DI-924MB

Multi-Channel Temperature Control Modules

Thermocouple or Millivolt Input Limit Alarms or Discrete Outputs

Models
DI-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.

This signal conditioner is a four-channel analog nput 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.
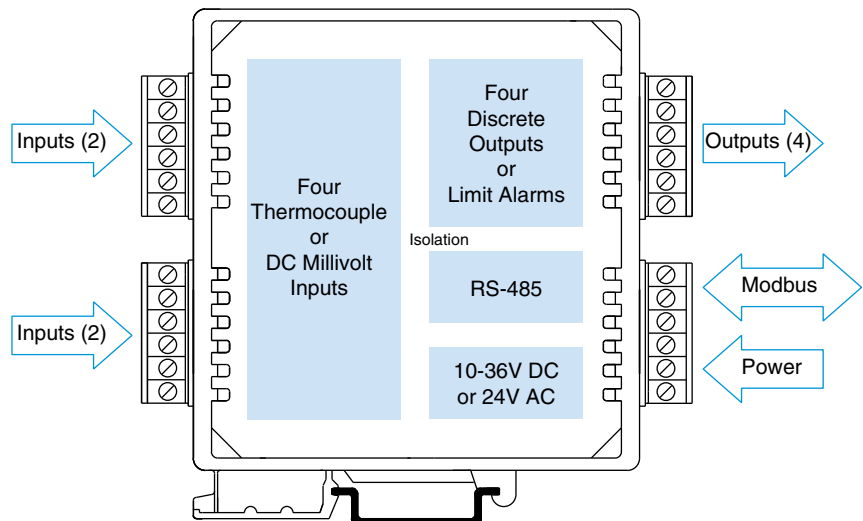
The programmable inputs accommodate eight thermocouple types plus wide-range millivolt signals. Flexible discrete outputs operate as alarms or on/off controllers. As limit alarms, each discrete output can be configured with high and/or low setpoints exclusively tied to an analog input channel. Alarm 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).

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.

Thermocouple/Millivolt Input Module

General Analog Output

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: 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

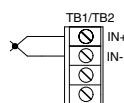### Power Requirements
10 to 36V DC, 22 to 26V AC.

Supply Current

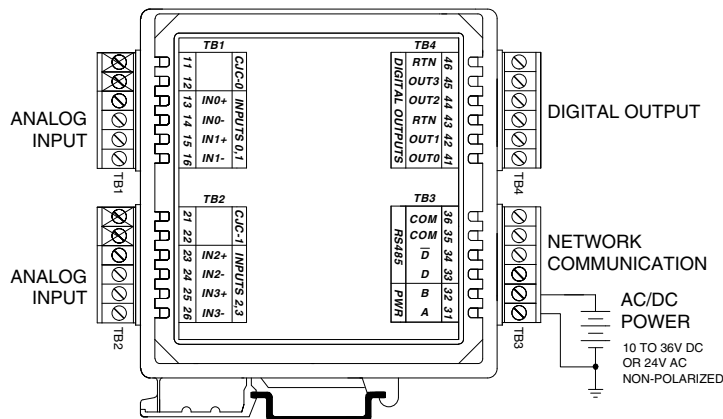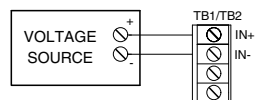| Supply	Current Draw
10V DC	100mA maximum
24V DC	45mA maximum
24V AC	85mA rms maximum

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-tochannel for common mode voltage to ±5V DC.
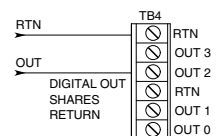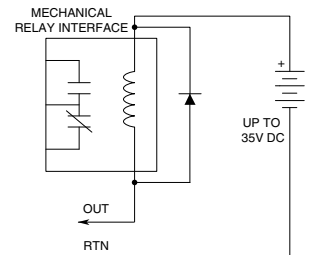

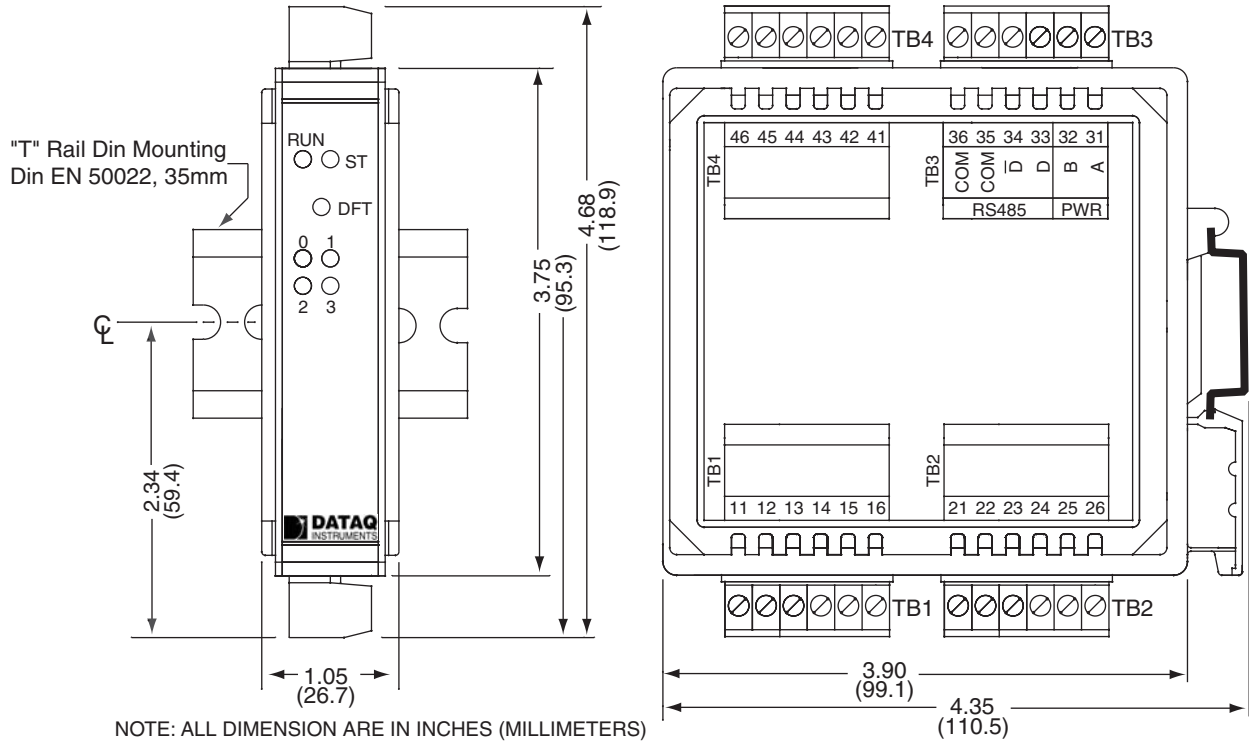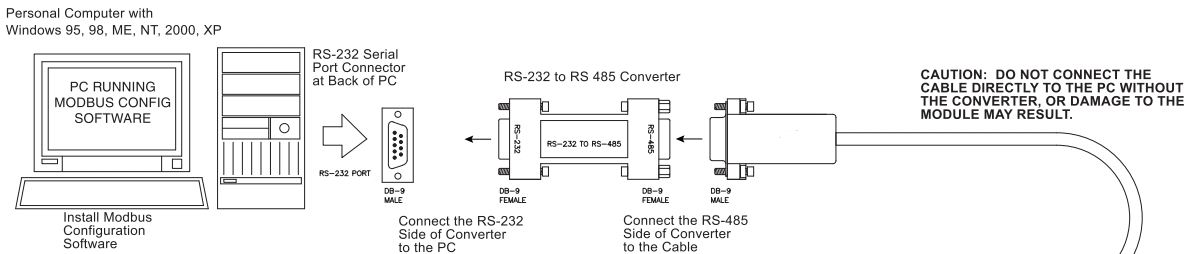ANALOG INPUT CONNECTIONS — TC INPUT / VOLTAGE INPUT — ANALOG INPUT — DIGITAL OUTPUT — NETWORK COMMUNICATION — AC/DC POWER 10 TO 36V DC OR 24V AC NON-POLARIZED

DIGITAL OUTPUT CONNECTIONS — MECHANICAL RELAY INTERFACE — UP TO 35V DC — DIGITAL OUT SHARES RETURN

900MB Technical Diagram

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

RUN
ST
DFT
0 1
2 3

DATAQ
INSTRUMENTS

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)

Communication Connections

Personal Computer with
Windows 95, 98, ME, NT, 2000, XP

PC RUNNING
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

RS-232 TO RS-485

RS-232   RS-485

DB-9
FEMALE

DB-9
FEMALE

DB-9
MALE

Connect the RS-485
Side of Converter
to the Cable

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

100969 COMMUNICATION CONNECTIONS

Connect Wires as Shown

Wire	Color	RS-485
A	Red	D
B	Black	D̄
C	Green	COM

RUN/PWR LED (Green)
STATUS LED (Yellow)

DEFAULT MODE SWITCH
Push for Default Mode

STATUS LED flashes
in Default Mode

ANY 900MB Module

Refer to the User's Manual
that came with your module
to complete the module's
power and I/O connections

DATAQ Instruments, Inc. 241 Springside Drive, Akron, Ohio 44333 Tel: 330-668-1444 Email: support@dataq.com www.dataq.com
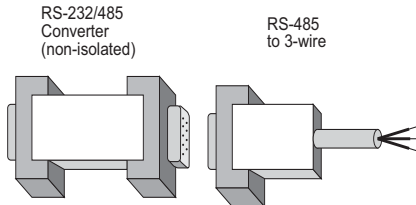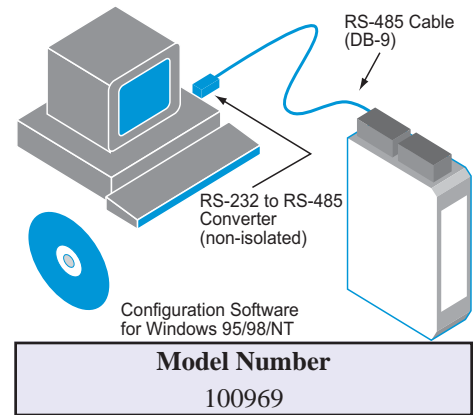
DATAQ Instruments, Inc., provides a full set of tools to help you get your modules set up and ready to run in an easy-to-order package that includes the Windows Configuration Software, an RS-232 to RS-485 Serial Port Converter, and an RS-485 Signal Cable.

The Software Interface Package Includes the following:

Configuration Software for Windows (95, 98, ME, NT, 2000, XP) on CD-ROM.
Non-isolated RS-232 to RS-485 Serial Port Converter, DB-95 to DB-9F.
RS-485 to 3-wire Cable Converter, DB-9M to 3 x 12 AWG RS-485 Cable, 8 ft.

RS-485 Cable (DB-9)

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

Configuration Software for Windows 95/98/NT

Model Number

100969

RS-232/485 Converter (non-isolated)

RS-485 to 3-wire

RS-232 to RS-485 Serial Port Converter

This Serial Port Converter is a non-isolated, port-powered, RS232-to-RS485 signal converter. Although the converter receives its power from the RS232 data and handshake lines, no handshaking lines are required to control the converter's RS485 driver. It plugs directly into the DB-9 male RS232 serial port connector on the back of most personal computers via the cable provided in the interface package.

Windows Configuration Software

The Windows Configuration Software provides an easy way to configure your module to whatever your application may be. The configuration software provides the following capabilities:

• Change Host and Slave communication settings (Baud Rate, COM Port, address, et al.
• Monitor the discrete I/O signal states and watchdog status allowing discrete outputs to be turned on/off.
• Allows a configuration to uploaded or downloaded to/from the module via the RS 485 interface.
• Provides controls the reset the module.
• Reads the contents of the Module Status Register.
• Allows optional user documentation to be saved with a module file.
• Allows a module's complete configuration to be printed in an easy-to-read, single-page format, including user documentation.

Test page (right) simplifies diagnostics with a live visual display of the module's input and output values.

DI-900MB series products are designed for Modbus RTU compatibility. Modbus is a communication protocol developed by MODI-CON, Inc. in 1979. In the years since its release, Modbus has evolved into a truly open standard and has become the most widely used networking communication protocol in the industrial automation field. Virtually all SCADA and HMI application software packages can easily fold DI-900MB devices into any new or existing data acquisition and control environment. DI-900MB products support the RTU (Remote Terminal Unit) Modbus extension, which is a binary protocol providing enhanced performance. The following is a brief list of Human Machine Interface (HMI) software vendors who support the Modbus RTU protocol, and therefore support DI-900MB Series products. The space available does not allow an exhaustive list.

Citect
USA Tel # (704)-329-3838
Web: http://www.citect.com/
Modbus-RTU I/O support: DLL Driver - use Modicon PLC 484 Series; OPC Server supplied by others

Intellution/GE Fanuc
USA Tel. (508) 698-3322
Web: http://www.intellution.com/
Modbus-RTU I/O support:
OPC Server – supplied by Intellution

Wonderware
USA Tel. 949-727-3200
Web: http://www.wonderware.com/
Modbus-RTU I/O support: Driver – Fast DDE; OPC Server – supplied by others

Iconics
USA Tel. (508) 543-8600
Web: http://www.iconics.com/
Modbus-RTU I/O support: Driver – supplied by Iconics; OPC Server – supplied by others

OPC Servers Vendors
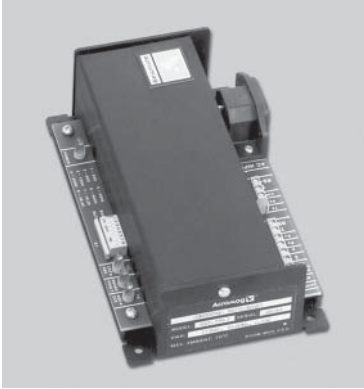
KEPware, Inc.
USA Tel. 207-864-5881
Web: http://www.kepware.com/

Digital Systems, Inc.
USA Tel. 704-895-7713
Web: http://www.caro.net/dsi/

Automated Solutions, Inc.
USA Tel. 707-575-9631
Web: http://www.automatedsolutions.com/

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 converter) across 4000 foot distances. Installation of additional network devices or extending the distance requires an Isolated Network Repeater (Model Numbers 100977 or 100978). Power cord included. Signal Cable (Model 100976) connects the PC's RS-232 Port to the Isolated Signal Converter.

Specifications

Baud Rates
Switch-selectabe 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.
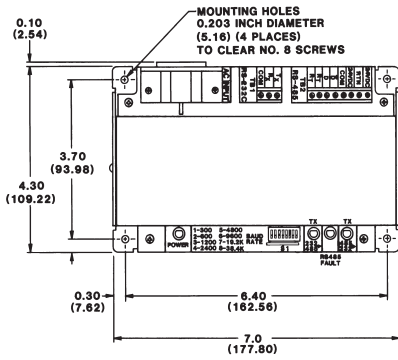
Wiring Connectors
Terminal blocks with screw clamps for 14-26AWG

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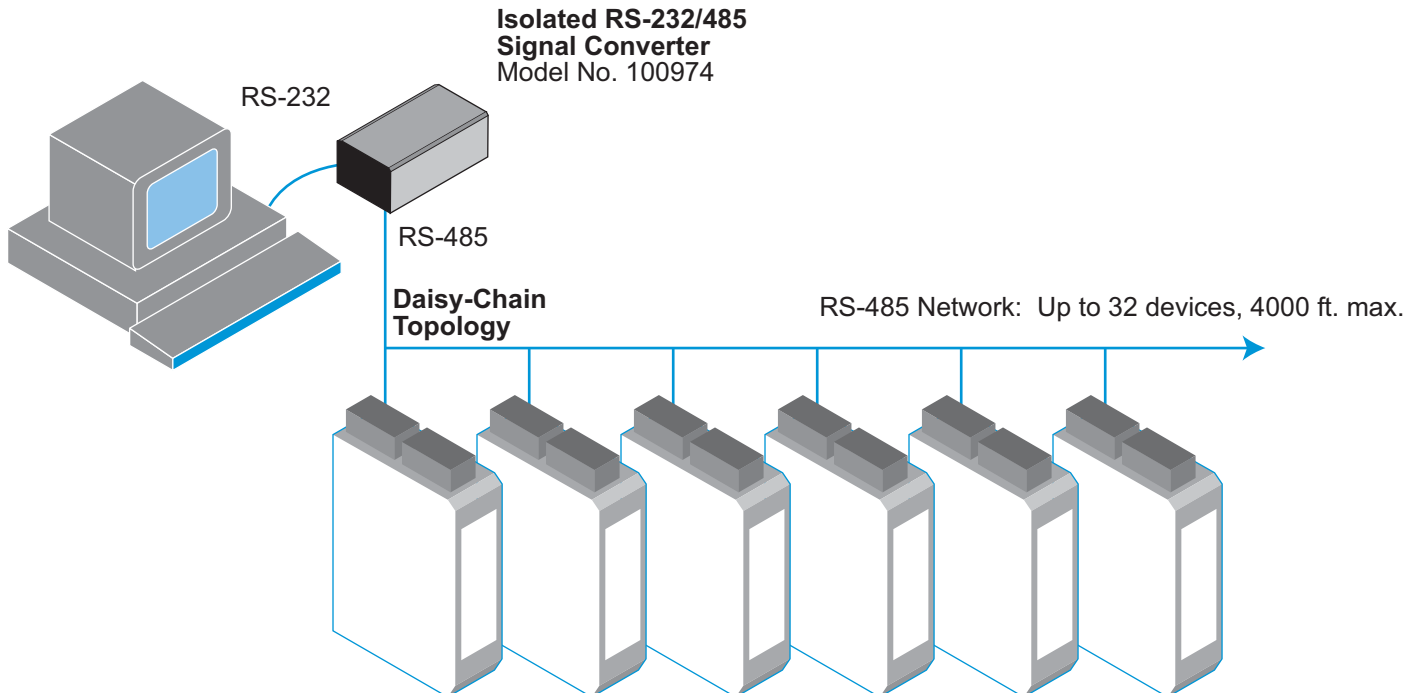-25 to 60°C (-13 to 140°F)

Isolation
Withstands 1500V AC surge for 60 seconds (250V AC or 354V DC continuous).
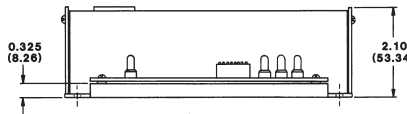
Model Numbers
100974 (115V AC Power) (discontinued)
100975 (230V AC Power) (discontinued)
100976 (8ft. long DB-9 to 3-wire RS-232 Cable)

System Connection

Isolated RS-232/485 Signal Converter
Model No. 100974

RS-232

RS-485

Daisy-Chain Topology

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

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 Network Repeater) 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.

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.
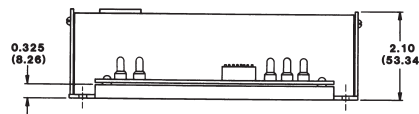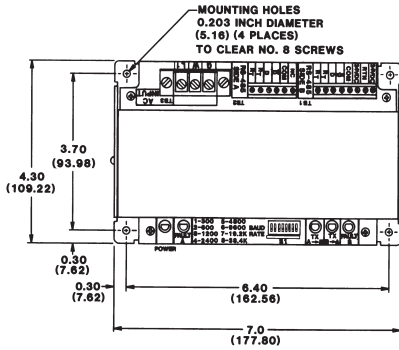
Power Wiring Connections
Terminal block with screw clamps for 12-18AWG.

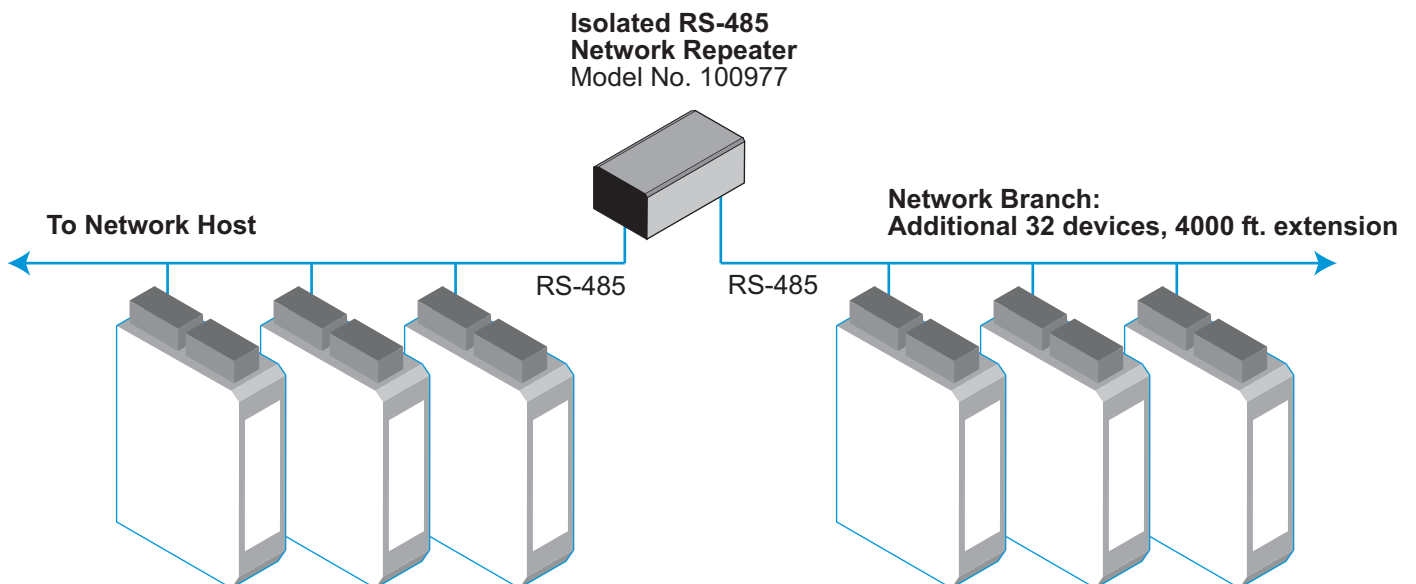**Operating Temperature Range**
-25 to 60°C (-13 to 140°F).

Isolation
Withstands 1500V AC surge for 60 seconds (250V AC or 354V DC continuous).
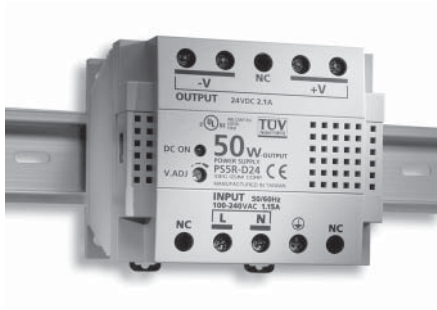
Model Numbers
100977 (115V AC Power)
100978 (230V AC Power)
100979 (115V AC Power Cord)

Extending the Network

Isolated RS-485 Network Repeater
Model No. 100977

To Network Host

RS-485   RS-485

Network Branch:
Additional 32 devices, 4000 ft. extension

Universal 50W Power Supply

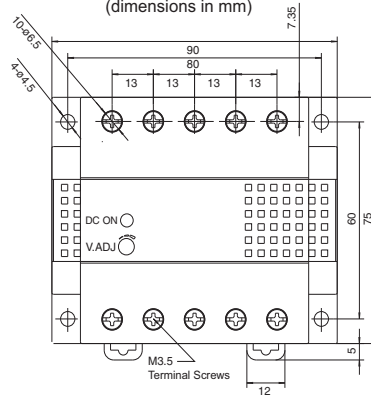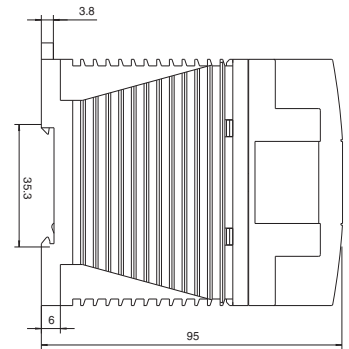This Universal 50W Power Supply is the ideal power source to drive your network.

Top View
(dimensions in mm)

Side View
(dimensions in mm)

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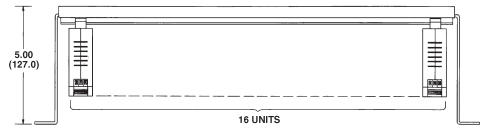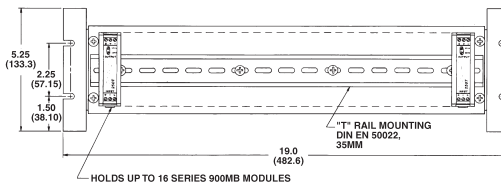105 to 370V DC

Output
24V DC, 2.1A (50W)

Model Number
100980

DIN-Rail Mounting
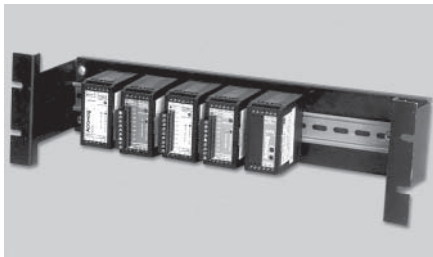
For your convenience, DATAQ Instruments, Inc., offers a rack mount kit to simplify your system installation. This 19-inch kit provides a clean solution for mounting your I/O modules and a power supply. Holds up to 16 DI-900MB modules.

Model Number
100971

USB to RS-232 Adapter

Convert signals from RS-232 to USB with this convenient adapter. For use with all DI-900MB Series modules.

Dimensions
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)

Model Number
100970

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.

Ordering Information

Description	Order Number
4-channel thermocouple or millivolt input	DI-924MB
DI-900MB Configuration Kit (includes Configuration Software, RS-232/485 non-isolated converter, and RS-485 to 3-wire cable, 8ft.)	100969
RS-232 to USB Adaptor	100970
19" rack mount kit with DIN rail	100971
RS-232 cable for 100974 and 100975 products (DB-9 to three-wire)	100976
Isolated Network Repeater, 115 VAC Power	100977
Isolated Network Repeater, 230 VAC Power	100978
115V AC Power Cord for 100977 and 100978 products	100979
50W universal power supply; 24V DC @ 2.1A (50W) output; 85-264V AC or 105-370V DC input	100980

Data Acquisition Product Links
(click on text to jump to page)
Data Acquisition | Data Logger | Chart Recorder | Thermocouple | Oscilloscope