DATAQ INSTRUMENTS

The way PC-based instrumentation should be

DI-900MB Series
Modbus/RS485 Network I/O Modules

Model DI-904MB/DI-905MB/DI-906MB

Digital Input/Output With Sourcing Outputs and Active-High Inputs

User's Manual

DATAQ Instruments' hardware and software products are not designed to be used in the diagnosis and treatment of humans, nor are they to be used as critical components in any life-support systems whose failure to perform can reasonably be expected to cause significant injury to humans.

Windows 95/98 & NT are registered trademarks of Microsoft Corporation. Modbus is a registered trademark of Modicon, Inc.

DATAQ INSTRUMENTS
241 Springside Dr., Suite #200
Akron, Ohio 44333 U.S.A.
Telephone: 330-668-1444
Fax: 330-666-5434
Designed and manufactured in the
United States of America

Warranty and Service Policy

Product Warranty

DATAQ Instruments, Inc., warrants the instruments described in this manual to be free from defects in materials and factory workmanship to the original buyer. This warranty is contingent upon proper use of the equipment, and does not cover equipment that has been modified or has been subjected to abusive physical or electrical stresses. DATAQ Instruments, Inc., agrees to repair or replace, at its sole discretion, any instrument that fails to perform as specified within 18 months after date of the original shipment from the factory, or 12 months after the date of installation, whichever date comes first.

DATAQ Instruments, Inc., reserves the right to make substitutions and modifications in the specifications of equipment that do not materially or adversely affect the performance of the equipment.

New equipment may be returned within 30 days of shipment with prior factory approval and upon the assignment of a Returned Material Authorization number, RMA number, by DATAQ Instruments, Inc. This number must be clearly shown on the return package(s). RMA numbers are valid for 30 days from date of issue. New items in factory sealed containers which are less than thirty days old after shipment may be returned for credit, less a minimum restocking and testing charge of twenty percent of the list price upon factory approval only, provided the customer pays all shipping and handling charges. Specially ordered, or modified goods, or goods which have been used or have been unpacked from the factory-sealed containers, or goods which have been shipped more than thirty days prior are not returnable.

The information contained in this manual is subject to change without notice. DATAQ Instruments, Inc., makes no warranty of any kind with regard to this material, including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose. Further, DATAQ Instruments, Inc., assumes no responsibility for any errors that may appear in this manual and makes no commitment to update, or keep current, the information contained in this manual.

Service Policy

Units within the warranty period returned for repair, test, and recalibration are serviced at no charge in accordance with the terms of the warranty policy. The Customer pays all transportation and other charges to the factory.

Units out of warranty returned for repair, test, and/or recalibration are handled on a time and material basis. If requested, or if costs exceed 50% of current list price, DATAQ Instruments, Inc., advises the customer prior to making the repairs. Such repairs are performed at the customer's expense. Typical test, recalibration, and repairs are 25% of the instrument's current list price. Transportation charges both ways are at the customer's expense.

Please be sure all returns are shipped with the following information included:

1. "Returned Material Authorization," RMA number, clearly shown on each package. Please call DATAQ Instruments, Inc., at 330-668-1444 to obtain your RMA number.
2. Your company Name with Billing and Shipping Addresses.
3. A complete description of your problem, or re-calibration data.
4. The contact person at your company, with their telephone and facsimile numbers.
5. Non-Warranty returns additionally need your Purchase Order Number.

Please pack your returned instruments in their original shipping cartons, or in equivalent strong protective shipping cartons.

Service and Repair Assistance

This module contains solid-state components and requires no maintenance, except for periodic cleaning and transmitter configuration parameter (zero, full-scale, setpoint, deadband, etc) verification. Since Surface Mount Technology (SMT) boards are generally difficult to repair, it is highly recommended that a non-functioning module be returned to DATAQ Instruments Inc., for repair. The board can be damaged unless special SMT repair and service tools are used. Further, DATAQ Instruments, Inc., has automated test equipment that thoroughly checks and calibrates the performance of each module. Please contact DATAQ Instruments, Inc., for complete details on how to obtain service parts and repair..

CAUTION: Risk of Electric Shock - More than one disconnect switch may be required to de-energize the equipment before servicing.

Preliminary Service Procedure

Before beginning repair, be sure that all installation and configuration procedures have been followed. Make sure that the correct baud rate is selected for the RS232-to-RS485 converter employed. The unit routinely performs internal diagnostics following power-up or reset. During this period, the green "Run" LED flashes.

If the diagnostics complete successfully, the "Run" LED will stop flashing after two seconds and remain ON. This indicates that the unit is operating normally. If the "Run" LED continues to flash, then this is indicative of a problem. In this case, use the Modbus Configuration Software to reconfigure the module and this will usually cure the problem. If the diagnostics continue to indicate a problem (a continuously flashing green LED), or if other evidence points to a problem with the unit, an effective and convenient fault diagnosis method is to exchange the questionable module with a known good unit. DATAQ Instruments' Application Engineers can provide further technical assistance if required. When needed, complete repair services are available from DATAQ Instruments, Inc.

Safety Summary

Means "Caution, refer to this manual for additional information."

IMPORTANT SAFETY CONSIDERATIONS

It is very important for the user to consider the possible adverse effects of power, wiring, component, sensor, or software failures in designing any type of control or monitoring system. This is especially important where economic property loss or human life is involved. It is important that the user employ satisfactory overall system design. It is agreed between the Buyer and DATAQ Instruments, Inc., that this is the Buyer's responsibility.

Table of Contents

1. Introduction

These instructions cover the hardware functionality of the transmitter models listed in the table below. Supplementary sheets are attached for units with special options or features.

Models Covered in This Manual		
Series/Input Type	-Options/Output/Enclosure/ Approvals[1]	-Factory Configuration[2]
DI-904MB	-0900	-C
DI-905MB	-0900	-C
DI-906MB	-0900	-C

Notes:

1. Agency approvals include CE, UL Listed, and cUL Listed.
2. Include the "-C" suffix to specify factory configuration option. Otherwise, no suffix is required for standard configuration.

The same circuit board is used to build all three models listed. The fully populated DI-906MB model includes tandem input and output circuits. Input circuitry is removed for DI-905MB models which are output only, and output circuitry is removed for DI-904MB models which are input only.

Description

The DI-900MB family is a group of process I/O modules and accessories for Modbus/RS485 network I/O applications. The DI-904MB/DI-905MB/DI-906MB models support up to twelve buffered inputs and/or sourcing outputs according to the model number. Inputs are active-high and outputs are current sourcing or high-side switches. These models are the complement of Models DI-901MB/DI-902MB/9DI-03MB which have open-drain current-sinking outputs and active-low inputs. The DI-900MB modules contain an advanced technology microcontroller with integrated downloadable flash memory and EEPROM for non-volatile program, configuration, and parameter data storage. Units are fully reconfigurable via our user-friendly Windows 95/98® or NT® Configuration Program and the RS485 interface. Once configured, these modules may operate as an active RS485 network slave connected to other modules and a host computer performing network I/O functions.

The Model DI-904MB supports up to 12 digital inputs. The Model DI-905MB supports up to 12 digital outputs. The model DI-906MB supports up to 12 tandem digital input and output channels. Each DI-900MB module provides an isolated RS485 network I/O path that utilizes the Modbus protocol. The active-low outputs of this model source from an external supply connected between the port excitation terminal (EXC) and return (RTN). Socketed I/O pull-down are installed and pull I/O channels down to the port RTN terminal. These resistors may be easily removed or exchanged according to your application requirements. I/O channels include yellow LED's on the front of the module that provide visual indication of the channel state. Additionally, green "Run" and yellow "Status" LED's provide local feedback of operating mode, system diagnostics, watchdog timeout, and module status.

All DI-900MB modules are designed to withstand harsh industrial environments. They feature RFI, EMI, ESD, EFT, and surge protection, plus low temperature drift, wide ambient temperature operation, and isolation between I/O, power, and the network. They also have low radiated emissions per CE requirements. As a wide-range DC-powered device, the unit may be powered from DC power networks incorporating battery backup. Since the input is diode-bridge coupled, the unit may be connected to redundant power supplies, or several units may safely share a single DC supply. The unit may also be powered from common 24VAC power.

Units are DIN-rail mounted and removable terminal blocks facilitate ease of installation and replacement, without having to remove wiring. Module power and network wiring are inserted at one side of the unit, while I/O wiring is

inserted at the other side. Module connectors are an industry standard screw clamp type that accept a wide range of wire sizes.

Flexible transmitter functionality, network reprogrammability, mixed signal I/O, alarm support, and a network interface, are all combined in a single package to make this instrument extremely powerful and useful over a broad range of applications. Further, the safe, compact, rugged, reconfigurable, and reliable design of this transmitter makes it an ideal choice for control room or field applications. Custom module configurations are also possible (please consult the factory).

Key Module Features:

- **Agency Approvals** - CE, UL, & cUL Listings pending.
- **Easy Windows® Configuration** - Fully reconfigurable via our user-friendly Windows 95/98® or NT® DI-900MB Configuration Program.
- **RS485/Modbus Network Interface** - This proven high speed interface is highly immune to noise, can operate over long distances, and allows a large number of modules to be networked together. The unit communicates using the industry-standard Modbus command/response protocol.
- **Nonvolatile Reprogrammable Memory** - This module has an advanced technology microcontroller with integrated, non-volatile, downloadable flash memory and EEPROM. This allows the functionality of this device to be reliably reprogrammed thousands of times.
- **Fully Isolated** - Digital I/O, network, & power are isolated from each other for safety and increased noise immunity.
- **Flexible Discrete Inputs and Outputs** - High voltage, high current, open-source outputs provide direct (high-side) control of external devices. High voltage buffered inputs allow outputs to be read back, or input levels monitored.
- **Tandem Input/Output Circuitry (DI-906MB Units)** - Input buffers are connected in tandem with open-source outputs for convenient loopback monitoring of the output state.
- **Self-Diagnostics** - Built-in routines operate upon power-up for reliable service, easy maintenance, and trouble-shooting. A watchdog timer is also built into the microcontroller that causes it to initiate a self reset if the controller ever fails to return from an operation in a timely manner or “locks up.”
- **Outputs Have Built-in Protection** - Outputs include over-temperature and over-current shut-down protection, plus active clamping circuitry for switching inductive loads.
- **I/O Watchdog Timer** - An I/O watchdog timer function is included and may be configured for timeout periods up to 65534 seconds (18.2 hours). A timeout will occur if no port channel I/O has taken place for the specified time period. Optionally, the digital outputs can be automatically set to a user-defined state following a watchdog timeout. A timeout is cleared via a read or write to any port I/O channel. Watchdog control of an output state has higher priority than direct control.
- **Convenient Pull-Down Resistors Mounted In Sockets** - SIP resistors are installed in sockets on board and provide I/O pull-down functionality. These SIP resistors can be easily removed or exchanged according to your application.
- **Wide-Range DC or 24VAC Power** - This device receives power over a wide supply range and the power terminals are diode-bridge coupled. This makes this transmitter useful for systems with redundant supplies, and/or battery back-up. Additionally, the power terminals are not polarized.
- **High-Speed Data Rates** - Supports half-duplex RS485 baud rates up to 115K baud.
- **Wide Ambient Operation** - The unit is designed for reliable operation over a wide ambient temperature range.
- **Hardened For Harsh Environments** - The unit will operate reliably in harsh industrial environments and includes protection from RFI, EMI, ESD, EFT, and surges, plus low radiated emissions per CE requirements.

- **Convenient Mounting, Removal, & Replacement** - The DIN-rail mount and plug-in type terminal blocks make module removal and replacement easy.
- **LED Indicators** - A green LED indicates power. A flashing yellow status LED indicates the unit is in the default communication mode and/or a watchdog timer timeout has occurred. Yellow LED's indicate the I/O state (active high) of the associated open-source output and/or digital input.
- **Default Communication Mode** - A push-button switch is provided to set the module to a default set of communication parameters for baud rate, module address, parity, and number of stop bits. This provides a convenient way of establishing communication with the module when its internal settings are unknown.

2. Specifications

General

DI-904MB/DI-905MB/DI-906MB network modules include up to twelve channels of digital input (DI-904MB), digital output (DI-905MB), or a combination of input and output channels (DI-906MB), and provide an isolated RS485/Modbus network interface. Outputs are open-source, high-side switches with their drains tied to the excitation terminal of the port (EXC). Inputs are active-high. Isolation is supplied between channel I/O, the network, and power. The high-voltage, high-current outputs provide discrete on/off control of external devices, while the non-inverting, buffered inputs provide support for digital level sensing, or for simple readback of the outputs (DI-906MB). Inputs and outputs share common. Socketed I/O pull-down resistor SIP's are included (5.6K). This network module is DIN-rail mounted.

The unit is configured and controlled with our user-friendly Windows 95/98® or NT® DI-900MB Configuration Program. Optionally, you may use your own software as long as you adhere to the Modbus command/response format for supported commands. A push button on the module allows communication with a module when its address, baud rate, and parity settings are unknown. Non-volatile reprogrammable memory in the module stores configuration information.

Model Number Definition

Transmitters are color coded with a white label. The prefix "9" denotes the Series 900, while the "MB" suffix specifies that this device is primarily a process transmitter for Modbus networks.

DI-904MB: Transmits and isolates up to 12 digital input channels.

DI-905MB: Transmits and isolates up to 12 digital output channels.

DI-906MB: Transmits and isolates up to 12 digital I/O channels.

-0900: The four digits of this model suffix represent the following options, respectively:
- 0 = No Options;
- 9 = Output: RS485/Modbus;
- 0 = Enclosure: DIN rail mount;
- 0 = Approvals (Pending): CE, UL Listed, and cUL Listed.

I/O Specifications

The same circuit board is used to build all three models. Input and output circuits are connected in tandem to an I/O terminal for the fully populated DI-906MB model. Input circuitry is removed for DI-905MB models (output only), and output circuitry is removed for DI-904MB models (input only). Supported outputs are the open source leads of n-channel mosfets whose drains are tied to the excitation terminal for the port. Outputs are intended for high-side switching (sourcing) applications only. Input buffers include series 100KΩ buffer resistors, plus diode over-voltage clamps to +5V, and are active-high. Transient protection is provided at each I/O terminal. Sockets for installation of optional pull-down resistors are also provided and 5.6K pull-down resistor SIP's are installed from the factory. The unit must be properly wired and configured for the intended I/O type (see Module Installation for details). Outputs may also be read back via the corresponding input (DI-906MB). The unit is easily configured via the Modbus Configuration Program. The following paragraphs summarize this model's I/O types and applicable specifications.

Digital Inputs (901MB & 903MB):	Supports up to 12 active-high, buffered inputs, with a common connection (COM). For DC voltage applications only. Observe proper polarity. Inputs include transient suppression devices and series connected 100KΩ resistors, plus diode over-voltage clamps to the internal +5V supply. Sockets are provided for installation of optional SIP resistor networks to act as pull-downs for the port. 5.6K pull-down resistors are installed from the factory.
Input Signal Voltage Range:	0 to 35VDC. Limit excitation voltages to 35V or less, or damage to the unit may result.
Input Current:	293uA, typical at 35VDC. This is computed as the applied input voltage minus 5.7V, divided by the series 100KΩ input resistance.
Input Signal Threshold:	TTL compatible with 100mV of hysteresis, typical. Low-to-High threshold is 1.5VDC typical, High-to-Low threshold is 1.4VDC, typical. Limit logic transition to TTL levels of 0.8VDC (Max LOW level) and 2.0VDC (Min HIGH level).
Input Resistance:	100KΩ, typical (pull-down sockets open); 5.6KΩ with factory standard pull-downs installed in sockets.
Input Hysteresis:	100mVDC typical.
Input Response Time:	500ns typical (low-to-high), 2us typical (high-to-low), measured to logic level transition at microcontroller (5V logic, 5.6K pull-downs installed). The microcontroller samples the inputs (as a group) every 10ms, typical. The actual input sampling rate will vary as interrupts may occur.
Digital Outputs (DI-905MB & DI-906MB Only):	Up to twelve independent, open-source, mosfet switches with a common drain connection tied to the port excitation terminal (EXC). Channels are grouped 4 to a port and include socketed pull-down resistor SIPS, one per port. 5.6K pull-down resistor SIP's are installed from the factory. Outputs are for DC voltage and high-side/sourcing applications only. Observe proper polarity. To control higher voltages and/or currents, or for controlling AC, an interposing relay may be used (see Drawing Electrical Connections (4501-823)). Transient protection is built-in, but external protection is recommended when switching inductive loads (see Drawing Electrical Connections (4501-823)).
Output Operating Voltage Range:	5.5 to 35V DC.
Output Leakage Current:	60uA typical, 120uA maximum (mosfet only, 25°C, 6V). Does not include the tandem input bias current of DI-906MB models (see Note below).
Note (DI-906MB):	The 100KΩ series input buffer resistors in combination with +5V voltage clamps at the input buffers will tend to increase the source current with increased excitation voltage (up to 0.3mA at 35V). This is due to the fact that the input buffer circuitry and output mosfet source circuitry are connected in tandem to the same I/O pin for the DI-906MB.
Output “ON” Current Range:	0 to 250mA DC, continuous (up to 3A total for all 12 channels combined). No deration required at elevated ambients. Group one COM/EXC connection per each group of 4 outputs.
Output R_{ds} ON Resistance:	0.13Ω typical, 0.15Ω Maximum.
Output Response Time:	Outputs are updated within 50ms of a write command. The output is switched within 5ms typical of receipt of command. For DI-906MB units, the output transition to input detection time (loop-back response) is 1us typical (low-to-high), 5us typical (high-to-low). Actual switching times will vary with output load, excitation levels, and interrupts.

General I/O Specifications

I/O Pull-Downs & Socket: : I/O channels include sockets for installation of optional SIP resistor networks to act as pull-downs for the channel. Refer to Drawing Pull-Down Resistor SIP Locations (4501-821) for socket locations. A socket is included for each group of four channels (port) and 5.6KΩ resistor SIP's are installed from the factory. The odd-numbered pins of these sockets are tied to common (COM). An external excitation supply is typically connected between the port EXC and COM terminals. The recommended SIP resistor is a four isolated resistor type (8 pins). These SIP resistors typically come in 0.2W, 0.3W, and 0.4W per element rated types. For example, refer to Bourns 4308R-102, 4308M-102, or 4308H-102 parts. You may also refer to Dale CSC08C03, MSP08C03, or MSM08C-03 parts. The 5.6KΩ SIP provided is a high-power type from Bourns (part number 4308H-102-562) and is rated at 0.4W per resistor up to 70°C.

IMPORTANT: When selecting a SIP resistor, be sure to limit the individual resistor power dissipation to less than the rated power per element. This is 0.4W for the 5.6KΩ SIP resistor installed from the factory. Further, do not exceed 250mA of source current per output, or 1A total per port COM terminal.

Excitation (DI-905MB/DI-906MB only): External excitation voltage is applied between the port EXC and COM terminals and must be limited to 35V or less. The EXC terminal is tied to the drains of the mosfets whose source leads are tied to the output pins. The excitation supply should be sufficient to provide up to 250mA per output. An EXC and COM terminal are provided for each port or group of 4 channels. See Drawing Pull-Down Resistor SIP Locations (4501-821).

Enclosure/Physical Specifications

See Drawing Enclosure Dimensions (4501-825). Units are packaged in a general purpose plastic enclosure that is DIN rail mountable for flexible, high density (approximately 1" wide per unit) mounting.

Dimensions: Width = 1.05 inches, Height = 4.68 inches, Depth = 4.35 inches (see Drawing Enclosure Dimensions (4501-825)).

DIN Rail Mounting (-xx0x): DIN rail mount, Type EN50022; “T” rail (35mm)

Connectors: Removable plug-in type terminal blocks; Current/ Voltage Ratings: 15A/300V; Wire Range: AWG #12-24, stranded or solid copper; separate terminal blocks provided for inputs, power/network, and outputs. For supply connections, use No. 14 AWG copper wires rated for at least 75°C.

Case Material: Self-extinguishing NYLON type 6.6 polyamide thermoplastic UL94 V-2, color beige; general purpose NEMA Type 1 enclosure.

Printed Circuit Boards: Military grade FR-4 epoxy glass.

Shipping Weight: 1 pound (0.45 Kg) packed.

Approvals (-xxx0)

0: Agency Approvals Pending - CE, UL Listed, and cUL Listed. UL3121 First Edition, CSA C22.2 No. 1010.1-92, Low Voltage Directive (72/23/EEC), EMC (89/336/EEC) Directives.

Product approval is limited to general safety requirements of the above standards.

Warning: This product is NOT approved for hazardous location applications.

Environmental Specifications

Operating Temperature: -25°C to +70°C (-13°F to +158°F).

Storage Temperature: -40°C to +85°C (-40°F to +185°F).

Relative Humidity: 5 to 95% non-condensing.

Power Requirements: Non-polarized 10-36V DC SELV (Safety Extra Low Voltage), or 22-26 VAC. See table below for current.

Caution: Do not exceed 36VDC peak, to avoid damage to the module.

DI-904/DI-905/DI-906MB Supply Current

Supply	Current Draw
10V	88mA Typical, 140mA Maximum
12V	75mA Typical, 110mA Maximum
15V	58mA Typical, 85mA Maximum
24V	39mA Typical, 56mA Maximum
36V	30mA Typical, 41mA Maximum
24VAC	74mA Typical, 95mA Maximum

Isolation: The I/O, network, and power circuits are isolated from each other for common-mode voltages up to 250VAC, or 354V DC off DC power ground, on a continuous basis (will withstand 1500VAC dielectric strength test for one minute without breakdown). This complies with test requirements of ANSI/ISA-82.01-1988 for the voltage rating specified. I/O points are not isolated channel-to-channel and share a common (COM) connection.

Installation Category: Designed to operate in an Installation Category (Overvoltage Category) II environment per IEC 1010-1 (1990).

Radiated Field Immunity (RFI): Complies with IEC1000-4-3 Level 3 (10V/M, 80 to 1000MHz AM & 900MHz keyed) and European Norm EN50082-1.

Electromagnetic Interference Immunity (EMI): Inputs and outputs do not change states under the influence of EMI from switching solenoids, commutator motors, and drill motors.

Electrical Fast Transient Immunity (EFT): Complies with IEC1000-4-4 Level 3 (2KV power; 1KV signal lines) and European Norm EN50082-1.

Electrostatic Discharge (ESD) Immunity: Complies with IEC1000-4-2 Level 3 (8KV/4KV air/direct discharge) to the enclosure port and European Norm EN50082-1.

Surge Immunity: Complies with IEC1000-4-5 Level 3 (2.0KV) and European Norm EN50082-1.

Radiated Emissions: Meets or exceeds European Norm EN50081-1 for class B equipment.

Communication Interface Specifications

These units contain an isolated RS485 communication port for the transmission of data.

Interface Standard: RS-485. Communication with this module is made over a 3-wire cable (D, D-bar, and Common).

Command/Response Protocol: Standard Modbus RTU protocol implemented as defined under "Modicon Modbus Reference Guide" PI-MBUS-300 Rev J (reference www.public.modicon.com, search keyword PI-MBUS-300 to obtain technical publication). See 4. Module Configuration for a review of Modbus and supported commands.

Baud Rate: Can be programmed for 2400, 4800, 9600 (Default Mode), 14400, 19200, 28800, 38400, 57600, 76800, or 115200 bits per second.

Duplex: Half Duplex only.

Parity: Odd, Even, or None (Default Mode).

Stop Bits: 1 Stop Bit for Even or Odd parity, 2 Stop bits for no parity.

Response Delay: This is the minimum communication turnaround delay that a module will wait before it sends its response to a message from the host. It is applied in addition to the inherent delay already present which varies between models. It can be set from 0-65500 ticks, with 1 tick equivalent to 1.085us. Some signal converters or host/software systems cannot accept an immediate response from the slave without additional delay. Note that you may have to specify an amount of delay that is comparable to the inherent delay already present before an effect can be measured.

Module Address: Can be set from 0-247 (01H-F7H). The Default Mode address is 247 (F7H).

Network Capacity: The Module has multi-drop capability for up to 31 modules, plus host, without use of an RS485 repeater. If a signal repeater is used for every 31 nodes, up to 247 modules may be networked, plus a host computer.

Communication Distance: Up to 4000 feet without use of a repeater. Distance can be extended with a signal repeater.

Default Communication Mode Parameters: In this mode, the module address is set to 247, the baud rate is set to 9600bps, the parity is set to none, and the number of stop bits is set to 2 by pressing the DFT push-button on the front of the module until the yellow Status LED flashes ON/OFF. This is provided as a means to communicate with a module when its internal address, baud rate, parity, and stop bit settings are unknown. Exit the Default Mode by pressing this button until the Status LED is NOT flashing (constant ON or OFF), or by issuing a software or power-on reset. Note that new communication parameters for module address, baud rate, and parity do not take effect outside of Default Mode until a software or power-on reset has occurred.

Watchdog Timer: A hardware watchdog timer is built into the microcontroller that causes it to initiate a self reset if the controller ever fails to return from an operation in a timely manner or "locks up." Additionally, an I/O watchdog timer function is implemented that may be configured for timeout periods up to 65534 seconds (18.2 hours). The I/O watchdog timer will cause the status LED to blink rapidly, set a bit in the Module Status Register, and optionally program the digital outputs to a pre-defined state upon watchdog timeout. An I/O watchdog timeout is cleared and the timer reinitiated via a read or write to any port input/output channel.

Supported Modbus Commands: The command & response protocol for communicating with this module adheres to the Modbus/RTU standard for the following Modbus Functions:

Function Code	Function
01 (01H)	Read Coil (Output) Status
02 (02H)	Read Input Status

03 (03H)	Read Holding Registers
04 (04H)	Read Input Registers
05 (05H)	Force Single Coil (Output)
06 (06H)	Preset Single Register
08 (08H)	Reset Slave
15 (0FH)	Force Multiple Coils (Outputs)
16 (10H)	Preset Multiple Registers
17 (11H)	Report Slave ID

Refer to 4. Module Configuration for detailed information on these functions.

Configuration and Controls

Module Push Button (See Drawing Pull-Down Resistor SIP Locations (4501-821) For Location): Default (DEF) - Push to engage or disengage the default communication mode with baud rate set to 9600bps, module address set to 247, and no parity selected. The Status LED will flash ON/OFF when the module is in the default mode. A module will leave the default mode following a software or power-on reset (Status LED will be OFF or constant ON).

LED Indicators: Run (Green) - Constant ON indicates power is applied and unit is operating normally. Flashing ON/OFF indicates unit is performing diagnostics (first two seconds following power-up), or has failed diagnostics (after a few seconds).

Status (Yellow) - A slow flashing LED indicates the module is in the Default Communication Mode. A rapid flashing LED indicates a watchdog timeout has occurred. The combination of timeout and default mode indication resembles rapid flashing bursts.

Input/Output (Yellow) - One per I/O point. OFF if output switch is OFF (not conducting), ON if output switch is ON (conducting). ON if input is asserted high, OFF if input is low.

Software Configuration

Units are fully reprogrammable via our user-friendly Windows 95/98® or NT® DI-900MB Configuration Program. Optionally, any software that supports the Modbus command/ response protocol may be used. See Drawing Network Connections (4501-805).

The following transmitter attributes are configurable via the DI-900MB Configuration Software. Optionally, you may use the Preset Single/Multiple Register functions to write configuration data to the appropriate register(s) as required by your application (see Register Map).

Host Communication Set via the Settings pull-down menu

Host - Communications Port: COM1-COM4 can be selected via the scroll window, or you can type in any COM port from COM1 to COM99.

Host - Baud Rate: Select 2400, 4800, 9600, 14400, 19200, 28800, 38400, 57600, 76800, or 115200 bits per second.

Host - Parity: Select Even, Odd, or None (See Parity Checking) for error checking. The odd or even parity bit is followed by 1 stop bit. If None is selected, 2 stop bits are used.

Host - Slave Address: Select a valid slave address in the range of 1-247 (01H-F7H). Address 247 is used to address a slave in the default mode.

Host - Update Communication Settings at Download:	Used to cause the host software to automatically change its communication parameters to match those set at the connected module following a download to it.
Slave Communication	
Slave - ID:	The Report Slave ID command will return the model number, run on/off status, firmware/model string, and module serial number.
Slave - Reset:	This command is used to trigger a reset of the module and its effect is equivalent to a power-on reset. An alternate method of resetting a module can be accomplished via a write to the Calibration Access & Reset Register (see Reset Register 40011). This is provided to accomplish a reset with software that does not support the Reset Slave command.
Slave - Address:	Select valid slave addresses in the range of 1-247 (01H-F7H). Address 247 is the default mode slave address.
Slave - Baud Rate:	Select 2400, 4800, 9600 (default), 14400, 19200, 28800, 38400, 57600, 76800, or 115200 bits per second.
Slave - Parity:	Select Even, Odd, or No Parity (See Parity Checking) error checking. Odd or even parity bit is followed by 1 stop bit. If no parity is selected, 2 stop bits are used.
Slave - Response Delay:	Can be set from 0-65500 ticks (1 tick = 1.085us) and refers to the additional delay a module will wait before it sends its response to a message from the host. Some signal converters or host/software systems cannot accept a response to a message immediately after sending the message without additional delay.
Slave - Status:	Use the Read Input Registers Command to read the contents of the Module Status Register to determine internal flash checksum error status, default mode indication, or port watchdog timeout status.
Slave - Watchdog:	A watchdog timer may be applied to each I/O port of this module (port 0 = I/O channels 0-3, port 1 = I/O channels 4-7, port 2 = I/O channels 8-11). Use the Port Watchdog Time Register to select a timeout period from 1 to 65534 seconds (18.2 hours). A time of 65535 (FFFFH) will disable the watchdog timer for the port. Use the Port Timeout State Register to define the states that the outputs of the port are to be programmed to upon timeout. The four lower order bits of this register value define the timeout states of each of the port output channels. Writing 65535 (FFFFH) to this register will leave the port outputs unchanged upon timeout. A port watchdog fault indication flag (bits 2-0 of the Module Status register) will be set if any of the port output channels have not been written to over the specified time period, or if any of the port input channels have not been read over the specified time period. In addition, the module status LED will blink rapidly if a watchdog timeout occurs (Note: A slow blink rate indicates the module is in the default communication mode and a timeout may temporarily mask default mode indication). The port watchdog timer is reinitiated via a read or write to any input/output channel of the same port.
Digital Input	No Channel Configuration Required.
Input - Read State:	On DI-906MB units, use the Read Input Status Command to read the actual status of the output channels (source leads). Note that the Read Input Status command will also reinitiate the port watchdog timer if enabled.

Input - Indication:	The current input state is indicated by a yellow status LED at the front of the module-LED is ON when input is high (or tandem output is sourcing current), and OFF when input is low (or tandem output is not conducting).
Digital Outputs	No Channel Configuration Required.
Output - Read State:	Use the Read Coil Status Command to read the ON/OFF status of the output channels. This is equivalent to a read of the gate signal of the n-channel mosfet driving the output. As such, it may not reflect the actual output state if the output is not pulled down or has no excitation.
Output - Write State:	Use the Force Single Coil command or Force Multiple Coils command to turn the outputs ON or OFF. Note that the Force Coil commands will also reinitiate the port watchdog timer if enabled.
Output - Indication:	The current output state is indicated by a yellow status LED at the front of the module-LED is ON when output is ON or sourcing current.
Output - Timeout State:	Use the Port Timeout State Register to define the states the outputs of the port are to be programmed to upon watchdog timeout. The four lower order bits of this 16-bit value define the timeout states of each of the port output channels. Writing 65535 (FFFFH) to this register will leave the port outputs unchanged upon timeout. Note that clearing a timeout via a read or write to any port I/O channel does not return the output to its pre-timeout state. The output remains in its timeout state until otherwise written.

Other Modbus Configuration Software Capabilities

In addition to configuring all features of the module described above, the Modbus Configuration Software includes additional capabilities for testing and control of this module as follows:

1. Monitors the discrete I/O signal states. Allows discrete outputs to be turned on or off. It also allows polling to be turned on or off.

2. Allows a configuration to be uploaded or downloaded to/from the module via the RS485 interface.

3. Provides controls to reset a module.

4. Reads the contents of the Module Status Register.

5. Allows optional user documentation to be assigned to a module. Documentation fields are provided for tag number, comment, configured by, location, and identification information. This information can also be uploaded from the module and printed via this software.

6. Allows a module's complete configuration to be printed in an easy to read, one-page format, including user documentation.

3. Getting Started

Unpacking and Inspection

Upon receipt of this product, inspect the shipping carton for evidence of mishandling during transit. If the shipping carton is badly damaged or water stained, request that the carrier's agent be present when the carton is opened. If the carrier's agent is absent when the carton is opened and the contents of the carton are damaged, keep the carton and packing material for the agent's inspection. For repairs to a product damaged in shipment, refer to the Warranty and Service Policy to obtain return instructions. It is suggested that salvageable shipping cartons and packing material be saved for future use in the event the product must be shipped.

This module is physically protected with packing material and electrically protected with an anti-static bag during shipment. However, it is recommended that the module be visually inspected for evidence of mishandling prior to applying power.

This circuit utilizes static sensitive components and should only be handled at a static-safe workstation.

Module Installation

This transmitter module is packaged in a general purpose plastic enclosure. Use an auxiliary enclosure to protect the unit in unfavorable environments or vulnerable locations, or to maintain conformance to applicable safety standards. Stay within the specified operating temperature range. As shipped from the factory, the unit is calibrated for all valid input ranges and has the default configuration shown in the table below.

WARNING: Applicable IEC Safety Standards may require that this device be mounted within an approved metal enclosure or sub-system, particularly for applications with exposure to voltages greater than or equal to 75VDC or 50VAC.

DI-906MB Default Factory Configuration

Parameter	Configuration
Module Address	247
Baud Rate	9600bps
Parity	None
Stop Bits	2 (When Parity=None)
Response Delay	0 (No Additional Delay)
Watchdog Time (Each Port)	0 (Disabled)
Timeout State (Each Port)	All ON (Timer Disabled)
Pull-Down Resistor	5.6K Installed (In Sockets)

Note: Do not confuse the Default Factory Configuration noted above with the Default Communication Mode, which refers to the fixed baud rate, module address, parity, and stop bit settings achieved by pushing the Default Mode button until the status LED flashes ON/OFF. The Default Communication Mode will temporarily over-ride any factory configuration of baud rate, module address, parity, and stop bits with settings of 9600bps, 247, None, and 2, respectively. It is provided as a convenient means of achieving communication with a module when these parameters are unknown.

Your application will typically differ from the default factory configuration and will require that the transmitter be reconfigured to suit your needs. This can be easily accomplished with the user-friendly Windows 95/98® or NT® DI-900MB Configuration Program. Configuration is normally done prior to field installation. Refer to 6. Module Software Configuration for detailed instructions.

Default Mode Switch

A push-button default mode switch and status LED are provided at the front of the module as a convenient way of communicating with the module when its baud rate and address settings are unknown. Push & hold this button until the Status LED flashes ON/OFF to indicate the module is in the Default Communication Mode with a fixed module address of 247, baud rate of 9600bps, no parity, and 2 stop bits. It is most convenient to configure a module in this mode, then leave the default mode by pressing this button again until the Status LED stops flashing (constant ON or OFF), or by resetting the module. Note that a rapidly flashing Status LED indicates a watchdog timer timeout has occurred and this may temporarily mask default mode indication. The Default Mode is disabled following a software or power-on reset. New communication parameters (for baud rate, address, and parity) will take effect following a reset of the module and the module will leave the Default Mode.

Pull-Down Installation & Removal (See Drawing Pull-Down Resistor SIP Locations (4501-821))

Sockets are installed on the board to accept SIP resistor networks for optional I/O pull-down installation. One 8-pin SIP socket is provided for every four I/O channels (port). These 8-pin sockets accept SIP's of four isolated resistors with the odd-numbered socket pins tied in common to return (RTN). Three 5.6KΩ resistor SIP's are installed from the factory, but may be changed or removed as required by your application. The cover must be removed to access these sockets (see Drawing Pull-Down Resistor SIP Locations (4501-821)). For the 5.6K resistor SIP provided, power must be limited to less than 0.4W per resistor element. Limit excitation voltages to 35V or less, and source currents to less than 250mA. Your choice of SIP resistor may further limit current and voltage according to its power rating (ratings of 0.2W, 0.3W, or 0.4W per resistor element are typical). Refer to the I/O Specifications section for recommended resistor types and suppliers.

IMPORTANT: You must provide I/O excitation to operate the outputs. Outputs are the open-source leads of n-channel mosfets whose drain terminals are tied in common with the port EXC terminal. The output source leads are pulled down via internal 5.6K resistors installed in sockets on the board. Connect a 5-35V excitation supply to the port EXC & RTN terminals to complete the circuit. Optionally, the internal pulldowns can be removed and the I/O terminals wired to an external pulldown or load circuit in similar fashion. Likewise, pulldowns are required to prevent the input circuit from floating. Failure to complete this circuit by providing an excitation supply and/or pulldowns will leave the inputs and outputs floating and/or inoperable.

Mounting

Refer to Drawing Enclosure Dimensions (4501-825) for mounting and clearance dimensions.

DIN Rail Mounting: This module can be mounted on “T” type DIN rails. Use suitable fastening hardware to secure the DIN rail to the mounting surface. Units may be mounted side-by-side on 1-inch centers for limited space applications.

“T” Rail (35mm), Type EN50022: To attach a module to this style of DIN rail, angle the top of the unit towards the rail and locate the top groove of the adapter over the upper lip of the rail. Firmly push the unit towards the rail until it snaps solidly into place. To remove a module, first separate the input terminal block(s) from the bottom side of the module to create a clearance to the DIN mounting area. Next, insert a screwdriver into the lower arm of the DIN rail connector and use it as a lever to force the connector down until the unit disengages from the rail.

Electrical Connections

Digital I/O, network, and power terminals can accommodate wire from 12-24 AWG, stranded or solid copper. Strip back wire insulation 1/4-inch on each lead before installing into the terminal block. Since common mode voltages can exist on signal wiring, adequate wire insulation should be used and proper wiring practices followed. It is recommended that I/O, network, and power wiring be separated for safety, as well as for low noise pickup. Note that I/O, network, and power terminal blocks are an industry-standard plug-in type and can be easily removed to facilitate module removal or replacement, without removing individual wires. Be sure to remove power before unplugging the terminals to uninstall the module, or before attempting service. All connections must be made with power removed.

CAUTION: Risk of Electric Shock - More than one disconnect switch may be required to de-energize the equipment before servicing.

1. **Power:** Refer to Electrical Connections (4501-823). Variations in power supply voltage within rated limits has negligible effect on module accuracy. For supply connections, use No. 14 AWG wires rated for at least 75°C. The power terminals are diode bridge-coupled and not polarized. The unit is powered from 10-36VDC, or 24VAC.

2. **Digital I/O:** Connect I/O per Electrical Connections Drawing 4501-823. Observe proper polarity when making I/O connections (see label for input type). All outputs are the open-source leads of mosfets whose drain terminals share an excitation supply connected between the EXC and COM terminals of the port. I/O pull-down resistor SIP's are installed in sockets on the board and connected to common. All terminals include transient voltage suppression and integrated snubbers, but may require additional protection when switching inductive loads (see below). Refer to 2. Specifications for output specifications and see the module side label for terminal designations. Note that outputs are for current sourcing (high-side switching) applications only. Inputs are active-high. The digital I/O circuitry is electrically isolated from the power and network circuits. If necessary, an interposing relay can be used to switch higher currents as illustrated in the Drawing Interposing Relay Conn. & Contact Pro. (4501-824).

   Note: Digital outputs go to their OFF state following a software or power-on reset of the module. Outputs may be optionally sent to user-defined states following a watchdog timeout.

   IMPORTANT - Protection With Inductive Loads: The output DMOS type mosfets have integrated shunt diode clamps connected from source to drain (cathode to drain/excitation) to help protect the output switch from damaging reverse emf voltages that are generated when switching inductive loads. You are encouraged to add external protection local to the inductive load for added protection and to prevent this emf from being distributed across the connection media. For DC inductive loads, place a diode across the load (1N4006 or equivalent) with cathode to (+) and anode to (-).

3. **Network Connections:** Wire network as shown in Drawing Network Connections (4501-805). Network common (COM) should connect to earth ground at one point.

4. **Grounding:** See Drawing Electrical Connections (4501-823). The module housing is plastic and does not require an earth ground connection..

WARNING: For compliance to applicable safety and performance standards, the use of shielded cable is recommended as shown in Drawing Electrical Connections (4501-823). Further, the application of earth ground must be in place as shown in Drawing Electrical Connections (4501-823). Failure to adhere to sound wiring and grounding practices may compromise safety & performance.

Software Installation

The 900MB Configuration Software is used to configure Series DI-900MB modules and is installed as follows:

1. Insert the DI-900MB Resource CD into your CD-ROM drive.

   IMPORTANT: Before continuing with installation, be sure to exit any other Windows programs that may be running.

2. The Window's AutoRun feature should start the CD and the installation software will run.

3. Select the option "Install DI-900MB Configuration Software" and click on OK.

4. The Welcome Dialog Box appears. Click on Next to continue with the installation or Cancel to abort.

5. Fill out your user information in the appropriate text boxes and click on Next.

6. The Choose Destination dialog box allows you to specify the program files' destination directory. To keep the default (C:\Program Files\Series900MB) click on Next, to change the destination click on the Browse button, select a destination, then click on Next.

7. The Select Program Folder allows you to designate the program folder. To keep the default (Series900MB), click on Next, to choose a different folder, make a selection from the list then click on Next.

8. The Start Copying Files dialog box shows the current settings and allows you to change them by using the Back button. To change settings, click on the Back button until you reach the setting you would like to change, change that setting, and click on the Next button until you get back to the Start Copying Files dialog box. To keep the current settings and install the software, click on the Next button.

9. Setup is complete. Click Finish to exit the DATAQ installation program and return to Windows.

10. To run the configuration software, go to the Start Menu and click on Programs > Series900MB > Series900MB Configuration (this is the default - if you did not keep the default settings choose the program folder and directory you had specified during installation).

4. Module Configuration

This module needs to be configured for your application. Configuration is easily accomplished using the Windows 95/98® or NT® Modbus Configuration Software and an RS232-to-RS485 signal converter. It is not required to use the Configuration software to communicate with the Series DI-900MB, as any software capable of sending Modbus protocol commands over an RS485 network can be used. However, the configuration software provides an easy to use Windows format for communicating with the module that does not require advanced familiarity with the Modbus protocol.

Register Map

Modbus registers are organized into the following reference types identified by the leading number of the reference address:

Reference	Description
0xxxx	Read/Write Discrete Outputs or Coils. A 0x reference is used to drive output data to a digital output channel.
1xxxx	Read Discrete Inputs. The ON/OFF status of a 1x reference is controlled by the corresponding digital input channel.
3xxxx	Read Input Registers. A 3x reference register contains a 16-bit number received from an external source-e.g. an analog signal.
4xxxx	Read/Write Output or Holding Registers. A 4x register is used to store 16-bits of numerical data (binary or decimal), or to send the data from the CPU to an output channel.

Notes:

1. The "x" following the leading character represents a four-digit address location in user data memory. The leading character is generally implied by the function code and omitted from the address specifier for a given function. The leading character identifies the I/O data type.
2. The ON/OFF state of discrete inputs and outputs is represented by a 1 or 0 value assigned to an individual bit in a 16-bit data word. This is sixteen 0x or 1x references per data word. With respect to mapping, the LSB of the word maps to the lowest numbered channel of a group and channel numbers increase sequentially as you move towards the MSB. Unused bits are set to zero.

The following table outlines the register map for Model DI-904MB/DI-905MB/DI-906MB network I/O modules. Modbus functions operate on these registers (except the Report Slave ID and Reset Slave functions).

Ref	Addr.	Description	Data Type/Format
Coil Registers (0x References, Read/Write)			
00001 Thru 00012	0-11 (0000-000B)	Twelve Discrete Outputs 0-11	Discrete Output Value. Addresses a specific bit of a 16-bit word that controls/ monitors the ON/OFF status for the output. A set bit (1) means the corresponding output is turned ON (sinking current). A clear bit (0) means the corresponding output is turned OFF (open). The bit position also corresponds to the output channel number (i.e. output 0 uses bit 0 of the 16-bit word at address 0, output 1 uses bit 1 of the 16-bit word at address 1, etc.) Unused bits are set to 0. Bits 15-12: Not Used. Additionally, unused bits in range 11-0 are set to 0.

Ref	Addr.	Description	Data Type/Format
Note: This signal corresponds to the gate signal of the n-channel high-side output mosfet. Thus, a read of this register may not reflect the actual output level at the source of the mosfet if the open-source is not pulled down or is left floating. On DI-906MB units, you can read the Contact Registers to obtain the actual output state(s) via closed loop feedback. After reset, these registers read 0 (outputs OFF) and these registers are not maintained in EEPROM.			
Contact Registers (1x References, Read-Only)			
10001 Thru 10012	0-11 (0000-000B)	Twelve Discrete Inputs 0-11	Discrete Input Value. Addresses a specific bit of a 16-bit word that monitors the ON/OFF status for the active-high input. A set bit (1) means the corresponding input is ON (active-high). A clear bit (0) means the corresponding input is OFF (low). The bit position corresponds to the input channel number (i.e. input 0 uses bit 0 of the 16-bit word at address 0, input 1 uses bit 1 of the 16-bit word at address 1, etc.) Unused bits of a word are set to 0. Bits 15-12: Not Used. Additionally, unused bits in range 11-0 are set to 0.
Note: This signal reflects the actual state of the corresponding input signal (DI-904MB & DI-905MB), or the source lead of the tandem output switch (DI-906MB). This signal is active-high. Failure to install input pulldowns and/or provide port excitation will leave inputs and/or outputs floating.			
Input Registers (3x References, Read-Only)			
30001	0000	Module Status	Bit 15: Flash Checksum; 1 = Error Flag; 0 = No Flash Error Bit 14: Zero (Not Used) Bit 13: Default Mode Flag; 1 = Default Mode Indication; 0 = Not Default Mode Bits 12-3: Zero Bit 2: Port 2 (CH 8-11) Watchdog Fault Bit 1: Port 1 (CH 4-7) Watchdog Fault Bit 0: Port 0 (CH 0-3) Watchdog Fault
Holding Registers (4x References, Read/Write)			
Note: Changes to Holding Registers take effect following the next software or power-on reset of the module, except for the Reset Register.			
40001	0(0000)	Slave Address Default=247	1-247
40002	1(0001)	Baud Rate Default = 2,9600bps	0 = 2400bps 1 = 4800bps 2 = 9600bps (Default) 3 = 14400bps 4 = 19200bps 5 = 28800bps 6 = 38400bps 7 = 57600bps 8 = 76800bps 9 = 115200bps
40003	2(0002)	Parity Default=0, None	0 = No Parity Check 1 = Odd Parity Checking 2 = Even Parity Checking
40004	3(0003)	Port 0(CH0-3) Watchdog Time Default=0, Disabled	Can be set from 1 to 65534 seconds. Set to 65535 (FFFFH) or 0 (0000H) to disable the watchdog timer.

Ref	Addr.	Description	Data Type/Format
Note: A port timeout can only be cleared via a read or write to any channel of the same port, or upon a software or power-on reset of the module.			
40005	4(0004)	Port 1(CH 4-7) Watchdog Time Default=0, Disabled	Can be set from 1 to 65534 seconds. Set to 65535 (FFFFH) or 0 (0000H) to disable the watchdog timer.
40006	5(0005)	Port 2(CH 8-11) Watchdog Time Default=0, Disabled	Can be set from 1 to 65534 seconds. Set to 65535 (FFFFH) or 0 (0000H) to disable the watchdog timer.
40007	6(0006)	Port 0(CH 0-3) TimeoutState (DI-905MB and DI-906MB Only) **Default=65535, Disabled.**	The four lowest order bits of this 16-bit register value define the state the output channels of the port will be programmed to following a watchdog timeout. Bit 0 corresponds to channel 0, bit 1 to channel 1, bit 2 to channel 2, and bit 3 to channel 4. Write 65535 (FFFFH) to this register to leave the outputs unchanged following a timeout.
Note: Clearing a timeout via an I/O read or write does not return the output(s) to their initial state. They remain in their timeout states until otherwise written.			
40008	7(0007)	Port 1(CH 4-7) Timeout State (DI-905MB and DI-906MB Only) **Default=65535, Disabled.**	The four lower order bits of this 16-bit register value define the state the output channels of the port will be programmed to following a watchdog timeout. Bit 0 corresponds to channel 4, bit 1 to channel 5, bit 2 to channel 6, and bit 3 to channel 7. Write 65535 (FFFFH) to this register to leave the outputs unchanged following a timeout.
40009	8(0008)	Port 2(CH 8-11) Timeout State (DI-905MB and DI-906MB Only) **Default=65535, Disabled.**	The four lower order bits of this 16-bit register value define the state the output channels of the port will be programmed to following a watchdog timeout. Bit 0 corresponds to channel 8, bit 1 to channel 9, bit 2 to channel 10, and bit 3 to channel 11. Write 65535 (FFFFH) to this register to leave the outputs unchanged following a timeout.
40010	9(0009)	Response Delay Time (Turnaround Delay) **Default=0, No Delay**	Can be set from 0 to 65500 ticks (1 tick = 1.085us). This is the additional delay the module will wait before responding to a message from the host. Increase this value if you have trouble communicating with the module or you encounter a high degree of error messages.
40011	10(000A)	**Alternate Method of Module Reset**	Writing 41429 (A1D5H) to this register will cause an immediate module reset. This is provided as an alternate method of Reset for software that does not support the Reset Slave (08) command. After a reset, this register reads 0 (no reset). This register is not maintained in EEPROM.

Notes (Register Map):

1. Note that the Report Slave ID and Reset Slave functions do not operate on Register Map locations.
2. Configuration variables stored in holding registers (4xxxx reference addresses) are maintained in EEPROM except as noted. Changes to these register parameters do not take effect until the next software or power-on reset of the module.

5. An Introduction to Modbus

The Modbus protocol provides an industry standard method that Series DI-900MB modules use for parsing messages. Modbus devices communicate using a master-slave technique in which only one device (the master) can initiate transactions (called queries). The other devices (slaves) respond by supplying the requested data to the master, or by taking the action requested in the query. The Series DI-900MB modules are slaves, while a typical master device is a host computer running appropriate application software. Masters can address individual slaves, or can initiate a broadcast message to all networked slaves. Slaves return a response to all queries addressed to them individually, but no response is returned to broadcast queries from a master device.

Remote Terminal Unit (RTU) Mode

The Series DI-900MB modules use the widely accepted Modbus network protocol in the RTU (Remote Terminal Unit) serial transmission mode. In RTU mode, each 8-bit message byte contains two 4-bit hexadecimal characters, and the message is transmitted in a continuous stream. The format for each byte in RTU mode is outlined below:

RTU Mode Byte Format

Coding System	8-bit binary, hexadecimal 0-9, A-F, two hexadecimal characters contained in each 8-bit field of the message.
Bits Per Byte	1 start bit + 8 data bits, lsb sent first + 1bit for even/odd parity or no bit for no parity + 1 stop bit if parity is used or 2 stop bits with no parity.
Error Check Field	Cyclical Redundancy Check (CRC)

A master's query is comprised of a slave address (or broadcast address), a function code defining the requested action, any required data, and an error checking field. A slave's response is comprised of fields confirming the action taken, any data to be returned, and an error checking field.

The query and response both include a device address + function code + data byte(s) + error checking field. If an error occurred in the receipt of the query, or if the slave is unable to perform the requested action, the slave will return an exception message as its response (see Modbus Exceptions). The error check field allows the master to confirm that the message contents are valid.

Modbus Message Framing

A Modbus message is placed in a frame by the transmitting device. A frame is used to mark the beginning and ending point of a message allowing the receiving device to determine which device is being addressed and to know when the message is completed. It also allows partial messages to be detected and errors flagged as a result.

RTU mode messages start with a silent interval of at least 3.5 character times implemented as a multiple of character times at the baud rate being used on the network (indicated as t1t2t3t4 below). The first field transmitted is the device address. The allowable characters transmitted for all fields are hexadecimal values 0-9, A-F. A networked device continuously monitors the network, including the silent intervals, and when the first field is received (the address), the device decodes it to determine if it is the addressed device. Following the last character transmitted, a similar silent interval of 3.5 character times marks the end of the message and a new message can begin after this interval. A typical message frame is shown below.

RTU Message Frame

Start	**Addr.**	**Function**	**Data**	**CRC**	**End**
t1t2t3t4	8 bits	8 bits	nx8 bits	16 bits	t1t2t3t4

The entire message must be transmitted as a continuous stream. If a silent interval of more than 1.5 character times occurs before completion of the frame, the receiving device flushes the incomplete message and assumes the next byte will be the address field of a new message.

In similar fashion, if a new message begins earlier than 3.5 character times following a previous message, the receiving device assumes it is a continuation of the previous message. This will generate an error, as the value in the final CRC field will not be valid for the combined messages.

How Characters Are Transmitted Serially

When messages are transmitted on Modbus serial networks, each character or byte is sent in the order of Least Significant Bit (LSB) to Most Significant Bit (MSB) as outlined below (left to right):

RTU Character Framing (No Parity)

Start	0	1	2	3	4	5	6	7	Stop	Stop

RTU Character Framing (With Parity)

Start	0	1	2	3	4	5	6	7	Parity	Stop

Note that an additional stop bit is transmitted to fill out the character frame for no parity.

Modbus Addresses

The master device addresses a specific slave device by placing the 8-bit slave address in the address field of the message. Valid addresses are from 1-247. When the slave responds, it places its own address in this field of its response to let the master know which slave is responding. Address 0 is reserved for the broadcast address, which all slave devices on a network recognize. A slave does not issue a response to broadcast messages. Further, not all function messages support the broadcast address.

With respect to data addresses, all data addresses in Modbus messages are referenced to 0, with the first occurrence of a data item addressed as item number zero. Further, a function code field already specifies which register group it is to operate on (i.e. 0x, 1x, 3x, or 4x reference addresses). For example, holding register 40001 is addressed as register 0000 in the data address field of the message. The function code that operates on this register specifies a “holding register” operation and the “4xxxx” reference is implied. Holding register 40108 is addressed as register 006BH (107 decimal).

Modbus Functions

The function code field of a message frame contains the 8 bits that tell the slave what kind of action to take. Valid codes are in the range 1-255. Not all codes apply to a module and some codes are reserved for future use. The following table highlights the subset of standard Modbus functions supported by the Model DI-904MB/DI-905MB/DI-906MB modules (the reference register addresses that the function operates on are also indicated):

Code	Function	Reference
01 (01H)	Read Coil (Output) Status	0xxxx
02 (02H)	Read Input Status	1xxxx
03 (03H)	Read Holding Registers	4xxxx
04 (04H)	Read Input Registers	3xxxx
05 (05H)	Force Single Coil (Output)	0xxxx
06 (06H)	Preset Single Register	4xxxx
08 (08H)	Reset Slave	Hidden
15 (0FH)	Force Multiple Coils (Outputs)	0xxxx
16 (10H)	Preset Multiple Registers	4xxxx
17 (11H)	Report Slave ID	Hidden

These functions are used to access the registers outlined in the Register Map for sending and receiving data as described in the previous chapter. Note that the Report Slave ID and Reset Slave commands do not operate on register map registers.

When the slave device responds to the master, it uses the function code field to indicate either a normal (error-free) response, or that some kind of error has occurred (an exception response). A normal response simply echoes the original function code of the query, while an exception response returns a code that is equivalent to the original function code with its most significant bit (msb) set to a logic 1. For example, the Read Holding Registers command has the function code 0000 0011 (03H). If the slave device takes the requested action without error, it returns the same code in its response. However, if an exception occurs, it returns 1000 0011 (83H) in the function code field and also appends a unique code in the data field of the response message that tells the master device what kind of error occurred, or the reason for the exception (See Modbus Exceptions). The master's application program must handle the exception response. It may choose to post subsequent retries of the original message, it may try sending diagnostic messages to the slave, or it may simply notify the operator an exception error has occurred.

The following paragraphs describe the Modbus functions supported by Model DI-904MB/DI-905MB/DI-906MB modules. Note that not all commands apply to each model.

Read Coil Status (01) (DI-905MB & DI-906MB Models Only)

This command will read the ON/OFF status of discrete outputs or coils (0x reference addresses) in the slave. For DI-905MB/DI-906MB models, its response is equivalent to the gate signal of the n-channel mosfet that drives the output. On DI-906MB models which include tandem input channels, you can read the corresponding input via the Read Input Status command to determine the actual state of the source lead via closed-loop feedback. Broadcast transmission is not supported.

The Read Coil Status query specifies the starting coil (output channel) and quantity of coils to be read. Coils correspond to the discrete open-source outputs of these models and are addressed starting from 0 (up to 12 coils are addressed as 0-11).

The Read Coil Status in the response message is packed as one coil or channel per bit of the data field. The output status is indicated as 1 for ON (sourcing current), and 0 for OFF (not conducting). The LSB of the first data byte corresponds to the status of the coil addressed in the query. The other coils follow sequentially, moving toward the high order end of the byte, and from low order to high order in any subsequent byte. If the returned coil quantity is not eight, the remaining bits of the data byte will be set to zero toward the unused high order end of the byte.

The following example reads the output channel status of coils 0-11 at slave device 247:

Read Coil Status Example Query

Field Name	Example Value (Hex)
Slave Address	247 (F7)
Function Code	1 (01)
Starting Address High Order	0 (00)
Starting Address Low Order	0 (00)
Number Of Points High Order	0 (00)
Number Of Points Low Order	12 (0C)
Error Check (LRC or CRC)	--

Read Coil Status Example Response

Field Name	Example Value (Hex)
Slave Address	247 (F7)
Function Code	1 (01)
Byte Count	2 (02)
Data (Coils 7-0)	170 (AA)
Data (Coils 11-08)	10 (0A)
Error Check (LRC or CRC)	--

Note that the leading character of the 0x reference address is implied by the function code and omitted from the address specified. In this example, the first address is 00001 and referenced via 0000H and this corresponds to coil 0.

To summarize, the status of coils 7-0 is shown as the byte value AA hex, or 10101010 binary. Coil 7 is the MSB of this byte, and coil 0 is the LSB of this byte. Reading left to right, the output status of coils 7.0 is ON-OFF-ON-OFF-ON-OFF-ON-OFF. This is summarized as follows:

Bin	1	0	1	0	1	0	1	0
Hex	A				A			
Coil	7	6	5	4	3	2	1	0

In the last (second) data byte, the status of coils 11..8 is shown as the byte value 0A hex, or binary 0000 1010. Coil 11 is the fifth bit position from the left and coil 08 is the LSB of this byte. The four remaining bits (toward the high-order end) are zero.

Bin	0	0	0	0	1	0	1	0
Hex	A				A			
Coil	NA	NA	NA	NA	11	10	9	8

Read Input Status (02) (DI-904MB & DI-906MB Models Only)

This command will read the binary ON/OFF status of discrete inputs (1x reference addresses) in the slave device. On DI-906MB models which have tandem input/output channels, you can read the corresponding state of the output source lead via closed-loop feedback with this command. Broadcast transmission is not supported.

The Read Input Status query specifies the starting discrete input channel and quantity of inputs to be read. Inputs are addressed starting from 0 (up to 12 inputs addressed as 0-11). Note that for DI-906MB models, and unlike the Read Coil Status command, this command reflects the actual state of the output source lead, rather than the gate control signal that turns the output ON.

The Read Input Status in the response message is packed as one input channel per bit of the data field. Inputs of these models are asserted high. That is, the input status is indicated as 1 for ON (output sourcing current or a high input signal), and 0 for OFF (output not conducting or a low input signal). The LSB of the first data byte corresponds to the status of the input addressed in the query. The other coils follow sequentially, moving toward the high order end of the byte, and from low order to high order in any subsequent byte. If the returned coil quantity is not eight, the remaining bits of the data byte will be set to zero toward the unused high order end of the byte. The following example reads the input channel status of digital inputs 0-11 at slave device 247:

Read Input Status Example Query

Field Name	Example Value (Hex)
Slave Address	247 (F7)
Function Code	2 (02)
Starting Address High Order	0 (00)
Starting Address Low Order	0 (00)
Number Of Points High Order	0 (00)
Number Of Points Low Order	12 (0C)
Error Check (LRC or CRC)	--

Read Input Status Example Response

Field Name	Example Value (Hex)
Slave Address	247 (F7)
Function Code	2 (02)
Byte Count	2 (02)
Data (Coils 00-07)	170 (AA)
Data (Coils 11-08)	10 (0A)
Error Check (LRC or CRC)	--

Note that the leading character of the 1x reference address is implied by the function code and omitted from the address specified. In this example, the first address is 10001 and referenced via 0000H and this corresponds to input channel 0.

To summarize, the status of inputs 07-00 is shown as the byte value AA hex, or 10101010 binary. Coil 07 is the MSB of this byte, and coil 00 is the LSB of this byte. Reading left to right, the input status of channels 07..00 is ON-OFF-ON-OFF-ON-OFF-ON-OFF, or HI-LO-HI-LO-HI-LO-HI-LO if referring to actual input signal levels (inputs of this

model are asserted/ON high). In the last (second) data byte, the status of channels 11..08 is shown as the byte value 0A hex, or binary 0000 1010. Channel 11 is the fifth bit position from the left and channel 08 is the LSB of this byte. The four remaining bits (toward the high-order end) are filled with zeros.

Read Holding Registers (03)

This command will read the binary contents of holding registers (4x reference addresses) in the slave device. Broadcast transmission is not supported.

The Read Holding Registers query specifies the starting register and quantity of registers to be read. Note that registers are addressed starting at 0 (registers 1-16 are addressed as 0-15).

The Read Holding Registers response message is packed as two bytes per register, with the binary contents right-justified in each byte. For each register, the first byte contains the high order bits and the second byte the low order bits.

The following example reads holding registers 40001…40003 (slave address, baud rate, and parity) at slave device 247:

Read Holding Register Example Query

Field Name	Example Value (Hex)
Slave Address	247 (F7)
Function Code	3 (03)
Starting Address High Order	0 (00)
Starting Address Low Order	0 (00)
Number Of Points High Order	0 (00)
Number Of Points Low Order	3 (03)
Error Check (LRC or CRC)	--

Read Holding Register Example Response

Field Name	Example Value (Hex)
Slave Address	247 (F7)
Function Code	3 (03)
Byte Count	6 (06)
Data High (Register 40001)	0 (00)
Data Low (Register 40001)	247 (F7)
Data High (Register 40002)	0 (00)
Data Low (Register 40002)	2 (02)
Data High (Register 40003)	0 (00)
Data Low (Register 40003)	1 (01)
Error Check (LRC or CRC)	--

To summarize, the contents of register 40001 (two bytes) is slave address 247 (00F7H). The contents of register 40002 (two bytes) is the baud rate setting 2 (9600bps). The contents of register 40003 is the parity setting 1 (Odd parity).

Read Input Registers (04)

This command will read the binary contents of input registers (3x reference addresses) in the slave device. Broadcast transmission is not supported.

The Read Input Registers query specifies the starting register and quantity of registers to be read. Note that registers are addressed starting at 0 (registers 1-16 are addressed as 0-15).

The Read Input Registers response message is packed as two bytes per register, with the binary contents right-justified in each byte. For each register, the first byte contains the high order bits and the second byte the low order bits.

The following example reads the module status register 30001 (flash checksum error flag, default mode flag, and port watchdog timeout flags) at slave device 247:

Read Input Register Example Query

Field Name	Example Value (Hex)
Slave Address	247 (F7)
Function Code	4 (04)

Read Input Register Example Response

Field Name	Example Value (Hex)
Slave Address	247 (F7)
Function Code	4 (04)

Starting Address High Order	0 (00)
Starting Address Low Order	0 (00)
Number Of Points High Order	0 (00)
Number Of Points Low Order	1 (01)
Error Check (LRC or CRC)	--

Byte Count	2 (02)
Data High (Register 30001)	0 (00)
Data Low (Register 30001)	0 (00)
Error Check (LRC or CRC)	--

To summarize, the contents of register 30001 (two bytes) indicates that no flags are set (0000H). That is, no checksum error is present, the module is not in the default mode, and no port timeouts have occurred.

Force Single Coil (05) (DI-905MB & DI-906MB Models Only)

This command will force a single coil/output (0x reference address) ON or OFF. For broadcast transmission, this function forces the same coil in all networked slaves.

The Force Single Coil query specifies the coil reference address to be forced, and the state to force it to. The ON/OFF state is indicated via a constant in the query data field. A value of FF00H forces the coil to be turned ON (i.e. the gate of the corresponding mosfet is set high), and 0000H forces the coil to be turned OFF (i.e. the gate of the corresponding output mosfet is set low). All other values are illegal and will not affect the coil. Note that coils are referenced starting at 0-up to 12 coils are addressed as 0-11 and this also corresponds to the output channel number.

The following example forces coil 9 ON (output 9) at slave device 247:

Force Single Coil Example Query

Field Name	Example Value (Hex)
Slave Address	247 (F7)
Function Code	5 (05)
Coil Address High Order	0 (00)
Coil Address Low Order	9 (09)
Force Data High Order	255 (FF)
Force Data Low Order	0 (00)
Error Check (LRC or CRC)	--

Force Single Coil Example Response

Field Name	Example Value (Hex)
Slave Address	247 (F7)
Function Code	5 (05)
Coil Address High Order	0 (00)
Coil Address Low Order	9 (09)
Force Data High Order	255 (FF)
Force Data Low Order	0 (00)
Error Check (LRC or CRC)	--

The Force Single Coil response message is an echo of the query as shown above, returned after executing the force coil command. No response is returned to broadcast queries from a master device.

Preset Single Register (06)

This command will preset a single holding register (4x reference address) to a specific value. Broadcast transmission is supported by this command and will act to preset the same register in all networked slaves.

The Preset Single Register query specifies the register reference address to be preset, and the preset value. Note that registers are addressed starting at 0--registers 1-16 are addressed as 0-15. The Preset Single Registers response message is an echo of the query, returned after the register contents have been preset. No response is returned to broadcast queries from a master device. The following example writes a baud rate of 9600bps to holding register 40002 (Baud Rate) at slave device 247:

Preset Holding Register Example Query

Field Name	Example Value (Hex)
Slave Address	247 (F7)
Function Code	6 (06)
Register Address High Order	0 (00)

Preset Holding Register Example Response

Field Name	Example Value (Hex)
Slave Address	247 (F7)
Function Code	6 (06)
Register Address High Order	0 (00)

Register Address Low Order	1 (01)
Preset Data High Order	0 (00)
Preset Data Low Order	2 (02)
Error Check (LRC or CRC)	--

Register Address Low Order	1 (01)
Preset Data High Order	0 (00)
Preset Data Low Order	2 (02)
Error Check (LRC or CRC)	--

Force Multiple Coils (15) (DI-905MB & DI-906MB Models Only)

This command will simultaneously force a sequence of coils (0x reference addresses) either ON or OFF. Broadcast transmission is supported by this command and will act to force the same block of coils in all networked slaves.

The Force Multiple Coils query specifies the starting coil reference address to be forced, the number of coils, and the force data to be written in ascending order. The ON/OFF states are specified by the contents in the query data field. A logic 1 in a bit position of this field requests that the coil turn ON, while a logic 0 requests that the corresponding coil be turned OFF. Unused bits in a data byte should be set to zero. Note that coils are referenced starting at 0-up to 12 coils are addressed as 0-11 and this also corresponds to the output channel number.

The Force Multiple Coils normal response message returns the slave address, function code, starting address, and the number of coils forced, after executing the force instruction. Note that it does not return the byte count or force value.

The following example forces odd-numbered coils (outputs) OFF & even-numbered coils ON, for coils 0-11 at slave 247:

Force Multiple Coils Example Query

Field Name	Example Value (Hex)
Slave Address	247 (F7)
Function Code	15 (0F)
Coil Address High Order	0 (00)
Coil Address Low Order	0 (00)
Number Of Coils High Order	0 (00)
Number Of Coils Low Order	12 (0C)
Byte Count	02
Force Data High (First Byte)	170 (55)
Force Data Low (Second Byte)	5 (05)
Error Check (LRC or CRC)	--

Note that the leading character of the 0x reference address is implied by the function code and omitted from the address specified. In this example, the first address is 00001, corresponding to coil 0, and referenced via 0000H. Thus, the first byte transmitted will address coils 7...0, with the least significant bit addressing the lowest coil in this set as follows:

Bin	0	1	0	1	0	1	0	1
Hex	5				5			
Coil	7	6	5	4	3	2	1	0

The second byte transmitted will address coils 11...8, with the least significant bit addressing the lowest coil in this set as follows (note that the four unused upper bits in the second data byte are set to zero):

Bin	0	0	0	0	0	1	0	1
Hex	0				5			
Coil	NA	NA	NA	NA	11	10	9	8

Force Multiple Coils Example Response

Field Name	Example Value (Hex)
Slave Address	247 (F7)
Function Code	15 (0F)

Coil Address High Order	0 (00)
Coil Address Low Order	0 (00)
Number Of Coils High Order	0 (00)
Number Of Coils Low Order	12 (0C)
Error Check (LRC or CRC)	--

The normal response returns the slave address, function code, starting coil address, and quantity of coils forced, after executing the force instruction. It does not return the byte count or force data. No response is returned to broadcast queries from a master device.

Preset Multiple Registers (16)

This command will preset a block of holding registers (4x reference addresses) to specific values. Broadcast transmission is supported by this command and will act to preset the same block of registers in all networked slaves.

The Preset Multiple Registers query specifies the starting register reference address, the number of registers, and the data to be written in ascending order. Note that registers are addressed starting at 0--registers 1-16 are addressed as 0-15.

The normal Preset Multiple Register response message returns the slave address, function code, starting register address, and the number of registers preset, after the register contents have been preset. It does not echo the preset values.

The following example writes a new slave address of 200, a baud rate of 28800bps, and sets parity to even, by writing to holding registers 40001 through 40003 at slave device 247 (changes to these parameters will take effect following a reset of the module):

Preset Multiple Registers Example Query

Field Name	Example Value (Hex)
Slave Address	247 (F7)
Function Code	16 (10)
Starting Register High Order	0 (00)
Starting Register Low Order	0 (00)
Number Of Registers High Order	0 (00)
Number Of Registers Low Order	3 (03)
Preset Data High (First Register)	0 (00)
Preset Data Low (First Register)	200 (C8)
Preset Data High (Second Reg)	0 (00)
Preset Data Low (Second Reg)	5 (05)
Preset Data High (Third Reg)	0 (00)
Preset Data Low (Third Reg)	2 (02)
Error Check (LRC or CRC)	--

Preset Multiple Registers Example Response

Field Name	Example Value (Hex)
Slave Address	247 (F7)
Function Code	16 (10)
Starting Register High Order	0 (00)
Starting Register Low Order	0 (00)
Number Of Registers High Order	0 (00)
Number Of Registers Low Order	3 (03)
Error Check (LRC or CRC)	--

The response simply echoes the query without returning the preset values after the register contents have been preset. No response is returned to broadcast queries from a master device.

Report Slave ID (17)

This command returns the model number, serial number, and firmware number for the slave device, the status of the Run indicator, and any other information specific to the device. This function does not operate on register map registers. Broadcast transmission is not supported.

The Report Slave ID query simply sends the slave address and function code with error check (CRC or LRC) as follows:

Report Slave ID Example Query

Field Name	Example Value (Hex)
Slave Address	247 (F7)
Function Code	17 (11)
Error Check (LRC or CRC)	--

Report Slave ID Example Response

Field Name	Example Value (Hex)
Slave Address	247 (F7)
Function Code	17 (11)
Byte Count	26 (1A)
Slave ID	0 (00H) = 924MB-0900 1 (01H) = 913MB-0900 2 (02H) = 914MB-0900 3 (03H) = 917MB-0900 4 (04H) = 918MB-0900 5 (05H) = 901MB-0900 6 (06H) = 902MB-0900 7 (07H) = 903MB-0900 8 (08H) = 904MB-0900 9 (09H) = 905MB-0900 10 (0AH) = 906MB-0900
Run Indicator Status (ON)	255 (FF) 00=OFF, FF=ON
Firmware Number ASCII Byte String (Additional Data Field)	"ACROMAG,9300-035A, 906MB-0900,"(41 43 52 4F 4D 41 47 2C 39 33 30 30 2D 30 33 35 41 2C 39 30 36 4D 42 2D 30 39 30 30 2CH)
Serial Number ASCII Byte String (Unique Per Module)	Six Numbers + Revision"123456A"(31 32 33 34 35 36 41H)
Error Check (LRC or CRC)	--

The Report Slave ID response message returns the slave model ID and firmware number string as shown above.

Reset Slave (08)

This command is used to trigger a reset of the module and its effect is equivalent to a power-on reset of the module. Note that changes to baud rate, slave address, and parity are initiated following reset. The Reset Slave command uses sub-function 01 (Restart Communications) of the standard Modbus Diagnostics Command (08) to accomplish a module reset. This function does not operate on register map registers. Broadcast transmission is not supported.

The Reset Slave query simply sends the slave address, function code, sub-function code, and data (data is ignored and simply echoed back), with error check (CRC LRC). A Reset Slave response is simply an echoed acknowledge that is returned just before the reset is executed. Allow a few seconds following reset to re-initiate communication a module.

Reset Slave Example Query

Field Name	Example Value (Hex)
Slave Address	247 (F7)

Reset Slave Example Response (Sent Prior To Reset)

Field Name	Example Value (Hex)
Slave Address	247 (F7)

Function Code	08 (08)
Sub-Function High Order Byte	0 (00)
Sub-Function Low Order Byte	1 (01)
Data Field High-Order Byte	0 (00)
Data Field Low Order Byte	0 (00)
Error Check (LRC or CRC)	--

Function Code	08 (08)
Sub-Function High Order Byte	0 (00)
Sub-Function Low Order Byte	1 (01)
Data Field High-Order Byte	0 (00)
Data Field Low Order Byte	0 (00)
Error Check (LRC or CRC)	--

Note that the response simply echoes the query just before the reset is triggered.

For Modbus software that does not support the Reset Slave function, an alternate method of generating a module reset is provided via a write to the Module Reset Register (See Reset Module Register 40011 of Register Map).

Modbus Data Field

The data field of a message frame contains a multiple of 8 bits that provides the slave with any additional information the slave requires to complete the action specified by the function code. The data field typically includes register addresses, count values, and written data. The data field can be nonexistent (zero length) as not all messages require data.

If no error occurs, the data field of a response from a slave will return the requested data. If an error occurs, the data field returns an exception code (see Modbus Exceptions) that the master application can use to determine the next action to take.

Supported Data Types

All I/O values are accessed via 16-bit Input Registers or 16-bit Holding Registers (see Register Map). Input registers contain information that is read-only. For example, the current input value read from a channel, or the states of a group of digital inputs. Holding registers contain read/write information that may be configuration data or output data. For example, the high limit value of an alarm function operating at an input, or an output value for an output channel.

I/O values for DI-900MB models are represented by the following simple data types for count values, temperature, percentage, and discrete on/off.

Summary Of Data Types Used By DI-900MB Modules

Data Types	Description
Count Value	A 16-bit signed integer value representing an A/D count, a DAC count, or a time value with a range of -32768 to +32767.
Percentage	A 16-bit signed integer value with resolution of 0.005%/lsb. ±20000 is used to represent ±100%. For example, -100%, 0% and +100% are represented by decimal values -20000, 0, and 20000, respectively. The full range is -163.84% (-32768 decimal) to +163.835% (+32767 decimal).
Temperature	A 16-bit signed integer value with resolution of 0.1°C/lsb. For example, a value of 12059 is equivalent to 1205.9°C, a value of -187 equals -18.7°C. The maximum possible temperature range is -3276.8°C to +3276.7°C.
Discrete	A discrete value is generally indicated by a single bit of a 16-bit word. The bit number/position typically corresponds to the discrete channel number for this model. Unless otherwise defined for outputs, a 1 bit means the corresponding output is closed or ON, a 0 bit means the output is open or OFF. For inputs, a value of 1 means the input is in its high state (usually >> 0V), while a value of 0 specifies the input is in its low state (near 0V).

Modbus Error Checking Fields

Modbus networks employ two methods of error checking: parity checking (even or odd parity, or none), and frame checking (Cyclical Redundancy Check).

Parity Checking

A Modbus device can be configured for Even or Odd parity checking, or for no parity checking, and this determines how the parity bit of the data frame is set.

If even or odd parity checking is selected, the number of 1 bits in the data portion of each character frame is counted. Each character in RTU mode contains 8 bits. The parity bit will then be set to a 0 or a 1, to result in an even (Even parity), or odd (Odd parity) total number of 1 bits. For example, if an RTU character frame contains the following eight data bits: 1100 0011, then since the total number of 1 bits is 4 (already an even number), the frame's parity bit will be 0 if even parity is selected. If odd parity is used, then the parity bit will be set to 1, making the total number of bits an odd number (five).

When a message is transmitted, the parity bit is calculated and applied to the frame of each character transmitted. The receiving device counts the quantity of 1 bits in the data portion of the frame and sets an error flag if the count differs from that sent. As such, parity checking can only detect an error if an odd number of bits are picked up or dropped off from a character frame during transmission. For example, if odd parity is employed and two 1 bits are dropped from a character, the result is still an odd count of 1 bits. Note that all devices on a Modbus network must use the same parity.

If no parity checking is selected, then no parity bit is transmitted and no parity check is made. An additional stop bit is transmitted to fill out the character frame for the no parity selection.

CRC Error Checking

RTU Mode message frames include an error checking method that is based on a Cyclical Redundancy Check (CRC). The error checking field of a frame contains a 16-bit value (two 8-bit bytes) that contain the result of a Cyclical Redundancy Check (CRC) calculation performed on the message contents.

The CRC value is calculated by the transmitting device and is appended to the message as the last field in a message-the low order byte is appended first, followed by the high-order byte. Thus, the CRC high-order byte is the last byte to be sent in a message. The receiving device calculates a CRC during receipt of a message and compares the calculated value to that received in the CRC field. If the two values differ, an error results.

The CRC is started by first preloading the 16-bit CRC register to all 1’s. Successive 8-bit bytes of the message (only the 8-data bits in each character--no start, stop, or parity bits) are applied to the current contents of the register, and each 8-bit character is exclusive OR'ed with the register contents. The exclusive OR result is shifted in the direction of the least significant bit (lsb) of the CRC, with a zero placed into the most significant bit (msb). The lsb is then extracted and examined, if the lsb is a 1, the register is exclusive OR'ed with a preset fixed value. If the lsb is a 0, no exclusive OR takes place. This process is repeated until 8 shifts have been performed. After the last (eighth) shift, the next 8-bit byte is exclusive OR’ed with the register’s current contents, and the process repeats itself for 8 more shifts as described above. The final contents of the CRC register after all the message bytes have been applied is the CRC value.

Modbus Exceptions

If an unsupported function code is sent to a module, then the exception code 01 (Illegal Function) will be returned in the data field of the response message. If a holding register is written with an invalid value, then exception code 03 (Illegal Data Value) will be returned in the response message. The following table lists possible exception codes:

Modbus Exception Codes

Code	Exception	Description
01	Illegal Function	The function code received in the query is not allowed or invalid.
02	Illegal Data Address	The data address received in the query is not an allowable address for the slave or is invalid.
03	Illegal Data Value	A value contained in the query data field is not an allowable value for the slave or is invalid.

04	Slave Device Failure	An unrecoverable error occurred while the slave was attempting to perform the requested action.
05	Acknowledge	The slave has accepted the request and is processing it, but a long duration of time is required to do so. This response is returned to prevent a timeout error from occurring in the master.
06	Slave Device Busy	The slave is engaged in processing a long-duration program command. The master should retransmit the message later when the slave is free.
07	Negative Acknowledge	The slave cannot perform the program function received in the query. This code is returned for an unsuccessful programming request using function code 13 or 14 (codes not supported by these models). The master should request diagnostic information from the slave.
08	Memory Parity Error	The slave attempted to read extended memory, but detected a parity error in memory. The master can retry the request, but service may be required at the slave.

In a normal response, the slave echoes the function code of the original query in the function field of the response. All function codes have their most-significant bit (msb) set to 0 (their values are below 80H). In an exception response, the slave sets the msb of the function code to 1 in the returned response (i.e. exactly 80H higher than normal) and returns the exception code in the data field. This is used by the master's application to recognize an exception response and examine the data field for the exception code.

6. Module Software Configuration

As shipped from the factory, each module has a default configuration as detailed in Module Installation. Your application will likely differ from the default configuration and the module will need to be reconfigured. Series DI-900MB modules may be configured by issuing the appropriate Modbus functions to the Register Map registers, as required to configure the unit. However, it is much simpler to use the DI-900MB Configuration Software to program & control module parameters and operating modes. This software is easy to use, self-explanatory, and complete configuration only takes a few minutes. On-line and context-sensitive help are built-in. As such, a comprehensive guide to the use of this program is not necessary. However, to begin configuration, you should already be familiar with Windows operation and have a basic understanding of module terminology as it relates to this model.

Before You Begin

1. Have you installed the DI-900MB Configuration Program? Be sure to complete the Module Installation section of this manual before proceeding.

2. Check that all necessary electrical connections have been made and that power is applied (module's green LED ON).

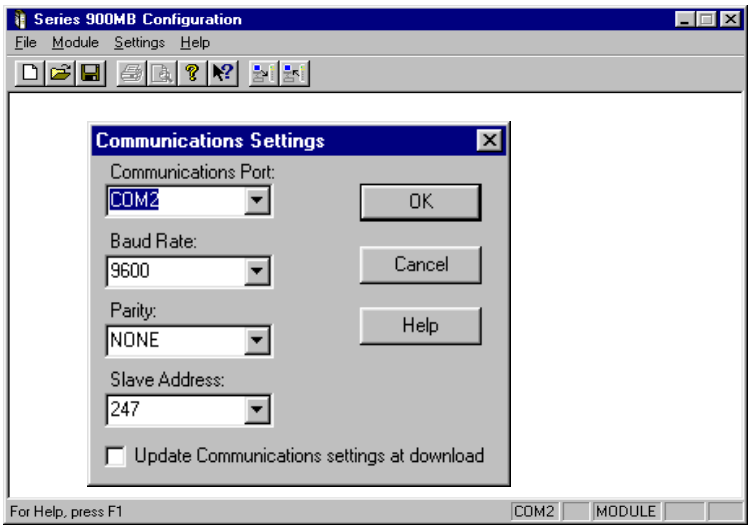
3. Have you set the correct baud rate at the RS485 converter (or repeater if used)?

4. Have you tried communicating using the Default Communication Mode? Press the “DFT” push-button of the module until the yellow status LED is flashing. This sets the module's communication parameters to 9600 baud, a slave address of 247, no parity, and two stop bits.

5. If you fail to communicate with the module or have a high degree of communication errors, try increasing the response delay time (See Response Delay Register 40011). Some network converters or host/software systems cannot accept an immediate response from a slave device without the additional delay provided via this parameter.

The following sections guide you through the DI-900MB Configuration Program property sheets used to configure the DI-904MB/DI-905MB/DI-906MB I/O Modules. Because these units perform simple digital I/O, configuration is simplified. Property sheets vary slightly from model to model, but the general approach is the same. Refer to the on-line Help feature if you have trouble understanding parameters unique to your module.

Starting The Program



After clicking on the Series DI-900MB program icon to boot the Configuration Program, a screen will be displayed similar to that shown at right.

To begin, click on the "Settings-Serial Communications…" pull-down menu (or press Ctrl-E) to set the COM port, baud rate, parity, and slave address that the host computer will use to communicate with the module. Optionally, you can check the "Update Communications settings at download" box to automatically change the host settings to match the module if new settings are later downloaded to the module (recommended to conveniently maintain communication with a module following reconfiguration).

Note that the host COM port selected is indicated in the first box of the lower right-hand corner. MODULE is indicated in the third box if a connected module is detected by the software. The fourth and fifth boxes indicate NUM for Num lock and CAP for Caps lock, respectively.

File
- New...
- Open...
- Save
- Save As...
- Print...
- Print Preview
- Print Setup...
- *Recent File Indicated*
- Exit

Use **File-New** to create a new configuration file. You will be prompted to select a model number. Use **File-Open** to open an existing configuration file.

Use **File-Save** to save the current configuration file to disk. Use **File-Save As** to save the current configuration file to a new file name.

Use **File-Print** to get a printout of the currently loaded configuration file. Use **File-Print Preview** to view the current configuration or preview the print documentation. Use **File-Print-Setup** to select a printer and font style.

Module

- Upload Configuration
- Download Configuration

Use **Module-Upload Configuration** to upload the module's current configuration and calibration.

Use **Module-Download Configuration** to write the currently loaded configuration to the module.

Settings

Serial Communications...
- Communications Port
- Host Baud Rate
- Host Parity
- Slave Address

Use the **Communications Port** Scroll Window to select the host COM port the module is connected to (COM1-COM4), or type in a COM port as required, from COM1 to COM99. The selected COM port is indicated in the lower right-hand corner of the screen.

Use the **Baud Rate** scroll window to select the baud rate to be used by the host in communicating with the module.

Use the **Parity** scroll window to select Odd, Even, or No Parity checking by the software for data transfer.

Use the **Slave Address** scroll window to tell the software which module to address.

If you wish to maintain communications with a module following download, you should check the **"Update Communications settings at download"** box of the Settings window to keep the host in synch with a module if the module settings are changed.

If the module is in the Default Mode (indicated via a flashing status LED), the baud rate, address, and parity assumed by the module are fixed at 9600bps, 247, and No Parity. You must use the same settings as the connected module.

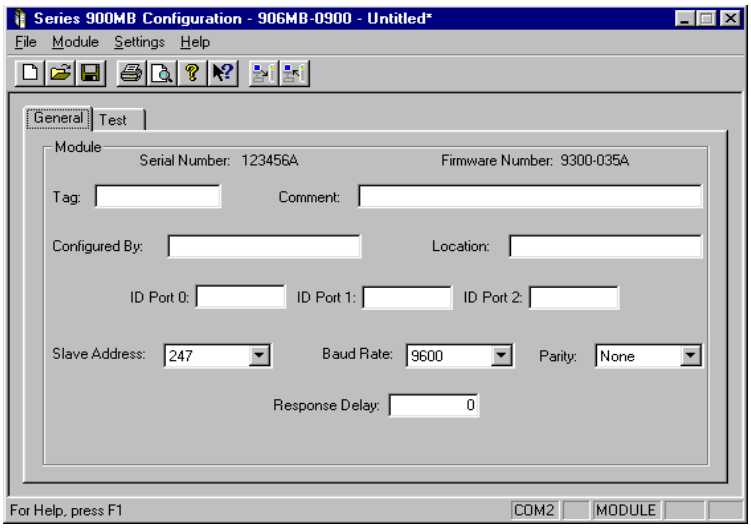
Help

Configuration Help Topics
Your Model Help Topics
About Modbus Configuration
About *Your Model*

Use **Help** to obtain information about using this software or configuring transmitters. Note that context sensitive help (?) is also available for help on a specific field or topic. Simply click on the [?] button, then click on the field or topic of interest to obtain help on that subject. You may also click the right mouse button to copy or print the help screen while it is being displayed.

The following sections review the configuration of a Model DI-903MB transmitter module. Configuration of your model should be similar.

Creating A Configuration File



You may use File-New to create a new configuration file, or File-Open to open an existing configuration file. You may also use Module-Upload Configuration to retrieve the current active configuration from the module connected (recommended).

Uploading first is recommended as it will automatically detect the correct model connected and load the property sheets for that model.

Once you create, open, or upload a configuration file, a screen similar to the one shown at right will be displayed. The model number is indicated at the top of the screen along with the current file name. Model DI-906MB Configuration is shown here. Your screen will vary according to your model number.

Note that only 2 property sheets define this transmitter's configuration: General and Test.

Module

The Serial and Firmware numbers are indicated at the top of the General screen and cannot be modified.

For "Tag:", enter up to 15 alphanumeric characters (optional).

For "Comment:", enter up to 31 alphanumeric characters (optional).

For “Configured By:”, enter your name up to 15 alphanumeric characters (optional).

You can also add a “Location:” note of up to 25 alphanumeric characters (optional).

For “Port ID:”, enter up to 15 alphanumeric characters of identification information relative to the port (optional).

Use the **“Slave Address”** scroll bar to select a new module address that will take effect following download. Select from 1 to 247. Address 247 is reserved for Default Mode.

Use the **“Baud Rate”** scroll bar to select a new baud rate to be used by the module following download. Select 2400, 4800, 9600 (Default Mode), 14400, 19200, 28800, 38400, 57600, 76800, or 115200 bits per second.

Use the **“Parity”** scroll bar to select Odd, Even, or No Parity (Default Mode) error checking by the module.

Use the **“Response Delay”** field to specify a delay from 0 to 65500 ticks with 1 tick equal to 1.085 micro-seconds. Response delay is the additional turnaround delay applied between message receipt by the module and its response to the host. A fixed amount of delay is already present and varies with the model. Thus, you will have to specify a comparable amount of response delay to measure any affect. Some host software or signal converters require additional delay to work properly.

Note that slave address, baud rate, parity, and response delay selections take effect following the next module reset and do not alter the settings used by the host software (which are configured separately via the **Settings** menu).

If you checked the “Update Communications settings at download” box of the Settings pull-down menu, the host software will automatically change its own settings to match the module settings that take effect following a download in an effort to easily maintain communication with the module. Otherwise, you must change the host Settings separately after downloading to match the new module settings.

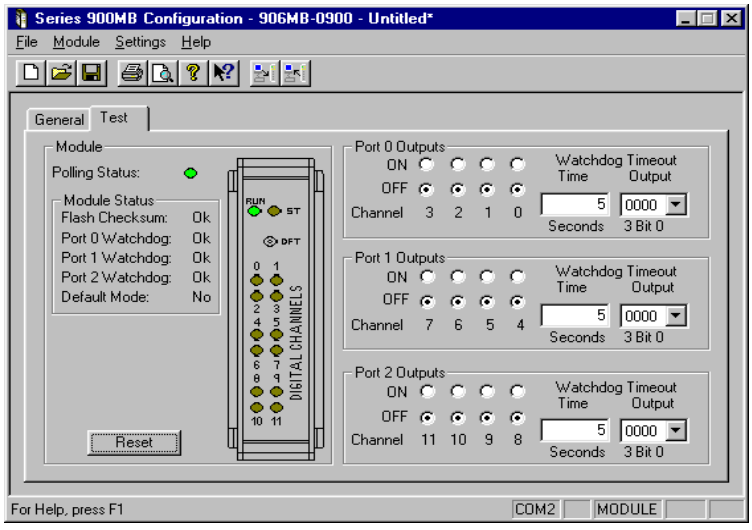
If the module is in Default Mode (indicated via a flashing status LED), the baud rate, address, and parity of the module are fixed at 9600bps, 247, and No Parity.

The Test Screen of the next page also provides configuration information with respect to the port watchdog timers and output timeout states.

Watchdog Timer and Testing

The “Test” portion of this program allows you to monitor polling, module status flags, reset the module, control output states, and monitor input states.

This page is also used to configure the port watchdog time and the timeout reset states for the port.



Port I/O Watchdog Timer

The right half of this screen allows you to configure the Port I/O Watchdog Timer. A watchdog timeout is triggered if no channel read or write occurs for one or more port channels, within the timeout period specified. A timeout is cleared and the timer reinitiated when a port channel read or write occurs. Clearing a timeout does not return the outputs to their pre-timeout state. They retain their current state until otherwise written.

Use the port 0, 1, & 2 **“Timeout Output”** scroll bar to select the timeout binary pattern to program the port outputs to following a timeout. A pattern of four bits is selected via this scroll bar and represents the ON (1) and OFF (0) states

the port output channels are to be sent to following a watchdog timeout. The lsb corresponds to the lowest numbered port channel. Select "None" if you want the port outputs to remain in their current states upon timeout.

Use the port 0, 1, & 2 **"Watchdog Time"** field to specify a watchdog timeout period up to 65534 seconds (18.2 hours). A value of 0 or 65535 will disable the port watchdog function and "Disabled" will be indicated below the Watchdog Time field.

Note that when this screen is selected, the module channels are continuously polled. Thus, you are not likely to ever encounter a watchdog timeout with this screen displayed.

Testing Your Operation

This screen also allows you to monitor polling, module status flags, reset the module, control output states, and monitor input states.

For each I/O channel, the current true input state is reflected via the simulated LED's of the module graphics. If polling cannot be achieved, the last received I/O states are indicated.

For DI-906MB models, input buffers are connected in tandem with open-source outputs for convenient loopback monitoring of the output state. The drain leads of each port output channel are tied in common to the port excitation lead (EXC). An external excitation supply must be connected between the port EXC and COM terminals. Turning an output ON connects the I/O lead to the excitation supply via the output mosfet. The inputs are active-high, as the outputs are high-side switches. The DI-904MB is the same as the DI-906MB, but has outputs removed. The DI-905MB is the same as the DI-906MB, but has inputs removed.

The output state of each port output channel is set via the "ON" or "OFF" bullet (DI-905MB & DI-906MB units only). Simply click ON or OFF as desired to turn the corresponding output ON or OFF. The output state corresponds to the gate signal of the output channel's mosfet and may not reflect the actual state of the mosfet's source lead if the drain is left open or floating. The actual output state of the DI-906MB is obtained via the simulated module LED's, as the input buffer is tied directly to the source of the output mosfet which connects to the output terminal.

Thus, for DI-906B models, the input state is the actual state of the output for the tandem I/O channel via closed-loop feedback.

However, on DI-905MB models, input circuitry is removed and the input state is assumed equivalent to the output state as it reflects the gate signal of the corresponding output mosfet. Thus, the DI-905MB LED's are driven via the gate signal and not the actual output signal.

Print Your Configuration

If you wish to document your transmitter configuration, then select **File-Print** to get a two page printout of all of your selected configuration parameters.

Saving Your Configuration

Note that the currently loaded configuration file name is indicated at the top of the screen to the right of the model number.

You may select **File-Save As** to save your configuration file to disk and give it a new file name. Otherwise, use File-Save to save the current file without renaming it.

In the event that you lose a configuration file, you can always upload it from the module via Module-Upload Configuration.

Note that the configuration process may vary slightly for other model types.

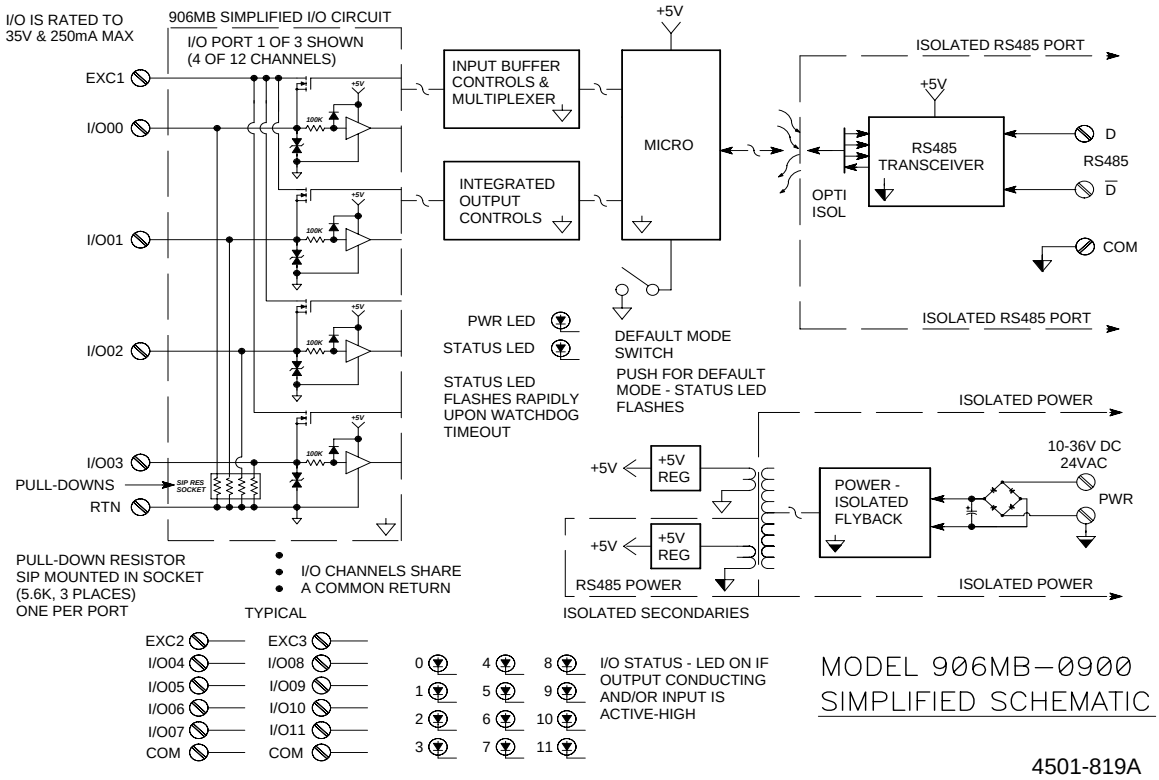
Now wasn't that easy! That's all there is to using the Configuration software to configure your module. The module is not ready for installation in the field.

7. Block Diagrams and Schematics

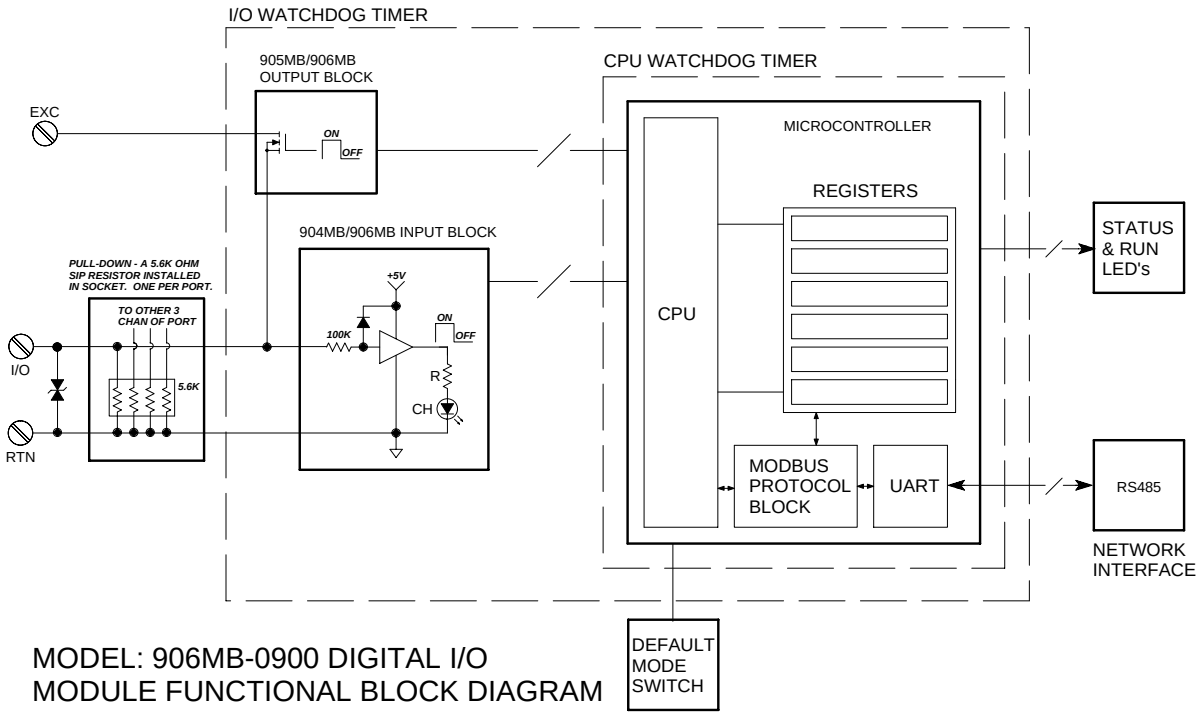
Theory of Operation

Refer to Simplified Schematic (4501-819) and Functional Block Diagram (4501-820) to gain a better understanding of the circuit. Note that these modules will interface with any mix of up to twelve digital input or output signals according to the model, and provide network commands to configure the module, monitor the inputs, and control the outputs. The outputs are the open-source leads of n-channel mosfets whose drains are tied to an excitation supply connected between the excitation terminal (EXC) and common (COM) of the port. Input buffers are connected in tandem with the source circuits via series 100KΩ resistors and include socketed pull-down resistors. Over-voltage clamps to +5V are connected to the buffer inputs. I/O terminals also include transient suppression. Sockets are installed for installation of optional input or output pull-down resistors. Outputs are the source leads of n-channel mosfets whose drains are tied to the excitation terminals. An external supply connected between EXC and the port common terminals provides excitation for the outputs. The microcontroller completes the information transfer according to the I/O type and its embedded program. I/O lines of the microcontroller switch the outputs ON/OFF, and sample the digital inputs, as required. The UART of the microcontroller sends/receives its I/O signals to the network via an optically isolated RS485 transceiver. Embedded configuration parameters are stored in non-volatile memory integrated within the micro-controller. Only the functions required by an application are actually stored in memory-new functionality can be downloaded via the host running the Modbus Configuration Software, or other compatible Modbus software along the network. A wide input switching regulator (isolated flyback) provides isolated power to the I/O circuit and RS485 port. Refer to Functional Block Diagram (4501-820) for an overview of how the software configuration variables are arranged.

Simplified Schematic (4501-819)



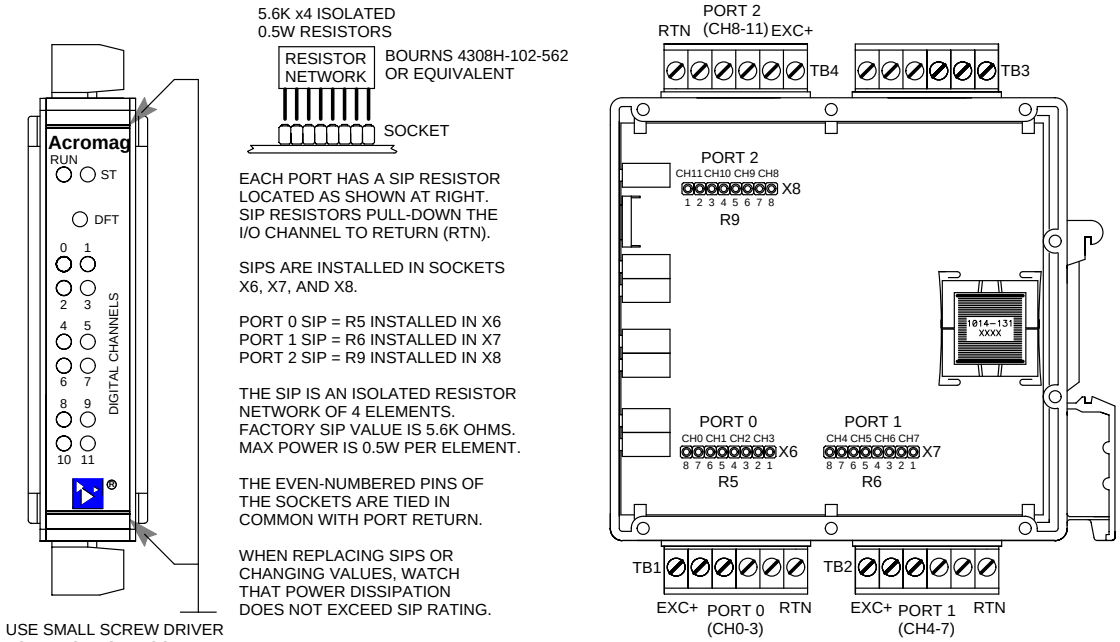
Functional Block Diagram (4501-820)



MODEL: 906MB-0900 DIGITAL I/O
MODULE FUNCTIONAL BLOCK DIAGRAM

4501-820A

Pull-Down Resistor SIP Locations (4501-821)



EACH PORT HAS A SIP RESISTOR LOCATED AS SHOWN AT RIGHT. SIP RESISTORS PULL-DOWN THE I/O CHANNEL TO RETURN (RTN).

SIPS ARE INSTALLED IN SOCKETS X6, X7, AND X8.

PORT 0 SIP = R5 INSTALLED IN X6
PORT 1 SIP = R6 INSTALLED IN X7
PORT 2 SIP = R9 INSTALLED IN X8

THE SIP IS AN ISOLATED RESISTOR NETWORK OF 4 ELEMENTS. FACTORY SIP VALUE IS 5.6K OHMS. MAX POWER IS 0.5W PER ELEMENT.

THE EVEN-NUMBERED PINS OF THE SOCKETS ARE TIED IN COMMON WITH PORT RETURN.

WHEN REPLACING SIPS OR CHANGING VALUES, WATCH THAT POWER DISSIPATION DOES NOT EXCEED SIP RATING.

USE SMALL SCREW DRIVER TO PRY OFF SIDE COVER. COVER IS HELD IN PLACE WITH EIGHT SNAP PINS.

WHEN REPLACING COVER, ALIGN ALL PINS, THEN SNAP TOGETHER IN SEQUENCE TO SECURE COVER.

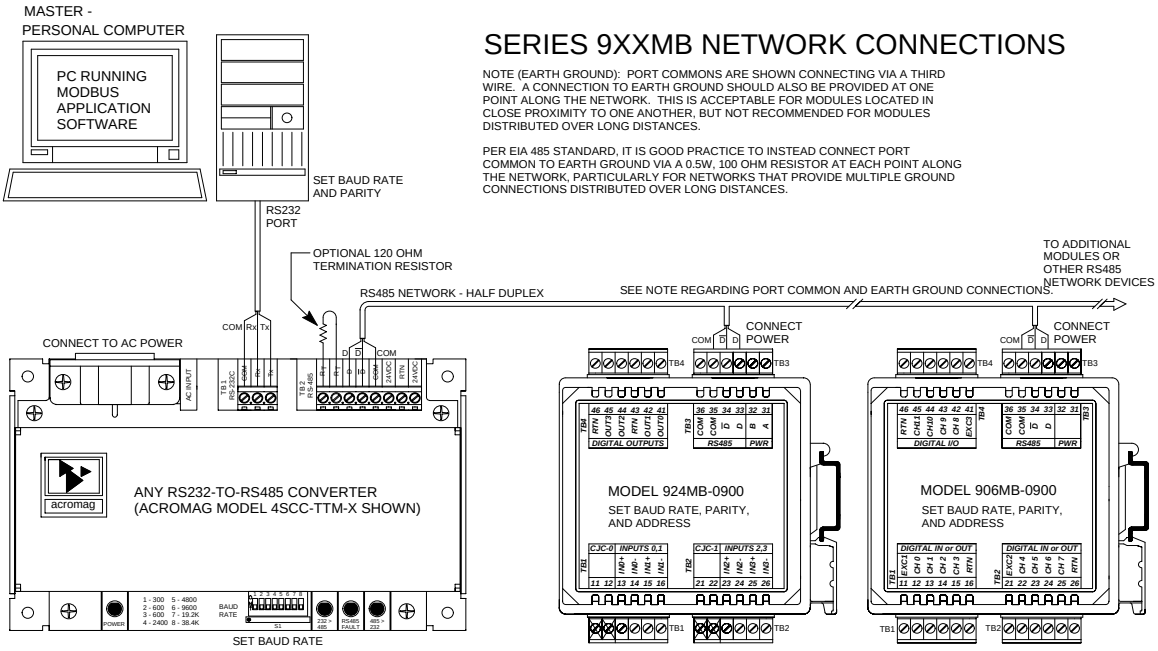
CAUTION: HANDLE CIRCUIT USING ESD-SAFE PROCEDURES.

904MB/905MB/906MB SHOWN WITH SIDE COVER REMOVED

SERIES 904MB/905MB/906MB SIP PULLDOWN RESISTOR SOCKET LOCATION

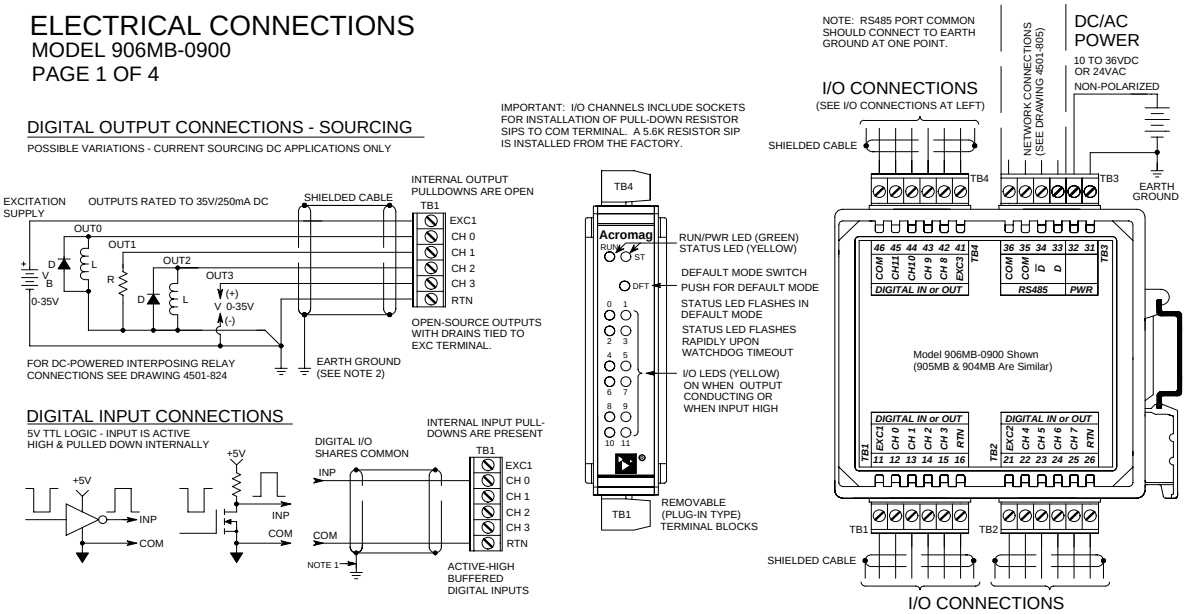
4501-821A

Network Connections (4501-805)



4501-805B

Electrical Connections (4501-823) (page 1 of 4)

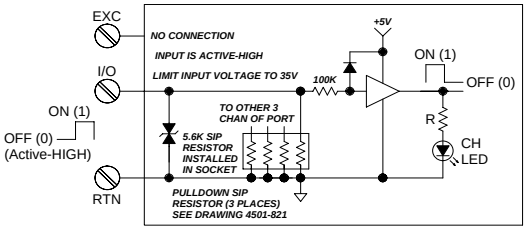


4501-823A

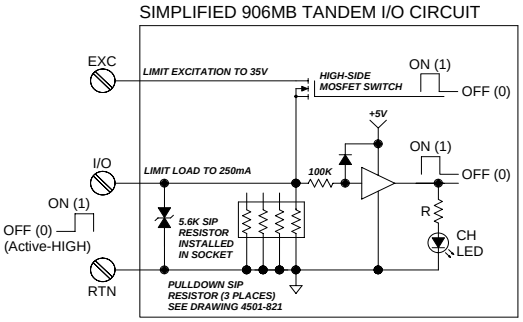
Electrical Connections (4501-823) (page 2 of 4)

ELECTRICAL CONNECTIONS
MODEL 906MB-0900
PAGE 2 OF 4

SIMPLIFIED 904MB INPUT CIRCUIT



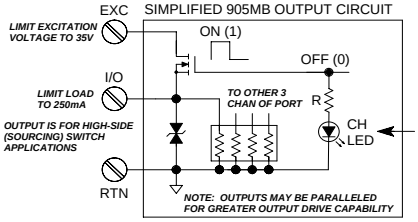
SIMPLIFIED 906MB TANDEM I/O CIRCUIT



IMPORTANT: I/O CIRCUIT WIRING MUST BE COMPLETE FOR PROPER OPERATION OF UNIT. I/O TERMINALS MUST NOT BE LEFT FLOATING. YOU MUST CONNECT EXCITATION AND/OR INSTALL PULLDOWNS FOR PROPER OPERATION.

REFER TO PULLDOWN RESISTOR LOCATION DRAWING 4501-821 TO INSTALL, REMOVE, OR REPLACE THE INTERNAL 5.6K PULLDOWNS.

SIMPLIFIED 905MB OUTPUT CIRCUIT



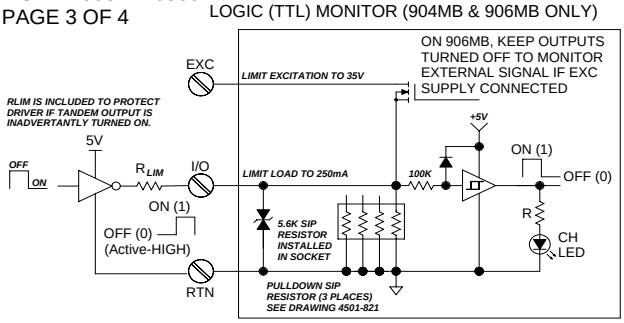
NOTE THAT LED REFLECTS GATE SIGNAL FOR 905MB UNITS AND MAY NOT REFLECT ACTUAL OUTPUT STATE IF OUTPUT IS LEFT FLOATING OR EXCITATION CIRCUIT IS NOT COMPLETE.

4501-823A

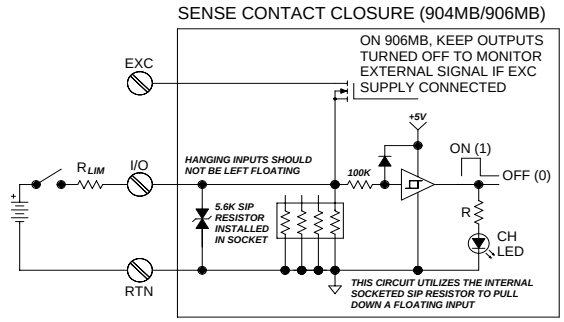
Electrical Connections (4501-823) (page 3 of 4)

ELECTRICAL CONNECTIONS
MODEL 906MB-0900
PAGE 3 OF 4

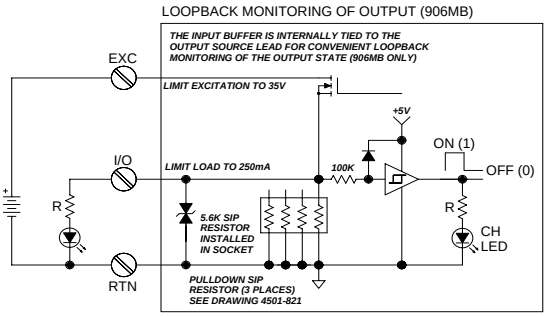
LOGIC (TTL) MONITOR (904MB & 906MB ONLY)



SENSE CONTACT CLOSURE (904MB/906MB)

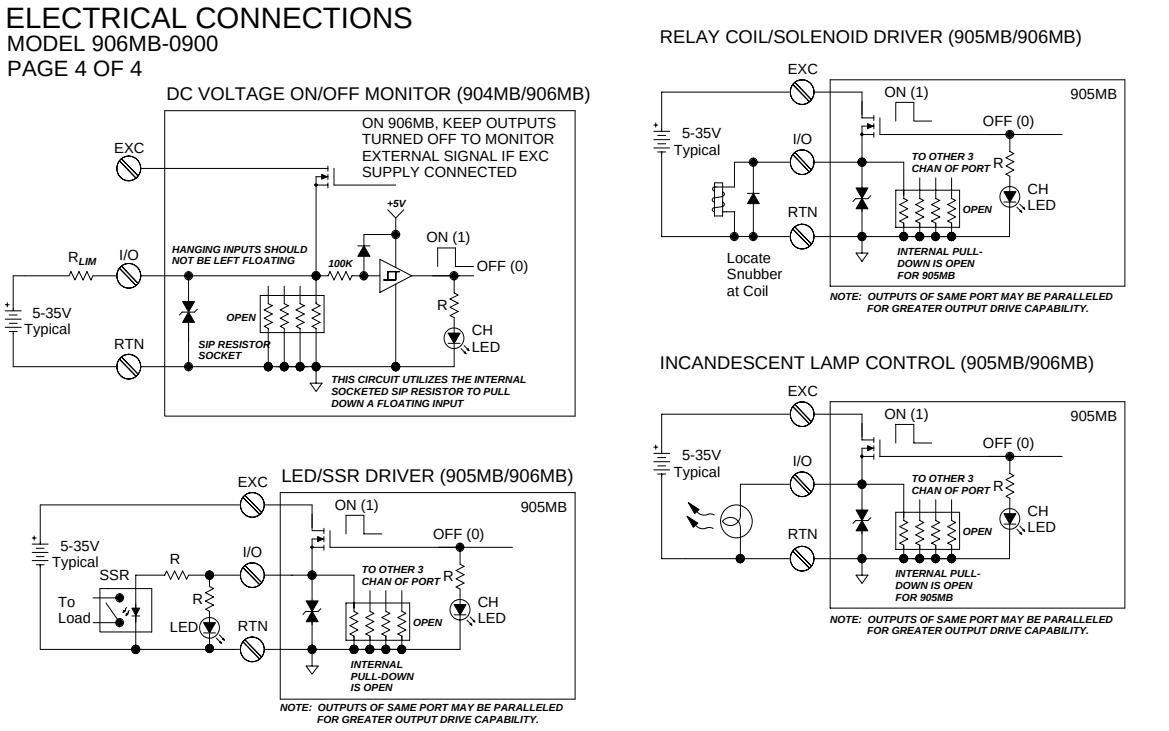


LOOPBACK MONITORING OF OUTPUT (906MB)



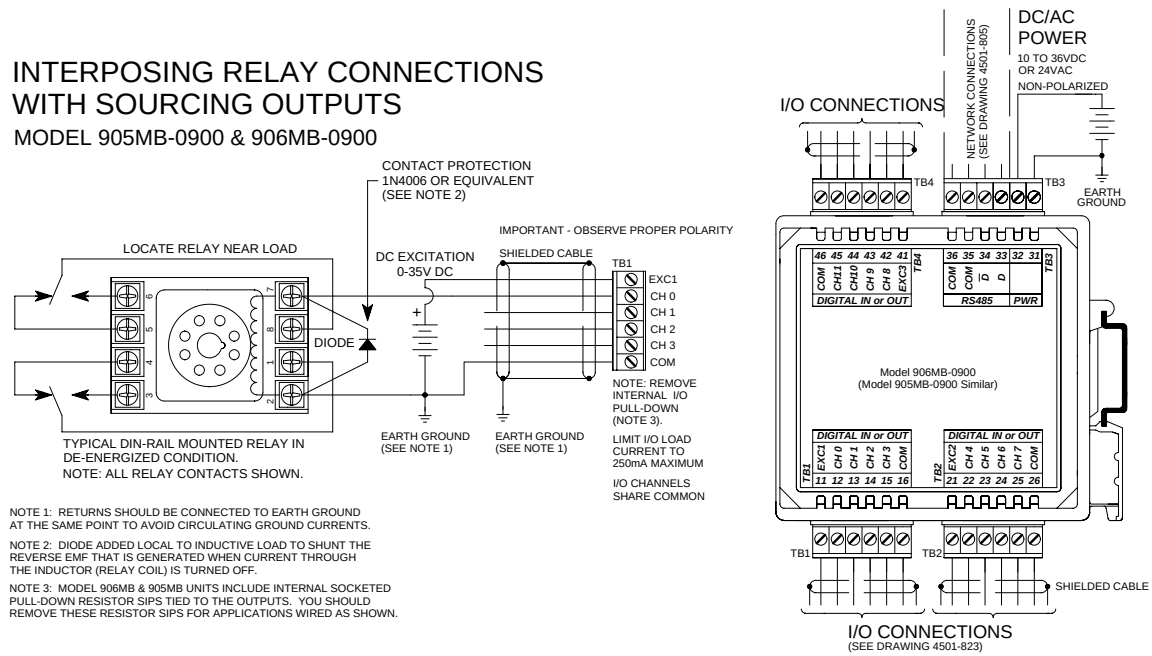
4501-823A

Electrical Connections (4501-823) (page 4 of 4)



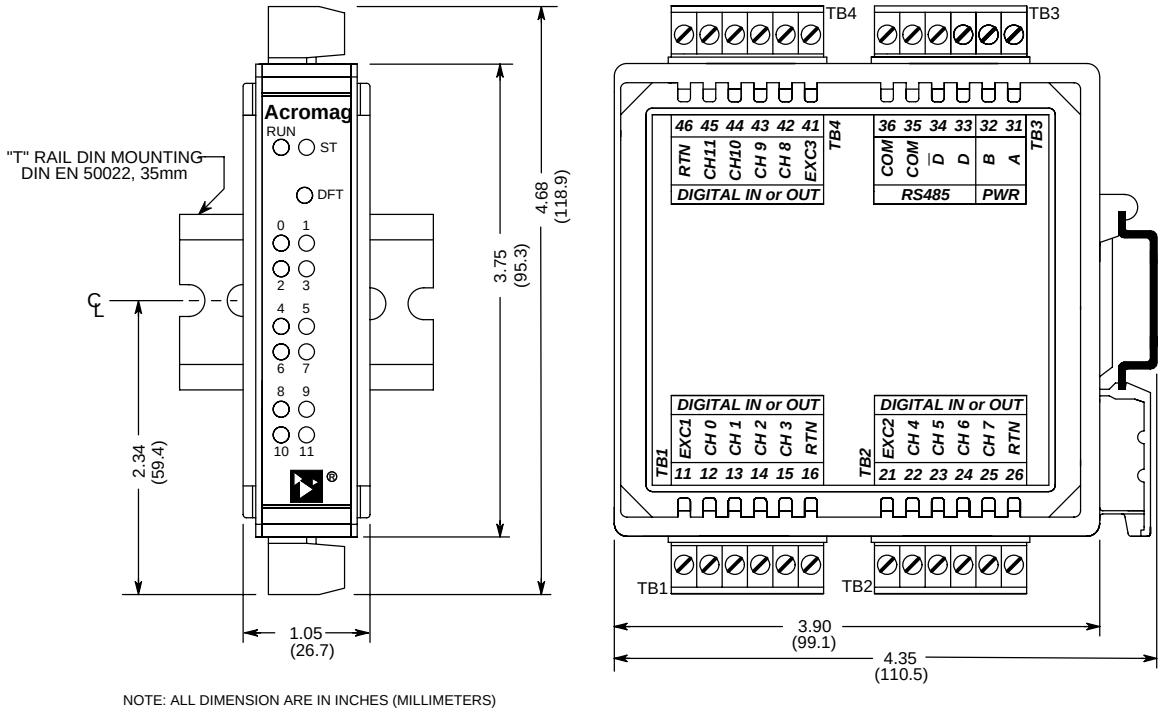
4501-823A

Interposing Relay Conn. & Contact Pro. (4501-824)



4501-824A

Enclosure Dimensions (4501-825)



NOTE: ALL DIMENSION ARE IN INCHES (MILLIMETERS)

MODEL 906MB ENCLOSURE DIMENSIONS
(MODEL 904MB AND 905MB ARE SIMILAR)

4501-825A

8. Accessories

Series DI-900MB Software Interface Package (Model 100969)

The Software Interface Package combines the DI-900MB Configuration Software, RS-232 to RS-485 Serial Converter, Interface Cable, and Instructions, into a complete kit for interfacing with Series DI-900MB I/O Modules.

DI-900MB Configuration & Control Software

Series DI-900MB modules are configured with this user-friendly Windows 95/98® or NT® Configuration Program. Optionally, any software that supports the Modbus/RTU protocol may be used to configure and control Series DI-900MB modules, but the use of this software makes getting started easier. All module functions are programmable and downloadable to the modules via this software. The software also includes on-line help. Non-volatile memory provides program and configuration storage within the module.

RS-232 to RS-485 Serial Adapter

This device is a non-isolated, port-powered, signal converter for communication between the RS-232 serial port of a personal computer and the RS-485 network interface of Series DI-900MB I/O Modules. It is used in conjunction with the DI-900MB Configuration Software for simple reconfiguration, testing, and troubleshooting of Series DI-900MB I/O modules. As a port-powered device, it is not intended for driving fully loaded RS-485 networks over long distances, and does not have sufficient power to drive terminated networks. The adapter has DB-9F connectors at both ends and plugs directly into the common DB-9M serial port connector of most personal computers. The module is connected to the RS-485 side of this adapter via a separate interconnecting cable (see Interface Cable described below).

Interface Cable

This 3-wire cable is used to connect the RS-485 side of the Serial Adapter to the RS-485 network terminals of Series DI-900MB modules. This cable is 8 feet long and has a DE-9M connector on one end, and three stripped and tinned wires on the other end. The wires are labeled A, B, and C for connection to the module D, Dbar, and COM terminals, respectively.

Isolated Signal Converter (Models 100974 and 100975)

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 Signal Converter) across 4000 foot distances. Installation of additional network devices or extending the distance requires the Network Repeater described below. Optional 115V AC Power (Model 100974) or 230V AC Power (Model 100975). Power cord included. The Model Number 100976 connects the PC's RS-232 port to the Isolated Signal Converter.

Isolated Network Repeater (Models 100977 and 100978)

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. Optional 115V AC Power (Model 100977) or 230V AC Power (Model 100978).

DATAQ Instruments, Inc.
241 Springside Drive
Akron, Ohio 44333
Telephone: 330-668-1444
Fax: 330-666-5434
E-mail: support@dataq.com

Direct Product Links

(click on text to jump to page)

Data Acquisition | Data Logger | Chart Recorder | Thermocouple | Oscilloscope