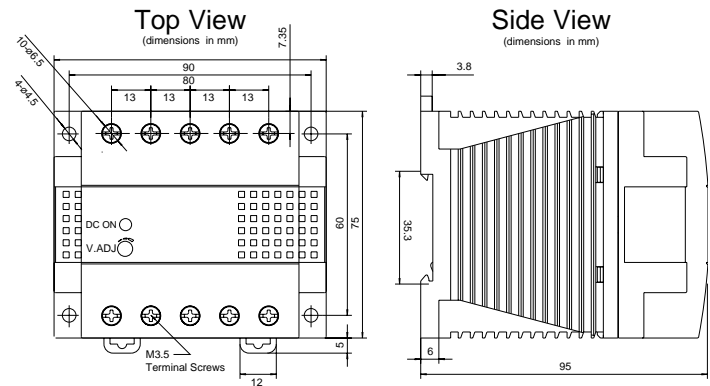
NC   L   N   ⏚   NC

Universal 50W Power Supply

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

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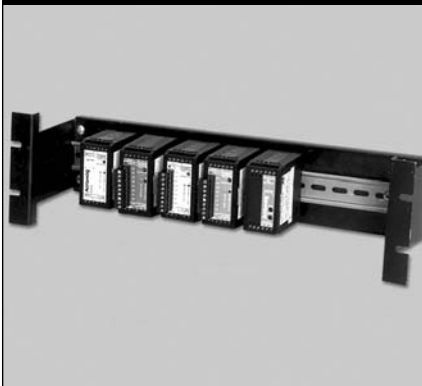Universal power
85 to 264V AC,
105 to 370V DC

Output
24V DC, 2.1A (50W)

■ Ordering Information

PS5R-D24
Universal Power Supply

Top View
(dimensions in mm)

90
80
13   13   13   13

DC ON
V.ADJ

M3.5
Terminal Screws

Side View
(dimensions in mm)

3.8

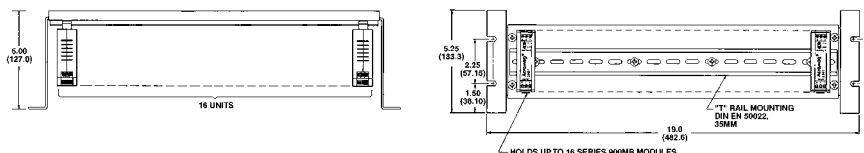35.3

6   95

Mounting Hardware

DIN-Rail Mounting

For your convenience, Acromag offers several mounting accessories to simplify your system installation. Our 19" rack-mount kit provides a clean solution for mounting your I/O modules and a power supply. Or you can buy precut DIN rail strips for mounting on any flat surface.

■ Ordering Information

20RM-16-DIN
19" rack-mount kit with DIN rail.

DIN RAIL 3.0
DIN RAIL 16.7
DIN rail strip, Type T, 3 inches (75mm) or 16.7 inches (425mm)

5.00
(127.0)

16 UNITS

Dimensions in inches (mm).

5.25
(133.3)
2.25
(57.15)
1.50
(38.10)

"T" RAIL MOUNTING
DIN EN 50022,
35MM

19.0
(482.6)

HOLDS UP TO 16 SERIES 900MB MODULES

BusWorks® Modbus I/O

BusWorks®

RS-232 to RS-485

4SCC-TTM x Isolated Signal Converter

This unit provides an isolated interface between the host PC's RS-232 port and RS-485 Modbus network devices. Signal conversion is bidirectional with operation that is transparent to all devices. The RS-485 network supports up to 32 devices (including the 4SCC-TTM Converter) across 4000 foot distances. Installation of additional network devices or extending the distance requires the 4SCR-TTM Network Repeater.

Dimensions in inches (mm).
Shipping Weight
3.0 lbs. (1.4 kg) packed.

Specifications

Baud Rates
Switch-selectable from 300 to 38.4K baud.

Duplex
Half duplex only.

Network Termination Resistors
Two terminal blocks and 120 ohm resistors provided to terminate both ends of the RS-485 network.

Wiring Connectors
Terminal blocks with screw clamps for 14-26AWG.

Operating Temperature Range
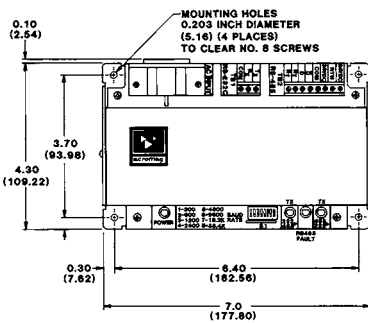-25 to 60°C (-13 to 140°F).

Isolation
Withstands 1500V AC surge for 60 seconds (250V AC or 354V DC continuous).

■ Ordering Information

4SCC-TTM-1
Signal Converter, 115V AC (power cord included)

4SCC-TTM-2
Signal Converter, 230V AC (power cord included)

5020-924
Signal Cable, 8ft. long, DB-9 to three wires. Connects PC's RS-232 port to 4SCC-TTM-x.

RS-485 to RS-485

4SCR-TTM x Isolated Network Repeater

This unit isolates and boosts RS-485 signals to extend communication distances or increase the number of devices on the network. Each Repeater permits the addition of a network branch with up to 32 devices (including the 4SCR-TTM) and will transmit RS-485 signals another 4000 feet. Operation is transparent to all devices and no handshaking is required. Two terminal blocks are provided for 120 ohm resistors to terminate both ends of the network branch.

Dimensions in inches (mm).
Shipping Weight
3.0 lbs. (1.4 kg) packed.

Specifications

Baud Rates
Switch-selectable from 300 to 38.4K baud.

Duplex
Half duplex only.

Network Termination Resistors
Two terminal blocks and 120 ohm resistors provided to terminate both ends of the RS-485 network.

RS-485 Wiring Connectors
Terminal blocks with screw clamps for 14-26AWG.

Power Wiring Connections
Terminal block with screw clamps for 12-18AWG.
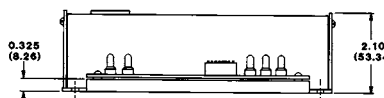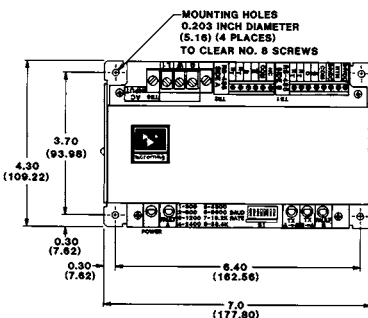
Operating Temperature Range
-25 to 60°C (-13 to 140°F).

Isolation
Withstands 1500V AC surge for 60 seconds (250V AC or 354V DC continuous).

■ Ordering Information

4SCR-TTM-1
Signal Converter, 115V AC power

4SCR-TTM-2
Signal Converter, 230V AC power

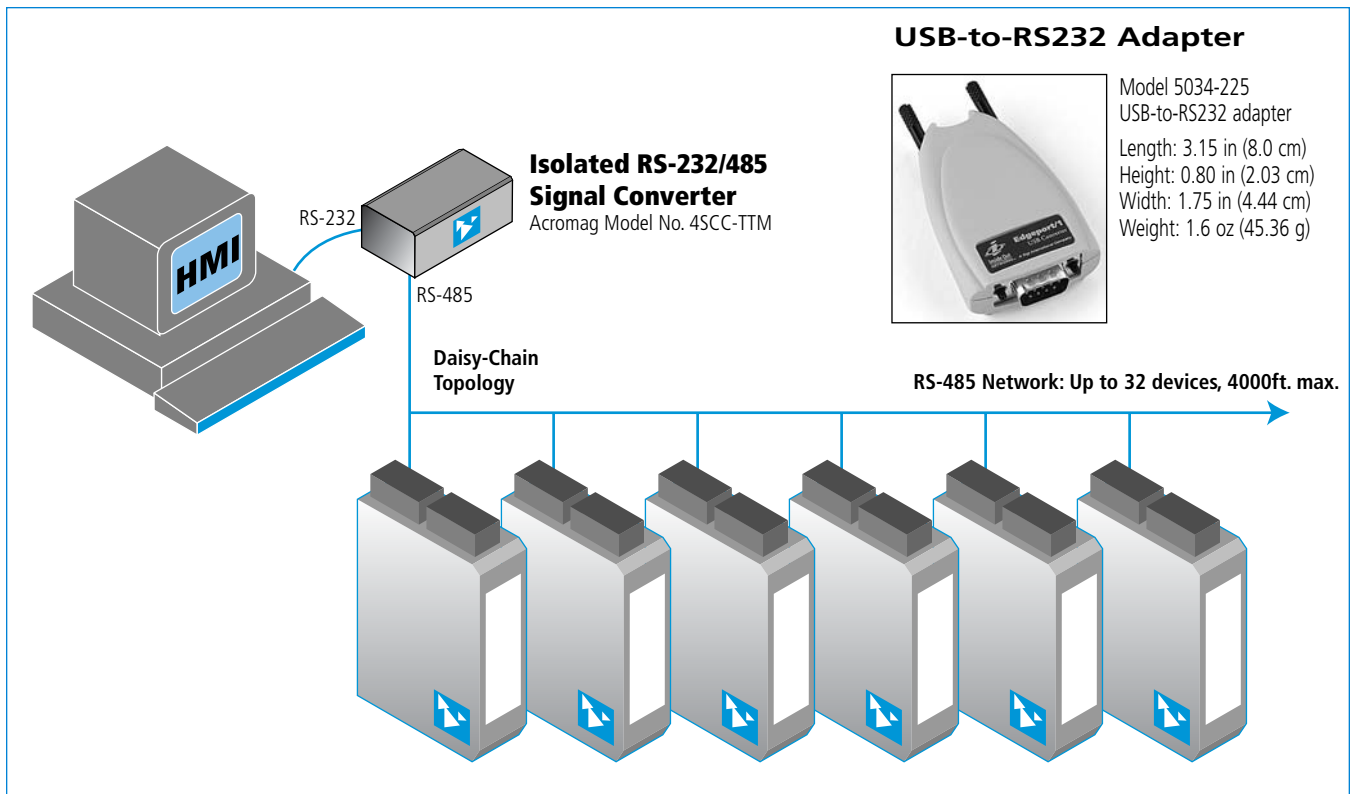**40LC-GBW-1**
115V AC power cord

System Connection

USB-to-RS232 Adapter

Model 5034-225
USB-to-RS232 adapter

Length: 3.15 in (8.0 cm)
Height: 0.80 in (2.03 cm)
Width: 1.75 in (4.44 cm)
Weight: 1.6 oz (45.36 g)

RS-232

Isolated RS-232/485 Signal Converter
Acromag Model No. 4SCC-TTM

RS-485

HMI

Daisy-Chain Topology

RS-485 Network: Up to 32 devices, 4000ft. max.

BusWorks® Modbus I/O

Extending the Network

Isolated RS-485 Network Repeater
Acromag Model No. 4SCR-TTM

To Network Host

**Network Branch:
Additional 32 devices, 4000ft. extension**

RS-485   RS-485

Acromag
THE LEADER IN INDUSTRIAL I/O
Tel: 248-624-1541 Fax: 248-624-9234 e-mail: sales@acromag.com www.acromag.com