Modbus/RS-485

Frequency/Counter Module

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
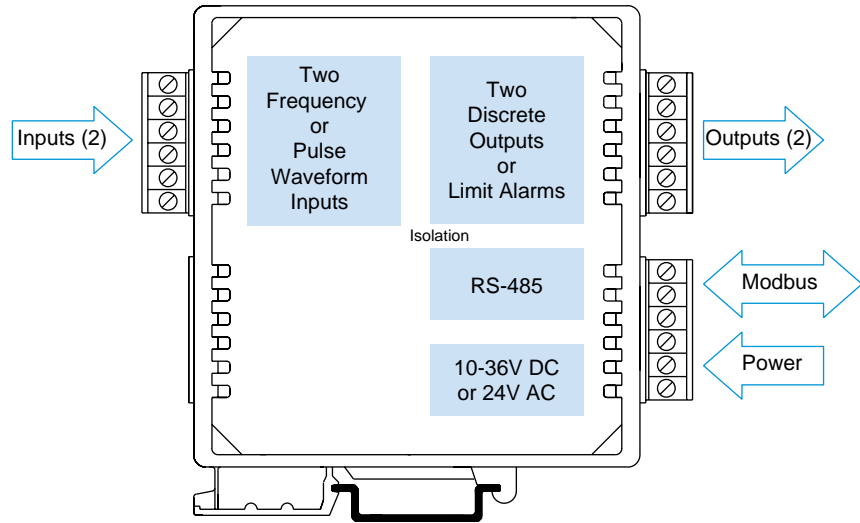
Network Communication
Modbus-RTU high-speed RS-485

Power Requirement
10 to 36V DC,
24V AC

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

■ 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.

Modbus I/O

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

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

■ Power and Isolation

Power Requirements
10 to 36V DC.
22 to 26V AC.

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

■ Ordering Information

942MB-0900
Frequency/counter input module

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

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

TBK-B02
Optional terminal block kit, barrier strip style, 4 pcs.
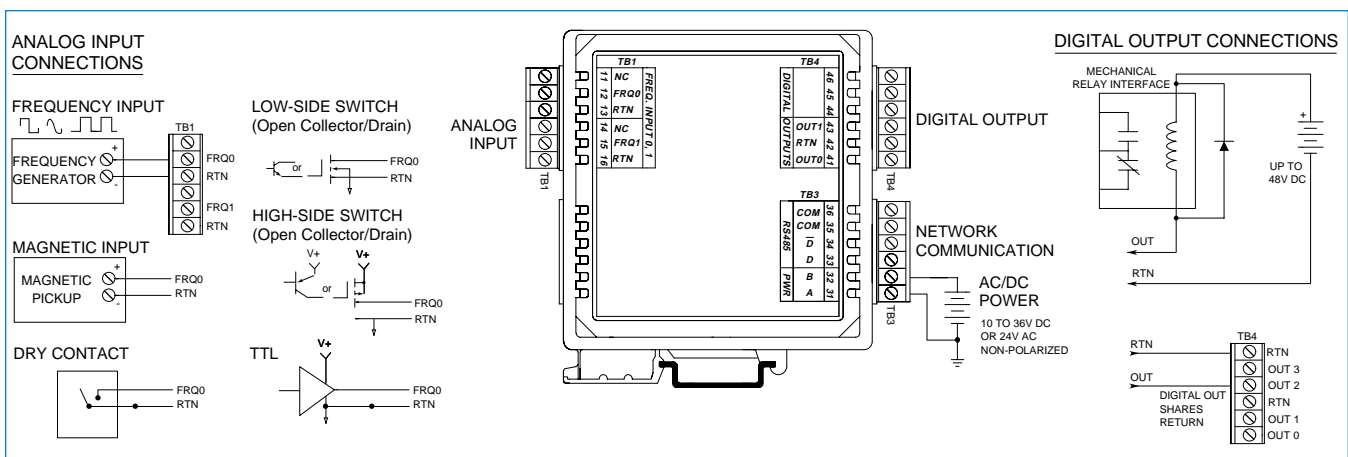
TBK-S02
Optional terminal block kit, spring clamp style, 4 pcs.

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.

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

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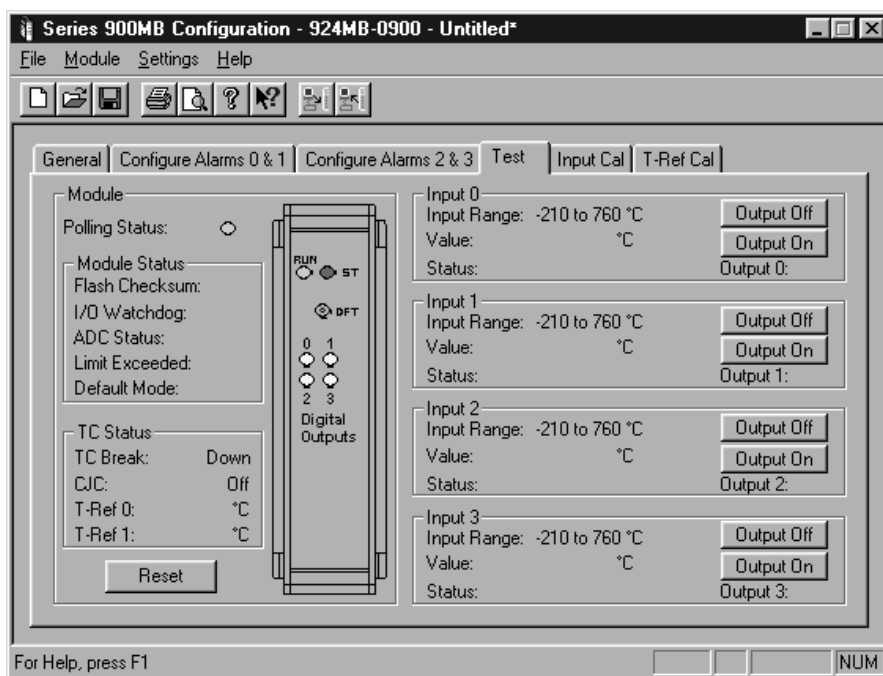Wire Range: AWG #12-24, stranded or solid copper.

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

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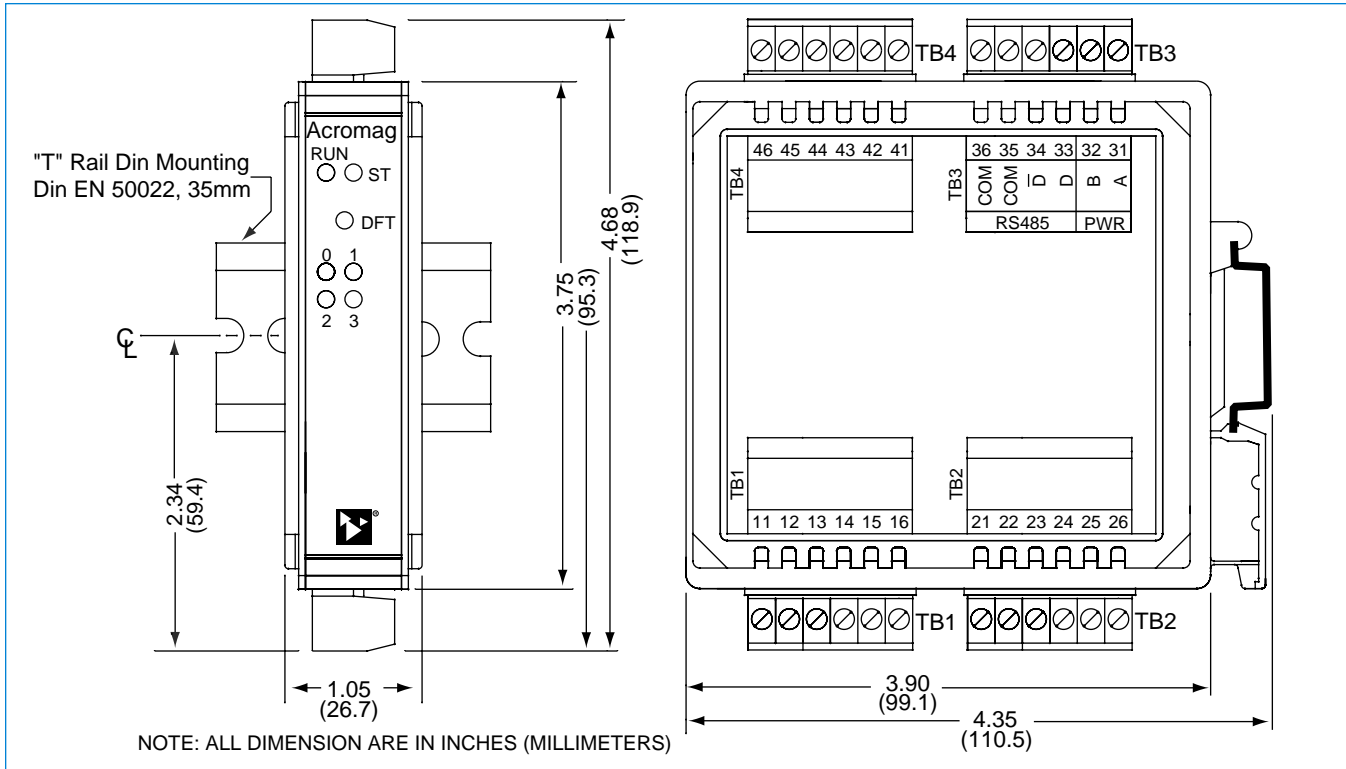DIN rail mount, Type EN50022; "T" rail (35mm).

Shipping Weight
1 pound (0.45 Kg) packed.

A test page simplifies diagnostics with a live visual display of the module's input and output values.
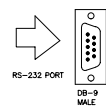
900MB Series Technical Diagrams

AcroMag
RUN
○ ○ ST
○ DFT
0 1
○ ○
2 3

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

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

| 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

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
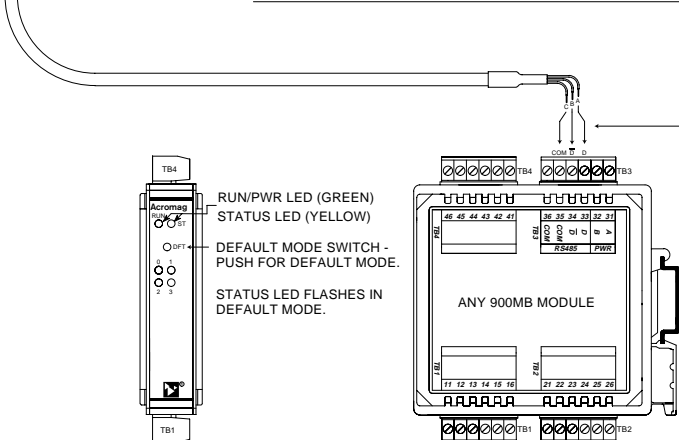MODEL 5034-214

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
DB–9 FEMALE
RS–232 TO RS–485
RS–485
DB–9 FEMALE
5034–202
DB–9 MALE

INSTALL MODBUS
CONFIGURATION
SOFTWARE

CONNECT THE RS-232
SIDE OF CONVERTER
TO THE PC
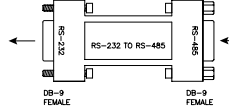
CONNECT THE RS-485
SIDE OF CONVERTER
TO THE CABLE

900C-SIP COMMUNICATION CONNECTIONS

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)

TB4

AcroMag
RUN ○ ○ ST
○ DFT
0
○ ○
2 3

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

DEFAULT MODE SWITCH -
PUSH FOR DEFAULT MODE.

STATUS LED FLASHES IN
DEFAULT MODE.

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

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

TB1   TB2

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
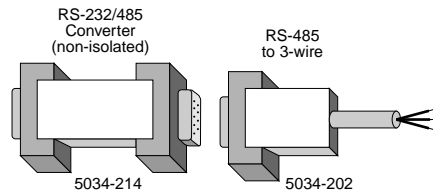
**Software Interface Package
Model No. 900C-SIP**

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
          MANUFACTURED IN TAIWAN

INPUT 50/60Hz
100-240VAC 1.15A

NC   L   N   NC

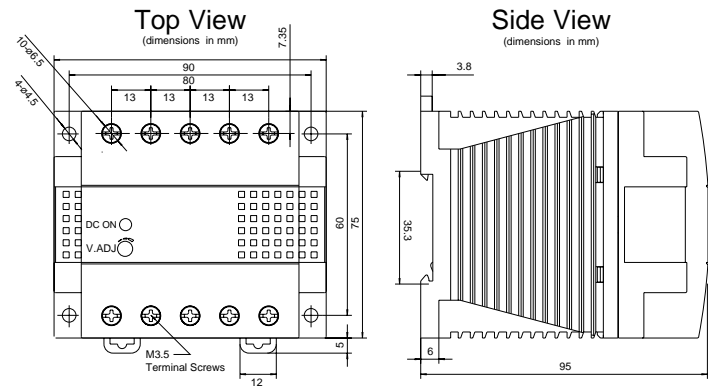## Universal 50W Power Supply

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

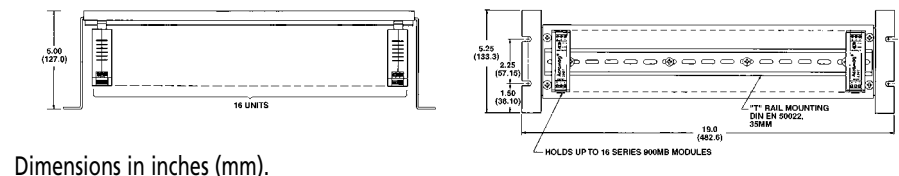**Side View**
(dimensions in mm)

3.8

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.

5.00
(127.0)

16 UNITS

Dimensions in inches (mm).

■ 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)

5.25
(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

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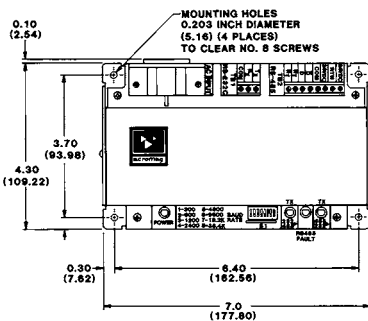
Operating Temperature Range
-25 to 60°C (-13 to 140°F).

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.

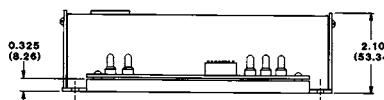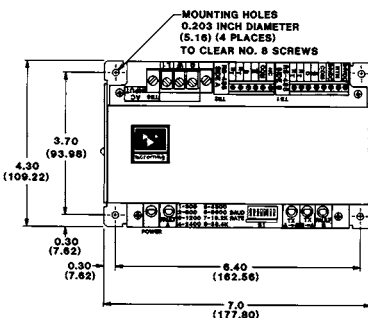**Operating Temperature Range**
-25 to 60°C (-13 to 140°F).

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

■ Ordering Information

4SCR-TTM-1
Signal Converter, 115V AC power
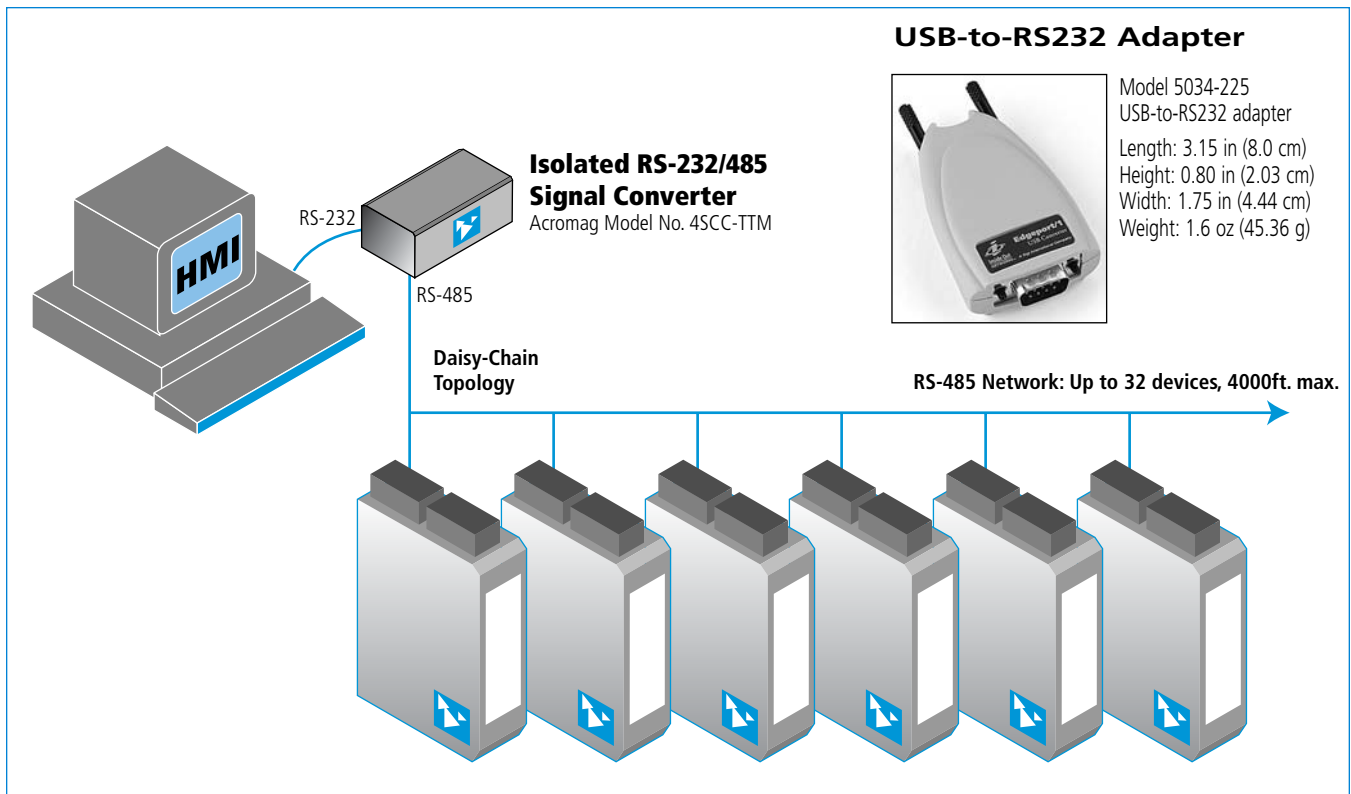
4SCR-TTM-2
Signal Converter, 230V AC power

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)

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

HMI

RS-232

RS-485

Daisy-Chain Topology

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

Extending the Network

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

To Network Host

RS-485   RS-485

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

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

41