BusWorks® 900MB Series
Modbus/RS485 Network I/O Modules

Model 942MB
Dual Frequency or Pulse Counting Input Module

USER'S MANUAL

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8500682H

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Symbols on equipment:

Means Refer to User's Manual (this manual) for additional information".

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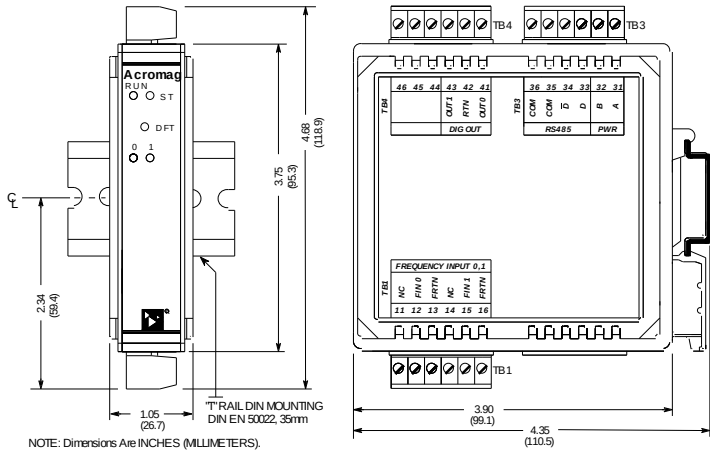
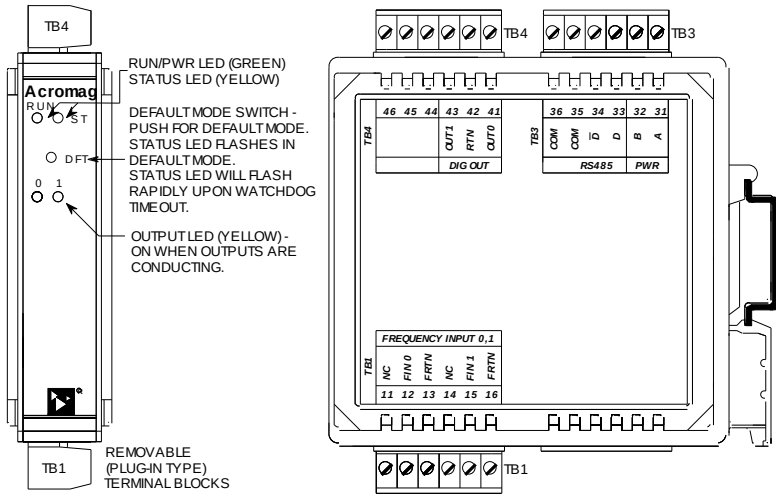
IMPORTANT SAFETY CONSIDERATIONS

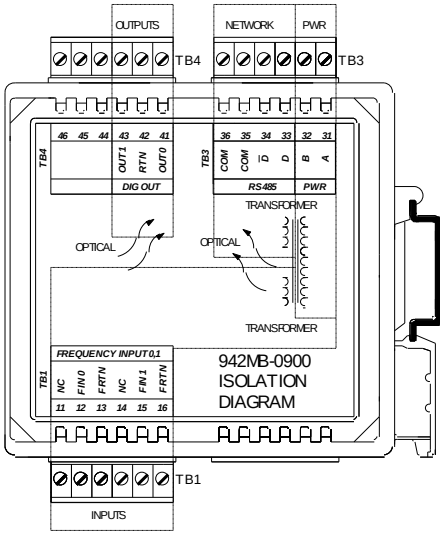
You must consider the possible negative effects of power, wiring, component, sensor, or software failure in the design of any type of control or monitoring system. This is very important where property loss or human life is involved. It is important that you perform satisfactory overall system design and it is agreed between you and Acromag, that this is your responsibility.

GETTING STARTED

TECHNICAL REFERENCE







MOUNTING AND DIMENSIONS

Unit mounts to "T" type DIN rails (35mm, type EN50022).

Units may be mounted side-by-side on 1-inch centers.

***WARNING:** 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.*

CONTROLS

Green Run LED will stay ON if power is on and unit is OK and will blink if unit fails.

Yellow ST LED will blink slowly if module is in Default Mode. This LED will blink quickly for a watchdog timeout and will stay ON if any channel is open or over-range.

Yellow Output LED's will turn ON if output switch is closed.

Push the DFT button to place module in Default Mode (ST LED will blink). This sets unit to 9600 baud, address 247, and no parity.

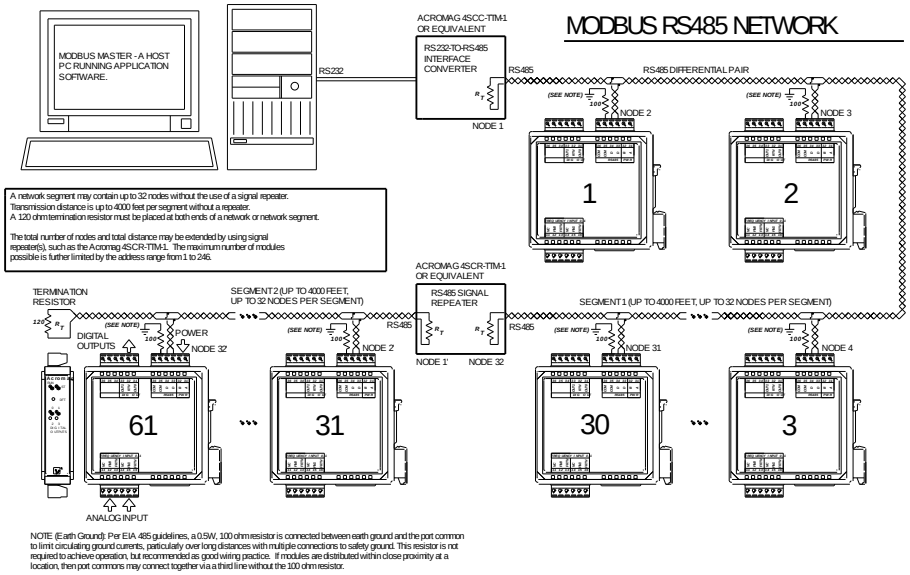
ISOLATION BARRIERS

Dashed Lines denote isolation barriers.

The inputs, outputs, network, and power circuits are isolated from each other for safety and noise immunity.

CONNECTIONS

Example Modbus System Connections.

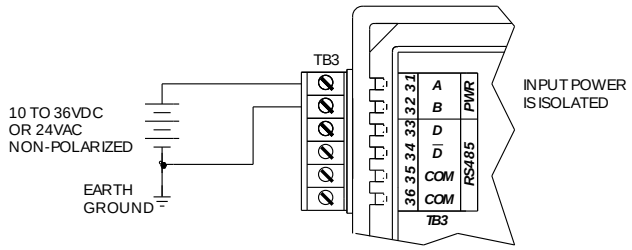


IMPORTANT – External Fuse: If unit is powered from a supply capable of delivering more than 1A to the unit, it is recommended that this current be limited via a high surge tolerant fuse rated for a maximum current of 1A or less (for example, see Bel Fuse MJS1).

Power

Voltage	Current
10VDC	135mA
12VDC	110mA
15VDC	90mA
24VDC	60mA
36VDC	45mA
24VAC	100mArms

✓ Connect 12-36V DC or 24VAC to the non-polarized power terminals labeled A & B. For supply connections, use No. 14 AWG wires rated for at least 75°C. **CAUTION:** Do not exceed 36VDC peak power voltage.



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

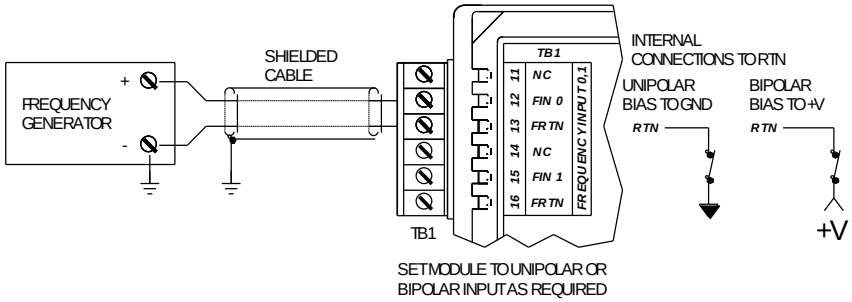
Input Connections

✓ Connect Frequency or Pulse signal to the input terminals FIN & FRTN. Refer to the examples below for connections to other types of inputs.

Connection to a standard frequency generator.

To prevent measurement error, limit maximum input frequency to less than 110% of full-scale.

Limit signal amplitude to ±200V peak (disconnect internal pullup/ pulldown connections above 11V).

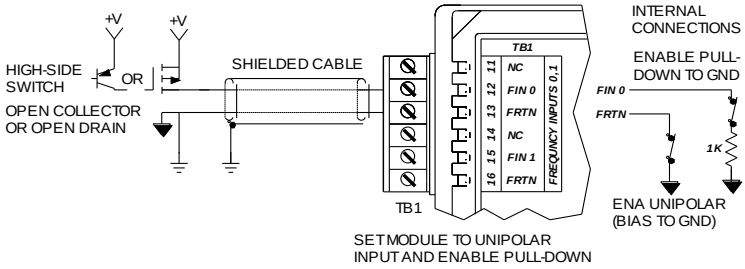


CAUTION: Do not connect internal pull-up or pull-down resistors for voltages greater than 11V peak, or damage to the circuit may result.

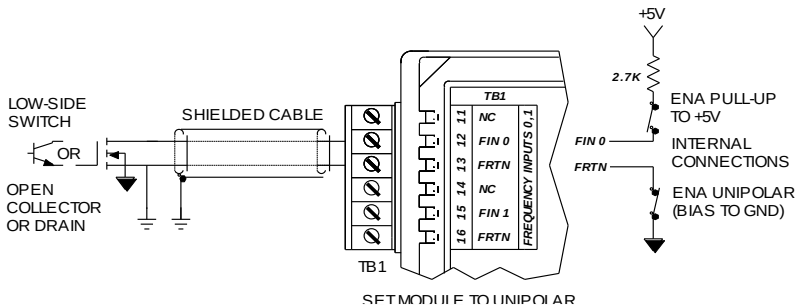
CONNECTIONS

Input Connections

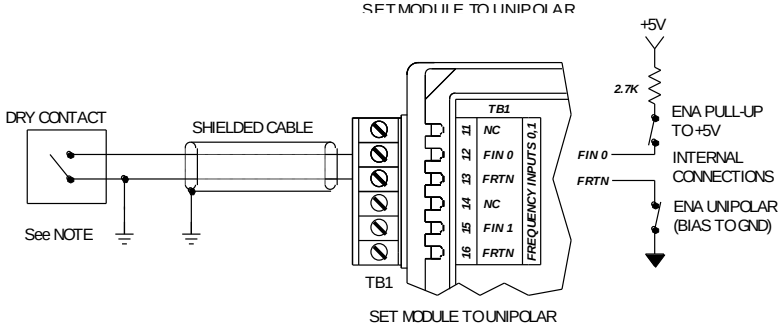
For low-side transistor switches, use the on board pull-up resistor. For high-side transistor switches, use the on board pull-down resistor.



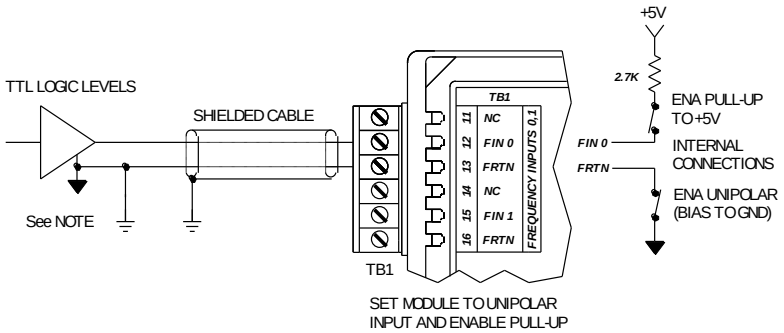
Connection to high-side switches.



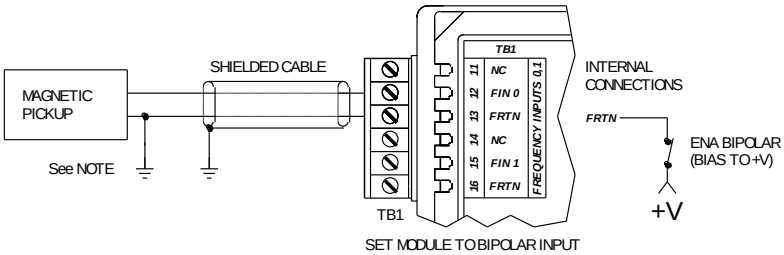
Connection to low-side switches.



Connection to dry-contact relays.



Connection to TTL logic signals.



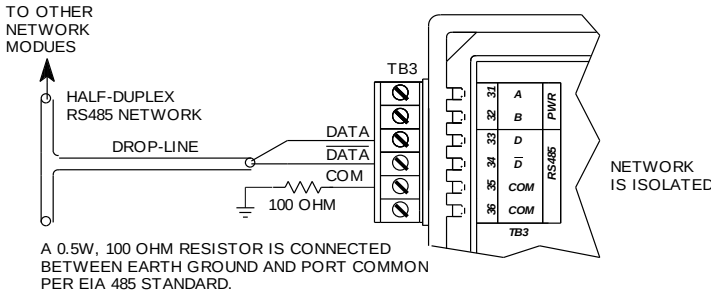
Connection to magnetic pickups.

CONNECTIONS

Network

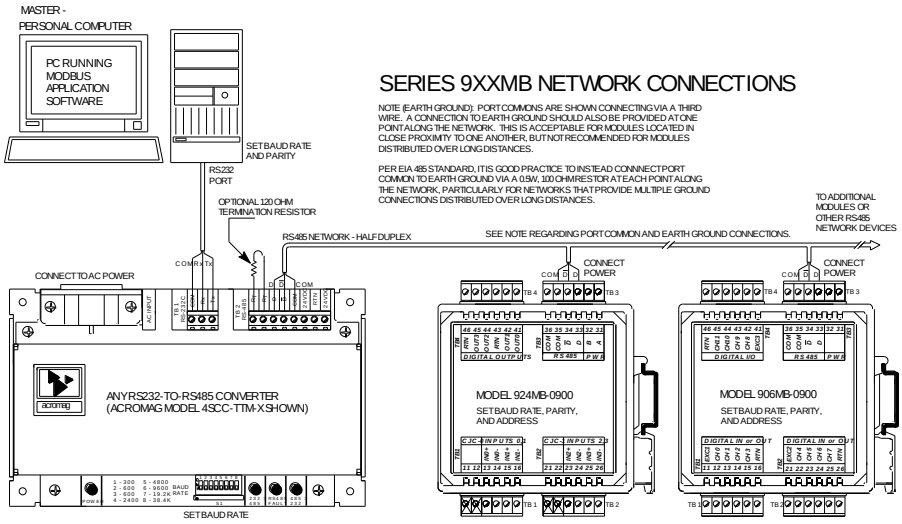
✓ Connect the RS485 terminals to your network. Differential data lines may use twisted pair. The 100 ohm resistor shown between port common and earth ground may be eliminated for modules in close proximity to one another.

Port common COM should connect to earth ground at each node. A 100 ohm resistor is shown connected between earth ground and port common per EIA 485 standard to limit circulating currents. This resistor is not required for operation, but is good wiring practice.



Refer to this drawing as an example of connections to an RS485 signal converter and network.

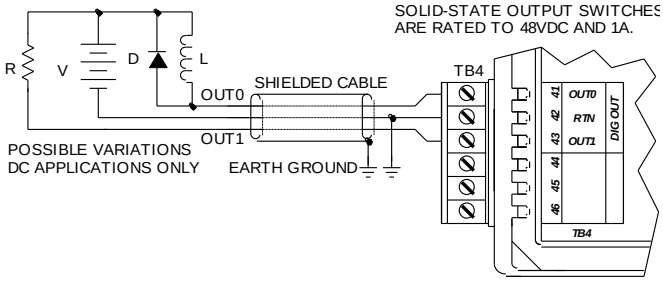
The Acromag 4SCC-TTM-X signal converter is shown here.



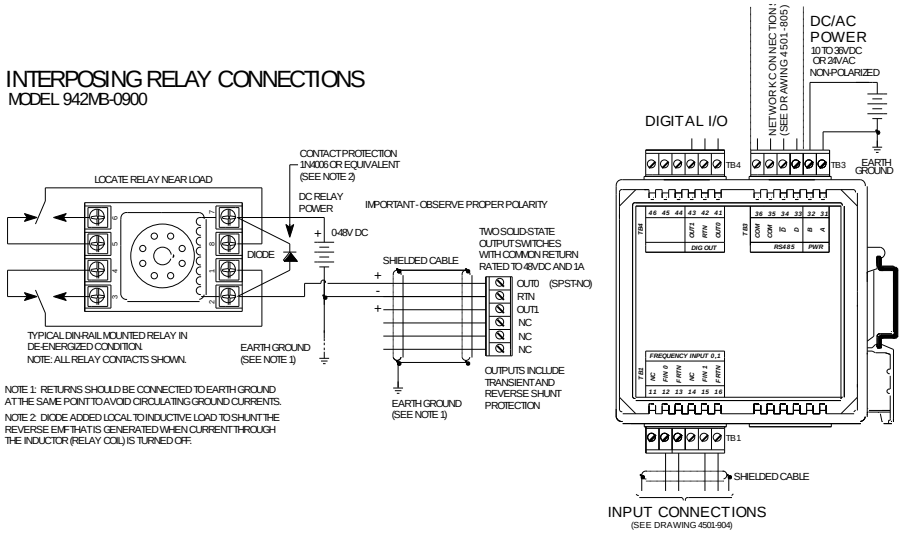
Output

✓ Connect solid-state output switches.

Outputs turn OFF (open) following a software or power-on reset of the module. Optionally, outputs may be sent to a defined state following a watchdog timer timeout.



IMPORTANT – Add Protection With Inductive Loads: Outputs already include internal reverse-bias shunt diodes to help protect the switch from damage due to the reverse-bias voltages generated when switching inductive loads. You should add external protection near the inductive load to prevent these transients from being sent along the connection wires. Place a diode (1N4006 or equivalent) across an inductive load with the cathode to (+) and the anode to (-) as shown above.



Refer to this drawing if you need to increase switching capacity with another relay.

✓ Connect Earth Ground as indicated in the example drawings above.

The plastic module housing itself does not require earth ground.

The ground connections noted in the drawings are recommended for best results and may be needed to meet EMC specifications. If sensors are already grounded, use caution and avoid making additional ground connections which could create ground loops.

Earth Ground

Warning: *To comply with safety and performance standards, use shielded cable and connect earth ground as noted. Failure to use good wiring and grounding practices may be unsafe and hurt performance.*

CONFIGURATION SOFTWARE

The software for this product is supplied on CDROM and included as part of the Series 900MB Software Interface Package (Order Model 900C-SIP).

Installation

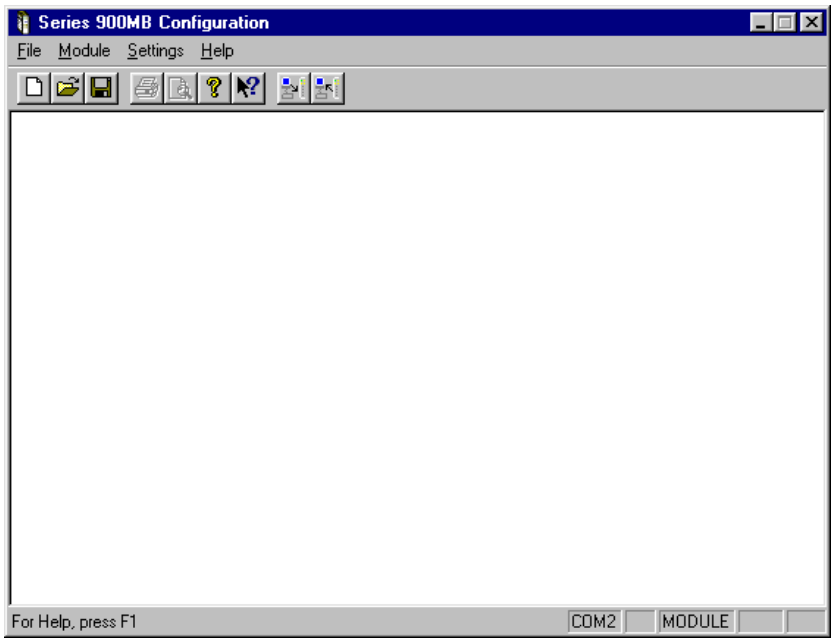
This software is used to configure Series 900MB modules and is installed similar to other Windows® programs. Any PC running Windows® with a CDROM drive may be used. Simply insert the CDROM into your drive. Click on the [START] button in the lower left hand corner of your Windows screen. Then click the "Run…" icon and execute SETUP.EXE. This will execute the Installshield Wizard for this program. Follow the on-screen instructions to complete the installation.

In addition to configuring all features of the module, the Modbus Configuration Software includes additional features as follows:

- Allows a configuration to be uploaded or downloaded to/from the module via the RS485 interface.
- Polls the module & allows polling to be turned on or off.
- Monitors the input frequency or event count.
- Monitors/controls the discrete output signal states.
- Reads the contents of the Module Status Register.
- Provides controls to reset one or both event counters.
- Provides controls to reset a module.
- Provides controls to separately recalibrate each input frequency range (high endpoint).
- Allows optional user documentation fields to be saved to a module file on the PC.
- Allows a module's complete configuration to be printed in an easy to read, one or two page format, including user documentation.

The following section will walk you through the software. You should have a module connected in order to access all pages of this software. Use of the Acromag software is the easiest method of setting up your module. For additional details on configuration of your module, please refer to the Technical Reference section at the back of this manual.

For detailed information on Modbus, please refer to our technical reference "Introduction To Modbus" (8500-648), available as a download from our website at www.acromag.com. This guide thoroughly explains Modbus as it relates to the Acromag 900MB modules and is an important supplement to this manual.

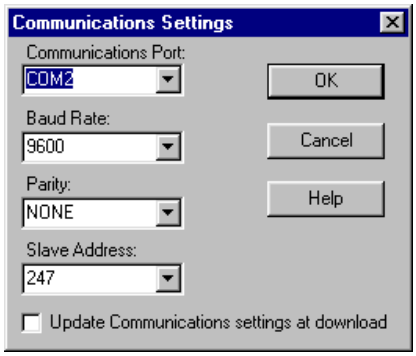


Starting The Program

Click on the Series 900MB program icon to boot the Configuration Program and the screen above will be displayed.

The host COM port setting 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.

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.



↑ You can check this box to automatically change host settings to match new module settings following download.

Set the host **Communication Port** the module is connected to (COM1-COM4), or type in a COM port from COM1 to COM99.
Set the host **Baud Rate** for communication with the module.
Set the host **Parity** to Odd, Even, or No Parity error checking.
Set the **Slave Address** the host is to use to talk to the module.

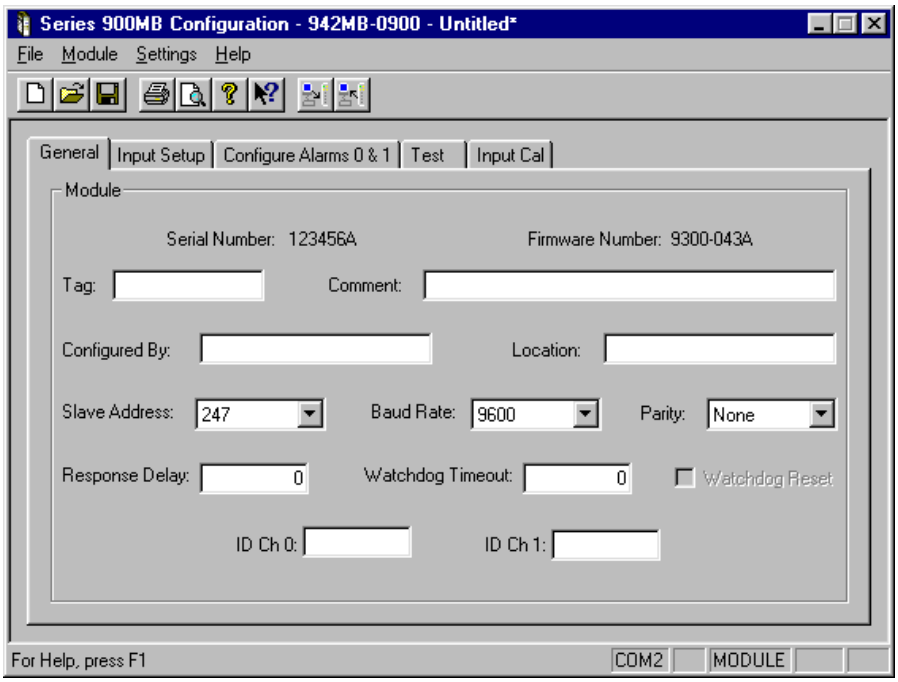
Use **File-New** to create a new configuration file.
Use **File-Open** to open an existing configuration file.
Use **File-Save** to save the current configuration file to disk.
Use **File-Save As** to save the current configuration file to a new file name.
Use **File-Print** to get a printout of the currently loaded configuration file.
Use **File-Print Preview** to preview a printout of the current configuration.
Use **File-Print Setup** to select a printer and font style.

Use **Module-Upload Configuration** to upload the module's current configuration and calibration (recommended).
Use **Module-Download Configuration** to write the currently loaded configuration to the module.

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

Creating A Configuration File



The model number is indicated at the top of the screen along with the current file name.

This screen is displayed once you choose to create, open, or upload a file.

Optional documentation: Enter a "Tag:" (15 characters), "Comment:" (31 characters), "Configured By:" (15 characters), "Location:" (25 characters), "ID Channel:" (15 characters). This info is not stored within the module.

Use the scroll bars of the following fields to make a selection. Your selection will take effect following the next download.

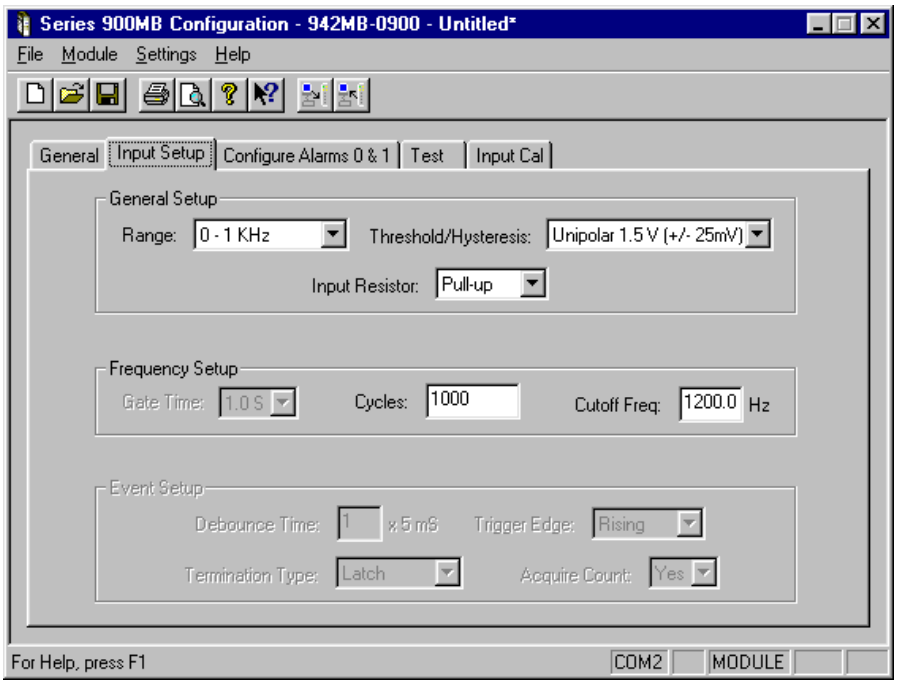
*Note that address, baud rate, & parity selections take effect following a configuration download, but do not alter the settings used by the host software which is configured separately via the **Settings** pull-down menu.*

Set **"Slave Address"** from 1 to 247.
Set **"Baud Rate"** (2400, 4800, 9600, 14400, 19200, 28800, 38400, 57600, 76800, or 115200 bits per second).
Set **"Parity"** to Odd, Even, or No Parity error checking.

If you already checked the "Update Communications settings at download" box of the Settings pull-down menu, the host software will change its own settings to match the new module settings that take effect after download in an effort to maintain communication with the module.

Some host software or signal converters may require a communications turnaround delay to work properly. Set **"Response Delay"** from 0 to 65500 ticks (1 tick=1.085us) if required. This will add delay between message receipt by the module and its response to the host. Since a fixed amount of delay is already present, you will have to specify a comparable amount of response delay to measure any affect.

You can enable the I/O Watchdog Timer by setting **"Watchdog Timeout:"** from 1 to 65534 seconds (0 or 65535 will disable timer). A timeout will occur if no I/O data transfer occurs within this time period. You may optionally click the **"Watchdog Reset"** check box to also send the digital outputs to their reset states upon watchdog timeout (Reset States are set separately via the Configure Alarms screen).



Input Setup

Click the Input Setup tab to display the screen shown above. Input Setup is used to specify parameters for the frequency or event counter inputs (parameters apply to both inputs together).

IMPORTANT: Count memory is volatile and totalized count values are not retained following loss of power.

General Setup

Use the field scroll bars to select parameters as follows:
For **"Range:",** pick 0-50KHz, 0-1KHz, 0-100Hz, or Event Counter.
For **"Threshold/Hysteresis:"**, pick Bipolar 0.0V (±25mV), Bipolar 0.0V (±83mV), Unipolar 1.5V (±25mV), or Unipolar 5.0V (±83mV).
For **"Input Resistor",** select an input pull-up to the internal +5V supply, an input pull-down to RTN, or none to leave the input pull resistors disconnected.

Thresh/Hysteresis Selection:
Sine Waves (Zero Crossing): Set Bipolar 0.0V (±25mV).
Square Waves (Logic Level): Set Unipolar 1.5V (±25mV).

Frequency Setup

Use the **"Gate Time:"** scroll bar to select a time period from 0.1s to 1.0s in 0.1s increments. This is the fixed time over which a number of input cycles is counted in order to calculate the period & frequency for the 0-50KHz range only.

Enter an integer from 1-255 into the **"Cycles:"** field to set the number of cycles to sample for the 0-1KHz and 0-100Hz ranges only. The total time to acquire this many cycles is used to calculate the period and frequency for the 0-100Hz and 0-1KHz ranges.

Enter a **"Cutoff Freq:"** into this field to set the minimum measurable frequency for the 0-100Hz and 0-1KHz ranges only. Frequencies below 0.5Hz (default), or below the specified cutoff frequency, will read as 0Hz. Specify a cutoff frequency to minimize the time to detect a loss of signal for a large number of cycles at low frequencies.

Event Setup (Event Counter Only)

In the **"Debounce Time:"** field, enter an increment multiple of 5ms from 0-200 (Default=1). This is the amount of time the module will wait following an event before it will allow another event to occur. Your maximum count rate will be reduced with increased debounce time.

Use the **"Trigger Edge:"** scroll bar to select the rising (positive-going) edge, or falling (negative-going) edge, of the input pulse that will trigger an event count.

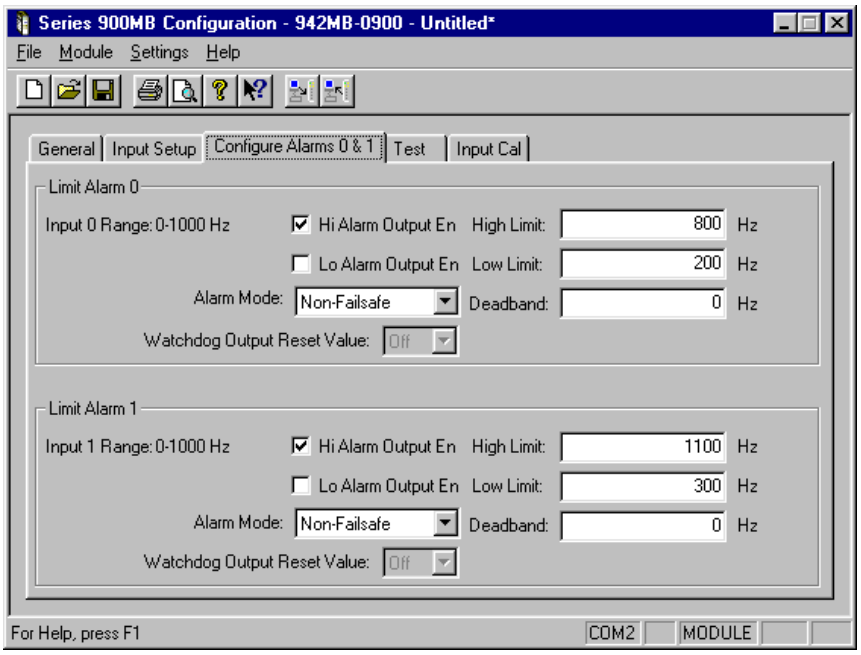
Note that the corresponding High limit must be separately enabled to control the associated digital output.

Use the **"Termination Type:"** scroll bar to select Auto-Reset, or Latch for the event counter. Auto-Reset will turn the alarm output ON for 100-200ms and reset the counter back to 0 when the limit value has been reached. Latch will turn the output ON upon reaching the limit and stop counting events, until the event counter is reset.

CAUTION: *Selecting "Yes" to periodically acquire the event count may cause the event counter (the sampling controller) to miss events for the time it takes to report its count to the main processor. You have the option of reporting the running count, but at the possible expense of count accuracy. Keep this in mind for critical counting applications.*

Use the **"Acquire Count:"** scroll bar to select No (default), or Yes. Normally, the event counter uses a high limit and alarm output to indicate it has reached a defined count limit and this keeps accurate count. Choosing "Yes" will cause the sampling controller to also send the running count to the main micro every 100ms for display purposes, rather than just relying on the high limit to report where the count is. However, choosing "Yes" can cause the sampling controller to miss events during the time it's reporting the count and this can decrease count accuracy. This field is set to "No" (off) by default and its use must be carefully considered where exact counts are required. Note that the totalized count value is volatile and will not be retained following loss of power.

The next section covers alarm configuration.



Alarm Configuration

Limit checking is always active for this module. The default limits are the input range endpoints.

Limit Alarm (Each Input)

Hi/Lo Alm Output Enable: Click to check this box and enable the High and/or Low Limit alarm output for each input.

Limit alarm control of the corresponding output takes priority over direct control when enabled.

High Limit/Event Counter Setpoint: Enter a high limit in Hertz (or events). The corresponding alarm output will go to its alarm state for an increasing input signal that equals or exceeds the high limit (if enabled).

Low Limit (Not For Event Counters): Enter a low limit in Hertz. The corresponding alarm output will go to its alarm state for a decreasing input frequency that equals or goes below the low limit (if enabled).

Be sure to enable the High Alarm Output for event counters, especially with Acquire Count set to "No".

Deadband (Not For Event Counters): Deadband is applied to both limit levels and determines the amount the input signal has to return into the "normal" operating range before the corresponding solid-state alarm relay will transfer out of the "alarm" state.

Deadband is normally used to eliminate false trips or switch "chatter" caused by fluctuations of the input near the limit.

Alarm Mode (Each Input): Select Failsafe or Non-Failsafe alarm output action. A failsafe alarm output will turn OFF in alarm (the same state as the power-down state). A non-failsafe alarm output will turn ON in alarm. Alarm outputs must be separately enabled.

Alarm control of an output will take precedence over direct control when the High/Low Alarm Output Enable box is checked. Keep this in mind if you try to control the state of an alarm output directly, as the module will seek to maintain the correct output state each time it scans the input, relative to the alarm condition and alarm mode. This does not apply for input signals within the deadband region, where the output state can be controlled directly. However, direct control of an alarm output is not recommended.

The Test Page of this software program will also report the alarm status for the module and at an input channel.

There are three methods of detecting an alarm: the output status LED can be used to indicate a transfer to the alarm state, a global limit exceeded flag will be set in the Module Status Register, and a high and/or low limit flag will be set in the Channel Status Register.

Watchdog Output Reset Value: This selection determines the state the output will be automatically toggled to following a watchdog timeout. Select "On" or "Off" as required. Watchdog timer control of the output will take precedence over alarm & direct control.

Writing Your Configuration

After making your General and Alarm Configuration selections, you must download the new settings as follows:

Select **Module-Download Configuration** to write your configuration to the module.

Module
Upload Configuration
→ Download Configuration

Note that you can select **Module-Upload Configuration** to retrieve the module's current alarm configuration/calibration, or to review and verify its configuration. Configuration data is stored in non-volatile memory within the module.

Printing Your Configuration

You can select **File-Print-Preview** to preview this document before printing. 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

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

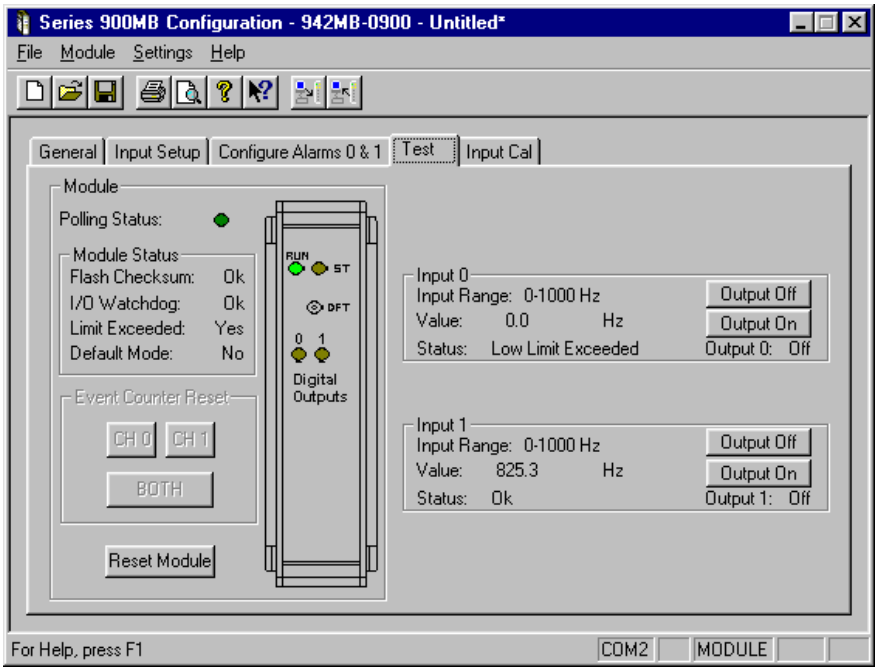
You should select **File-Save As** to save your configuration file to disk and give it a new file name.

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**.

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

The next section covers testing of your configuration. If you have made changes to any of the module configuration screens, be sure to download your changes to the module prior to invoking any of the active Test or Input Calibration pages.



Testing Your Module

CAUTION: *Always download your changes to the module before invoking the active Test or Input Cal pages as selecting this page may change some of your software settings to match those obtained from polling the module.*

Click the "Test" tab to display a screen similar to the one above. This screen allows you to actively interact with and poll the module, monitor the module status flags and I/O values, reset the module, and control and monitor the outputs.

The flashing green dot of "Polling Status" indicates the software is communicating with the module and polling its I/O. Polling is automatic when this screen is displayed and turns off if another screen is selected. The LED's of the graphic simulation will reflect actual module LED states.

For Event Counters, you can click the CH0, CH1, or BOTH Event Counter Reset buttons to reset event counters.

Note that the count value is volatile and will not be retained following loss of power.

You can reset the module by clicking the "Reset" button (same effect as power-on reset).

Note that a module will exit the Default Mode following a reset.

For each input, the current selected input range, input value ("Value:"), and input status is indicated. Output states are also indicated. You may turn outputs On or Off by clicking the "Output On" and "Output Off" buttons (assuming they are not already enabled as alarm outputs).

Keep in mind that alarm control of an output has priority over direct control (if enabled) and will seek to maintain the correct output state relative to the input level each time the input is scanned.

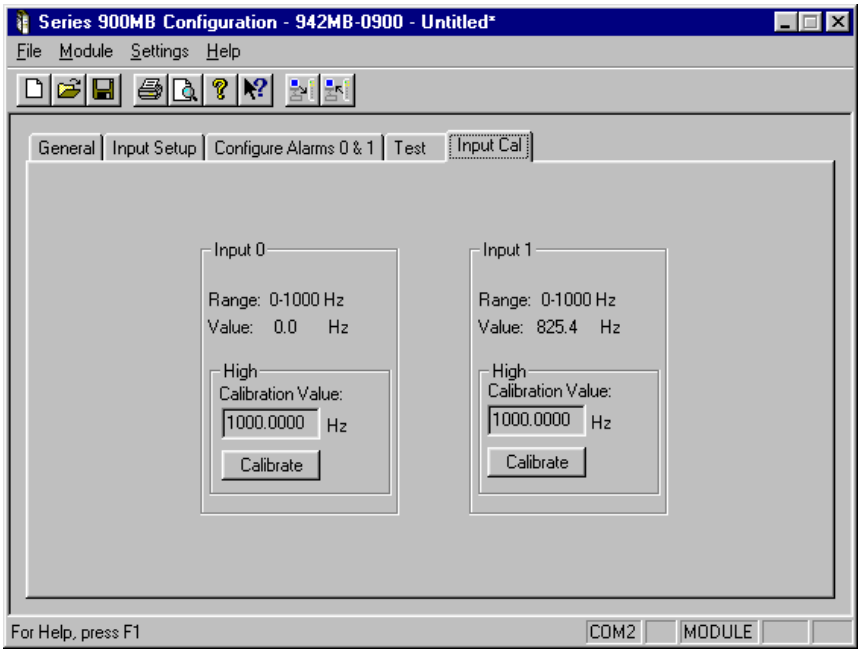
Clearing a watchdog timeout by initiating I/O with a module that has timed out will not automatically return the digital outputs to their pre-timeout state. It simply returns control of the output state to the alarms, or to the operator via manual control. Watchdog timeout control of the output has the highest priority (if enabled), followed by alarms (if enabled). Manual control of the outputs has the lowest priority.

The next section covers calibration of your frequency inputs. Calibration has already been done at the factory and adjustment is not generally required. However, periodic re-calibration may be performed to correct for component aging, or as part of your company's maintenance requirements.

INPUT CALIBRATION

CAUTION: *Always download your changes to the module before invoking the active Test or Input Cal pages as selecting this page may change some of your software settings to match those obtained from polling the module.*

IMPORTANT: *Calibration of the input ranges has already been done at the factory. Recalibration is normally not required, except as necessary to correct for long term aging effects.*



Module Input Calibration (Frequency Inputs Only)

We recommend a Gate Time setting of 1 second with 0-50KHz range and 8 Cycles with the 0-1KHZ or 0-100Hz ranges to improve measurement accuracy.

Calibration is simplified using the controls of this software. Simply connect the high-endpoint frequency indicated, then click the "Calibrate" button.

For best results, you will need a precision signal generator capable of producing the high calibration frequency indicated, and at least as accurate as the module itself. If calibration is attempted with equipment of poor accuracy, then recalibration may degrade performance, or possibly render a channel inoperable.

Module Input Calibration

1. Click the Input Calibration tab to display the screen shown above.

   Uploading first will help prevent miscalibration if the input range set at the module is different than that selected via this software.

   Note that Module-Upload Configuration will recall the module's current calibration. After uploading, the current active calibration values are indicated in the High Calibration Value field of each input. These correspond to the selected input range's upper endpoint signal.

2. Observe proper polarity and wire your frequency generator to the input channel you wish to calibrate. Adjust this input frequency to the High Calibration value indicated.

3. Note the measured frequency indicated in the Value field at the top of the screen. If the indicated value does not precisely match the High Calibration Value, then click the High **"Calibrate"** button to reset the High Calibration endpoint. After a moment, the value indicated at the top of the screen should closely match the High Calibration Value. If not, carefully repeat this procedure.

   You may wish to independently verify this frequency via a precision frequency counter.

4. Repeat steps 2-3 for the second input channel, as required.

TROUBLE-SHOOTING

The module routinely performs internal diagnostics following power-up or reset. During this period, the green "Run" LED will flash for a moment. If the diagnostics complete OK, the "Run" LED will stop flashing after a few seconds and remain ON. This indicates the unit is operating normally.

If your problem still exists after checking your wiring and reviewing the table below, or if other evidence points to another problem with the unit, an effective and convenient fault diagnosis method is to exchange the module with a known good unit. Acromag's Application Engineers can provide further technical assistance if required. Complete repair services are also available from Acromag.

Diagnostics

SYMPTOM	POSSIBLE CAUSE	POSSIBLE FIX
Cannot communicate.	Is power ON at the module and/or RS485 converter?	Check power. Is green RUN LED ON?
	Is baud rate correct?	Check baud rate settings at the host, module, and/or any RS485 signal converter or repeater.
	Is address correct?	Check address settings at the host and at the module.
	Is parity correct?	Check parity settings at the host and at the module.
	Additional response or turnaround delay time may required. Some host systems or signal converters require additional turnaround delay to work properly.	Try increasing the Response Delay Time at the module. Setting is found by experimentation and you must specify a time that is greater than the inherent time already present to notice a difference.
	Have you tried the Default Communication Mode?	Press the DFT button until ST LED begins to blink. In this mode, the baud rate is 9600, the address is 247, and no parity is set.
Continuous flashing green RUN LED.	Internal firmware problem.	Return module to factory to restore firmware.
Communication was lost while in the Default Mode.	Has module been reset?	Module leaves the Default Mode if reset and internal baud, address, & parity settings take effect. Press DFT button until ST LED blinks to re-enter Default Mode.
Input frequency is in error or input is inoperable.	Miscalibration	Use the Configuration Software to recalibrate the input channel. Check your signal generator.
	Missing pullup or pulldown?	Review input resistor selection.
	Wrong threshold?	Review selection of polarity/threshold/hysteresis.

Some network converters or host/software systems cannot accept an immediate response from a slave device without additional delay inserted between message receipt and module response.

SYMPTOM POSSIBLE CAUSE POSSIBLE FIX

Diagnostics

Input frequency measurement indication is much lower than actual or 0Hz.	Aliasing - Input signal is too fast to be sampled.	Limit maximum input frequency below 110% of nominal. The maximum measurable frequency of your unit is about 54.5KHz.
	Missing pullup or pulldown?	Review selection of input resistor.
	Wrong threshold?	Review selection of polarity/threshold/hysteresis.
Event counter is missing events.	Is Acquire Count enabled?	Count accuracy can be degraded if Acquire Count is set to Yes, as the sampling controller can miss events during the time it takes to report its running count. Disable Acquire Count and use the High Limit alarm to report count.
	Has power been cycled?	Totalized count values are volatile and are not retained following loss of power.
	Debounce Time is too long.	Reduce Debounce Time.
	Frequency of events is too fast.	With debounce time set to 0, the maximum count rate that can be obtained is about 200 samples per second. Reduce the frequency of events.
	Missing pullup or pulldown?	Review selection of input resistor.
	Wrong threshold?	Review selection of polarity/threshold/hysteresis.
Yellow ST status LED remains ON.	Indicates Over-range at an input.	Reduce input frequency.
Yellow ST status LED blinks slowly.	Indicates module is in Default Mode.	To exit Default Mode, You can press the DFT button, reset the module, or cycle power off/on to the module.
Yellow ST status LED blinks rapidly.	Indicates a watchdog timeout has occurred.	I/O communication with the module will clear a timeout.
Yellow ST LED blinks in rapid bursts.	Indicates both Default Mode and watchdog timeout.	See above.
Cannot get unit to indicate Default Mode or Watchdog Timeout.	Yellow ST LED is always ON.	This occurs if input frequency is over-range (between 100 and 110% of full-scale). Reduce input frequency until ST LED changes state.

TECHNICAL REFERENCE

KEY FEATURES

- **Easy Setup With Windows® Configuration Software –** You don't have to be a programmer to quickly setup and operate this module.
- **RS485/Modbus Network Interface** – Highly immune to noise and can operate over long distances. Allows many modules to network together.
- **High-Speed Data Rates** – RS485 up to 115K baud.
- **Nonvolatile Reprogrammable Memory** – Allows the functionality of this device to be reliably reprogrammed thousands of times.
- **Fully Isolated** – The inputs, outputs, network, and power are all isolated from each other for safety and increased noise immunity.
- **Wide-Band Frequency Inputs With Event Counter** - Two channels of frequency in 3 ranges from 0Hz to 50KHz, plus event counter.
- **High Voltage Inputs** – Signal amplitudes up to 140VAC, or 200V peak.
- **Flexible Interface Supports Many Input Types** – Programmable pull-up and pull-down resistors provide support for a variety of input types.
- **Supports Bipolar or Unipolar Input Signals** – Variable input bias for both zero crossing and non-zero crossing periodic signals. The voltage threshold and relative hysteresis are also user-selectable.
- **Plug-In Terminal Blocks & DIN-Rail Mount -** Make mounting, removal, and replacement easy.
- **Event Counter Alarm Function** – Counts pulses on the positive or negative edge, upward, in the range 0-65535. Counter may latch at a high limit and turn the high alarm output ON, or pulse the alarm output and reset itself to 0 after reaching the high limit. Counter(s) may be reset remotely.
- **Input Filtering** - Inputs include hysteresis, over-sampling (frequency inputs), debounce (event counter), and deadband (alarms).
- **Dual Discrete SSR or Alarm Outputs** - High voltage/current solid-state switches provide for direct or alarm control of external devices, with both failsafe and non-failsafe modes.
- **Self-Diagnostics & Built In Watchdog** - For easy maintenance and troubleshooting. Includes a hardware watchdog timer built into the microcontroller that causes it to initiate a self reset if the controller ever "locks up" or fails to return from an operation in a timely manner.
- **Wide-Range DC-Power or 24VAC Power** - Non polarized and diode-coupled for use with redundant supplies, and/or battery back-up.
- **I/O Watchdog Timer** – For periods up to 65534 seconds (18.2 hours). Timer will timeout if an I/O channel read or write operation does not occur for the configured time period. Outputs may also be automatically set to user-defined states following timeout.
- **Hardened For Harsh Environments** - For protection from RFI, EMI, ESD, EFT, & surges. Has low radiated emissions per CE requirements.
- **Wide Ambient Operation** – Reliable over a wide temperature range.
- **LED Indicators** - A green LED indicates power. A yellow status LED indicates over-range, default communication mode, and watchdog timeout. Another yellow output LED indicates the On/Off output state.
- **Push-Button Default Communication Mode –** Can set the module to a default set of communication parameters for baud rate, module address, and parity if its internal settings are unknown.
- **Alarm Function With Variable High and Low Limits Plus Deadband -** Includes optional failsafe or non-failsafe alarm outputs.

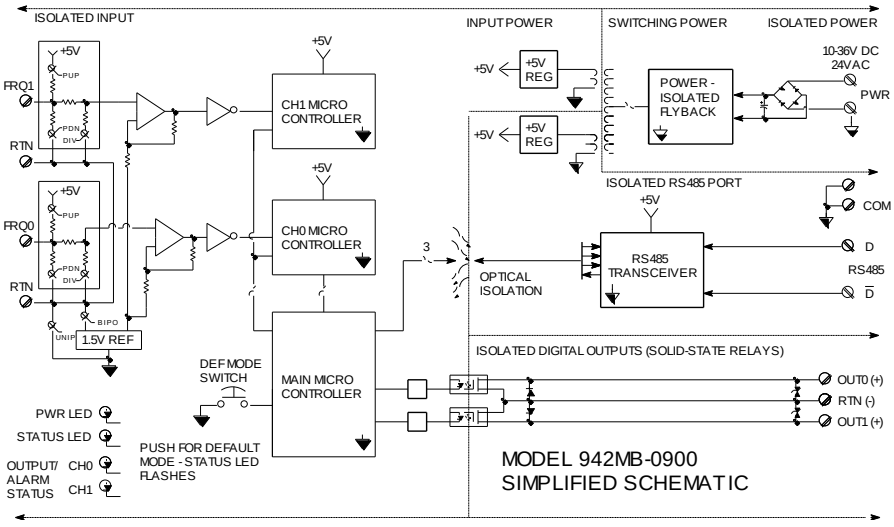
HOW IT WORKS

These transmitters use a comparator and logic gate to convert the input signal into a digital pulse stream. The comparator provides the threshold and hysteresis, while the logic gate will "square" the wave-shape. Separate microcontrollers sample the input pulse streams and track the number of internal clock cycles to determine the period of the input signal and its frequency. Two methods of determining frequency are used according to the input range.

For the 0-50KHz range, the microcontroller counts the number of input cycles over a gated time period from 0.1 to 1.0s (Gate Time) and calculates the relative period and frequency. Thus, the longest Gate Time is 1 second for this range making 1Hz the slowest possible frequency that can be measured. For this range, input frequencies below 1Hz will read as 0Hz.

For the 0-100Hz and 0-1KHz ranges, the microcontroller measures the period of a signal by counting a specified number of cycles while using the internal clock to track the total time. The total time divided by the number of cycles determines the period. The lowest measurable frequency for these ranges is 0.5Hz, but with a slow input frequency and a high number of cycles, the time to detect a loss of signal may be high. In this case, a specified cutoff frequency is used and any frequency below the cutoff will read as 0Hz.

The microcontroller will compute the input frequency and complete the transfer equation according to the input type and its embedded function. The microcontroller also compares the signal value to the limit value for the alarm function and completes all necessary alarm functionality according to its embedded program. I/O lines of the microcontroller will switch the solid-state relays ON/OFF, as required. The UART of the microcontroller sends/receives its I/O signals to the network via an optically isolated RS485 transceiver. Embedded configuration and calibration parameters are stored in non-volatile memory integrated within the controller. New module functionality can be downloaded from a host computer running the Modbus Configuration Software, or other compatible Modbus software via the network interface. Refer to the simplified schematic that follows to gain a better understanding of the circuit.



CONFIGURATION TERMS AND DEFINITIONS

Each module has already been calibrated and has a default factory configuration as noted in the SPECIFICATIONS section. Your application will likely differ from the default configuration and the module will need to be reconfigured. The easiest way to reconfigure your module is to use the 900MB Configuration Software provided to program and control the module parameters and operating modes. You may also configure this module by issuing the appropriate ModBus functions to Register Map registers, as required by your application.

Below is a subset of standard Modbus functions that are supported by this module along with the reference register addresses that the function operates on. Use these functions to access these registers as outlined in the Register Map for sending and retrieving data. Any software that supports the Modbus RTU command/response protocol may also be used.

CODE	MODBUS FUNCTION	REFERENCE
01 (01H)	Read Coil (Output) Status	0xxxx
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*

For detailed information on Modbus, feel free to download our technical reference "Introduction To Modbus" at www.acromag.com.

The following parameters and controls are supported by Model 942MB-0900.

Slave Communication

Report Slave Identification: This command returns the model number, run on/off status, serial number, and firmware number.

Reset Slave: This command resets the module (equivalent to a power-on reset). A reset can also be done by a write to the Calibration Access & Reset Register (see Memory Map register 40025) for use with Modbus software that does not support the Reset Slave command.

Slave Address: Select from 1 to 247 (01H-F7H). Address 247 is the default communication mode address.

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

Parity: Select Even, Odd, or No Parity error checking. Acromag modules will accept no parity with 1 or 2 stop bits.

Response Delay: Select 0 to 65500 ticks (1 tick = 1.085us) for the additional delay a module is to wait before it sends its reply to the host. Some signal converters or host/software systems will not accept a message response immediately after sending the message without added delay.

TIP: Try increasing this delay if you cannot communicate with the module or have many errors.

Module Status: This register tracks alarm status, I/O watchdog timeout, and internal flash memory checksum error status.

CONFIGURATION TERMS & DEFINITIONS

I/O Watchdog Timer & Output Reset: A watchdog fault flag (bit 0 of the Module Status register) will be set if any of output channels have not been written to over the specified time period, or if any of the I/O channels have not been read over the same period. In addition, a timeout will cause the ST status LED to blink rapidly. Use the Watchdog Time Register to select a period from 1 to 65534 seconds (up to 18.2 hours). A time of 65535 (FFFFH) or 0 (0000H) will disable the timer. Use the Timeout State Register to set the states the outputs go to upon timeout (the two lower order bits of this register define the timeout states of each output channel). Writing 65535 (FFFFH) to this register will leave the outputs unchanged upon timeout. Watchdog output state control takes precedence over alarm and direct control.

Input Configuration

Range/Type: Choose 0-100Hz, 0-1KHz, 0-50KHz, or Event Counter, for both inputs together.

Threshold (Bipolar/Unipolar): Choose bipolar (zero crossing), or unipolar (non-zero crossing) thresholds.

Resistor (Pullup/Pulldown/None): Enable/disable an internal input pullup (2.7KΩ to 5V), or pulldown (1KΩ to input RTN), to connect to the input.

Gate Time (0.1 to 1.0s, 0-50KHz Range Only): A gated period of this time is used to count the number of input wave cycles in order to determine the period and frequency for this range.

Cycles (1-255, 0-100Hz & 0-1KHz Ranges Only): This is the number of cycles that are counted while tracking the total time to determine the average input period before updating the frequency. This is useful for applications that make use of encoders with irregular cycle widths in one period (revolution). The measurement is a running average of this many cycles which helps to minimize jitter in these applications. Note the response time will be increased by the factor selected.

TIP: *You can examine the channel's Raw Value register to determine if an input is 0Hz due to a broken lead (exactly 0), or because the input is below the cutoff frequency (greater than 0).*

Cutoff Frequency (0-100Hz & 0-1KHz Inputs Only): Input frequencies below cutoff read as 0Hz. Cutoff is used to minimize the time to detect a loss of signal with slow frequencies and a high number of cycles. Values slightly above cutoff may be intermittently reported as 0 due to 10ms of uncertainty. You can approximate the cutoff time within ±10ms via the expression: Cutoff Time = (Cycles+1)/Cutoff Frequency.

Calibration (Frequency Input Only): The configuration software can be used to calibrate the high endpoint of the frequency ranges. Optionally, you may use the Preset Register Functions and your own software to write appropriate data to the calibration registers to achieve calibration.

Event Counter Debounce Time (0-200 x5ms): Select a time factor from 0 to 200 (multiple of 5 milliseconds). Debounce is used to eliminate false counts due to mechanical contact bounce. Be sure to set this time appropriately with respect to your count rate (bandwidth).

Event Counter Trigger-Edge (Rising/Falling): Select the rising edge (positive), or falling edge (negative) of the input pulse to trigger a count.

Event Counter Termination (Auto-Reset, or Latch): An auto-reset counter will count up to the limit, then reset to 0 and resume counting while simultaneously pulsing the output ON for 100-200ms. A latching counter will count up to the limit, latch there, and turn the output ON. The event counter remains latched until it is reset. Note the high limit output must be enabled for the output to turn ON, or you will have no indication of the limit being reached (unless you also choose to acquire the count). Counter can be reset to zero using the Event Counter Reset Register, or via Reset Event Counter of the Configuration Software.

CONFIGURATION TERMS & DEFINITIONS

Event Counter Acquire Count (Yes or No): If you acquire count, the running count will be reported every 100ms. This can cause the sampling processor to miss events during the time it reports its count (decreasing accuracy), so consider its use carefully when exact counts are required. Otherwise, you can rely on the high limit alarm to let you know where the count is and this provides best accuracy.

Event Counter Reset: Causes one or both event counters at channel 0 and channel 1 to reset their counts to zero.

Output Configuration

Output State: The coil registers (0x references) may be read via the Read Coil (01) command to determine the current state of the outputs. The output state is also indicated by a yellow status LED at the front of the module (ON when switch is closed). The Force Single Coil (05) and Force Multiple Coil (15) commands may be used to directly control the output state via the coil registers. The outputs may also be set under alarm control, or via watchdog timeout.
IMPORTANT: Alarm limits take precedence over direct control and must be disabled if direct control is desired. Watchdog timeout control has the highest priority if enabled.

Alarm Configuration

Alarm Output State & Output Enable: Use the Alarm Output State and Alarm Output Enable Register to make the corresponding output act as an alarm output and to select failsafe or non-failsafe activation. A failsafe alarm will turn OFF in alarm (same state with power off). A non-failsafe alarm will turn ON in alarm. Alarm limit checking is always active for the module, but assignment of an alarm output is optional via this control. Event counter high limit outputs are non-failsafe only.

High Limit Value/Event Counter Setpoint: Use the channel High Limit Value Register to write a high limit value with the same units as the input (Hz for Frequency, Counts for Event Counters). Limit values must be within the full input range (see SPECIFICATIONS). The corresponding digital output will transfer to the alarm state when the high limit value is exceeded and remains at that state until the input signal has retreated below the limit, plus any deadband.

Low Limit Value (Not for Event Counters): Use the channel Low Limit Value Register to write a low limit value with the same units as the input (Hz for Frequency, Counts for Event Counters). The corresponding digital output will transfer to the alarm state when the low limit value is exceeded and remains at that state until the input signal has retreated above the low limit, plus any deadband.

Deadband Value (Not for Event Counters): Use the channel Deadband Value Register to assign deadband to limit checking. Use the same units as the input (Hz for Frequency, Counts for Event Counters) choose a value within the full input range. Deadband is the amount the input signal has to return into the "normal" operating range before the output will turn OFF. Deadband is normally used to eliminate false trips or alarm "chatter" caused by input fluctuations near the alarm point.

IMPORTANT: *Noise or jitter on the input signal has the effect of reducing an instrument's deadband and may cause output chatter. This can reduce the life of any mechanical relay controlled via the output. To prevent this, increase the deadband.*

Alarm Output Indication: The yellow output LED can provide visual status indication of when the corresponding channel is in alarm. This LED is ON when the output switch is closed. Thus, this LED will turn ON for a non-failsafe alarm, and OFF for a failsafe alarm.

Software Alarm Indication: The Module Status Register will indicate if any inputs are in alarm. The Channel Status Register will indicate if a specific input is in alarm.

REGISTER MAP

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 also identifies the I/O data type.

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

Reference	Description
0xxxx	Read/Write Discrete Outputs or Coils. A 0x reference address is used to drive output data to a digital output channel.
1xxxx	Read Discrete Inputs. The ON/OFF status of a 1x reference address 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.

The following Modbus functions operate on register map registers to monitor, configure, and control module I/O:

CODE	FUNCTION	REFERENCE
01 (01H)	Read Coil (Output) Status	0xxxx
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*

All I/O values are accessed via the 16-bit Input Registers or 16-bit Holding Registers given in the 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.

The following table outlines the register map for the Model 942MB-0900 network I/O module. You will find it helpful to refer to this map as you review the Modbus function descriptions later.

REGISTER MAP
Model 942MB-0900

IMPORTANT: Disable the corresponding limit if you wish to control the state of an output directly by writing to these registers, as limit alarm control will take precedence over direct control.

Ref	Addr.	Description	Data Type/Format
Coil Registers (0x References, Read/Write)			
00001* Thru **0**0002	0-1 (0000-0001)	Control & monitor the On/Off status of Discrete Outputs 0 & 1	Discrete Output Value. Addresses a specific bit of a 16-bit word that controls/ monitors the ON/OFF status for the output. Bits 15-2: 0, Not Used. Bits 1,0: A set bit (1) means the corresponding output is ON (closed). A clear bit (0) means the corresponding output is OFF (open). Bit position corresponds to the output channel number—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.) Additionally, any unused bit is set to 0.
After reset, these registers read 0 (outputs OFF) and these registers are not maintained in EEPROM. *Note that 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.*			
Input Registers (3x References, Read-Only)			
30001	0 (0000)	Module Status Report	Bit 15: Flash Checksum 1 = Error, 0 = No Error Bit 14: Zero Bit 13: Default Mode Flag 1 = Default Mode Indication 0 = Not In Default Mode Bits 12-4: Zero Bit 3: I/O Watchdog Fault 1 = Watchdog Timeout 0 = No Timeout Bit 2: Limit Detect Flag 1 = Global Limit Exceeded 0 = No Limit Exceeded Bits 1,0: Zero
30002	1 (0001)	Current Input Range Register (Both Inputs)	Bits 15-2: Zero Bits 1,0: Input Range 00 = 0 = 0-50000Hz 01 = 1 = 0-1000Hz 10 = 2 = 0-100Hz 11 = 3 = Event Counter
30003	2 (0002)	Current Input Threshold/ Hysteresis Register (Both Inputs)	Bits 15-2: Zero Bits 1,0: Inp Thresh (Hysteresis) 00 = 0 = Bipolar 0.0V (±25mV) 01 = 1 = Bipolar 0.0V (±83mV) 10 = 2 = Unipolar 1.5V (±25mV) 11 = 3 = Unipolar 5.0V (±83mV)
30004	3 (0003)	Current Input Resistor (Both Inputs)	Bits 15-2: Zero Bits 1,0: Input Resistor: 00 = 0 = Pullup to 5V 01 = 1 = PullDown RTN 10 = 2 = None – Floating 11 = 3 = Reserved

REGISTER MAP

The 0-50KHz range uses a gated period of this time to count the number of input wave cycles in order to determine the input period and frequency. The maximum Gate Time provides the greatest resolution, while the minimum Gate Time provides the quickest measurement.

The 0-100Hz & 0-1KHz ranges will count this many wave cycles and the elapsed time to determine the average period before updating the frequency.

This is the amount of time the event counter input will wait after logging an event before allowing another event.

Ref.	Addr.	Description	Data Type/Format
Input Registers (3x References, Read-Only)			
30005	4 (0004)	Current Gate Time (seconds) for 0-50KHz Range (Both Inputs, 0-50KHz Frequency Inputs Only)	Bits 15-4: Zero Bits 3,2,1,0: Gate Time 0000 = 0 = Not Used 0001 = 1 = 0.1s 0010 = 2 = 0.2s 0011 = 3 = 0.3s 0100 = 4 = 0.4s 0101 = 5 = 0.5s 0110 = 6 = 0.6s 0111 = 7 = 0.7s 1000 = 8 = 0.8s 1001 = 9 = 0.9s 1010 =10 = 1.0s
30006	5 (0005)	Number of Cycles for Period Measurement (Both Inputs, 0-100Hz & 0-1KHz Frequency Inputs Only)	Bits 15-8: Zero Bits 7-0: A 8-bit count from 1-255 representing the number of cycles per period for encoders. The measurement will represent an average of this number of cycles. This is useful in minimizing jitter when monitoring an encoder output with varying cycle widths in a single period (revolution).
30007	6 (0006)	Event Counter Debounce Time (Both Inputs, Event Count Only)	Bits 15-8: Zero Bits 7-0: An 8-bit count from 0-200 that represents a debounce delay time multiple of 5 milliseconds to be applied to event counter inputs (0-1.0 seconds in 5ms increments possible).
30008	7 (0007)	Event Counter Trigger Edge (Both Inputs, Event Count Only)	Bits 15-1: Zero Bit 0: Event Trigger Edge 0 = 0 = Rising Edge 1 = 1 = Falling Edge Specifies which edge of the pulse will trigger an event count.
30009	8 (0008)	Acquire Count Enable and Event Count Termination (Both Inputs, Event Count Only)	Bit 15: Acquire Count 0 = No (Default) 1 = Yes (Enabled) Bits 14-1: Zero Bit 0: Count Terminate 0 = Auto-Reset (Default) 1 = Latching
30010	9 (0009)	Cutoff Frequency (Both Inputs, 0-100Hz & 0-1KHz Ranges Only) Default=5 (0.5Hz)	Bits 15-1: Cutoff Frequency, 0 to 10000 representing Hertz/10. Value is 0-10000 which is 0.0-1000.0 with 0.1Hz resolution. For the 0-100Hz and 0-1KHz ranges, input frequencies below the cutoff will read as 0Hz.

REGISTER MAP

Ref.	Addr.	Description	Data Type/Format
Input Registers (3x References, Read-Only)			
30011	10 (000A)	CH 0 Input Value	Count – 16-bit Unsigned, 0-65535 Hz or 0-65535 Counts. Not Applicable To Event Counters unless Acquire Count is enabled.
30012	11 (000B)	CH 0 Status Value	Bits 15-4: Zero Bit 3: High Limit Flag 1 = High Limit Exceeded 0 = Below High Limit Bit 2: Low Limit Flag (Not For Event Counters) 1 = Low Limit Exceeded 0 = Above Low Limit Bits 1,0: Range Flag 00 = In Range; 01 = Overrange; 10 = Under Range; 11 = Not Defined
30013	12 (000C)	CH 1 Input Value	*Format Same As Ch 0*
30014	13 (000D)	CH 1 Status Value	*Format Same As Ch 0*
30015	14 (000E)	CH 0 Raw Value	Untrimmed Value Read From Sampling Micro 0
30016	15 (000F)	CH 1 Raw Value	Untrimmed Value Read From Sampling Micro 1
Holding Registers (4x References, Read/Write)			
40001	0 (0000)	Slave Address **Default=247**	1-247
40002	1 (0001)	Baud Rate **Default= 2, 9600bps**	0 = 2400bps 1 = 4800bps 2 = 9600bps 3 = 14400bps 4 = 19200bps 5 = 28800bps 6 = 38400bps 7 = 57600bps 8 = 76800bps 9 = 115200bps
40003	2 (0002)	Parity **Default= 0, None**	0 = None 1 = Odd Parity 2 = Even Parity
40004	3 (0003)	I/O Watchdog Time **Default= 0, Disabled**	Set from 1-65534 sec. Set to 65535 (FFFFH) or 0 (0000H) to disable the watchdog timer (default).
40005	4 (0004)	Output Channel Timeout State **Default= 65535/disable**	The two lower order bits of this 16-bit register define the state the output channels will be sent to following watchdog timeout. Bit 0 is for channel 0, and bit 1 for channel 1. Write 65535 (FFFFH) to this register to leave outputs unchanged following a timeout (this is the default value).

Changes to Holding Registers4xxxx take effect following the next software or power-on reset, except as noted below

Watchdog timeout control takes precedence over alarm and direct control of the output relay.

REGISTER MAP

TIP: Increase this time if you are having communication problems or a high amount of error messages

***WARNING:** Do not enable internal pullup/pulldown resistor for voltages above 11V, or damage to the unit may result.*

The 0-50KHz range uses a gated period of this time to count the input wave cycles in order to determine the input period and frequency. A 1.0s Gate Time will provide the greatest resolution, while a 0.1s Gate Time will give the quickest measurement.

The 0-100Hz & 0-1KHz ranges will count this number of wave cycles and the elapsed time to measure the period before updating frequency.

Ref	Addr.	Description	Data Type/Format
Holding Registers (4x References, Read/Write)			
40006	5 (0005)	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 host message.
40007	6 (0006)	Range Configuration (Both Inputs) **Default=0, 0=50KHz**	Bits 15-2: Zero Bits 1,0: Input Type/ Range 00 = 0 = 0-50000Hz 01 = 1 = 0-1000Hz 10 = 2 = 0-100Hz 11 = 3 = Event Counter
40008	7 (0007)	Threshold/ Hysteresis Configuration (Both Inputs) **Default=0, Bipolar 0.0V ±25mV**	Bits 15-2: Zero Bits 1,0: Input Thresh/Hysteresis 00=0=Bipolar 0V, ±25mV 01=1=Bipolar 0V, ±83mV 10=2=Unipolar 1.5V, ±25mV 11=3=Unipolar 5.0V, ±83mV
40009	8 (0008)	Input Resistor Configuration (Both Inputs) **Default=0, Pullup to 5V**	Bits 15-2: Zero Bits 1,0: Input Resistor: 00 = 0 = 2.7KΩ Pull-Up to 5V 01 = 1 = 1KΩ Pull-Down to RTN 10 = 2 = None - Floating 11 = 3 = Reserved
40010	9 (0009)	0-50KHz Range Gate Time in Seconds (Both Inputs, 0-50KHz Frequency Inputs Only) **Default=0, 1.0 Second**	Bits 15-4: Zero Bits 3,2,1,0: Gate Time 0000 = 0 = 1.0s 0001 = 1 = 0.1s 0010 = 2 = 0.2s 0011 = 3 = 0.3s 0100 = 4 = 0.4s 0101 = 5 = 0.5s 0110 = 6 = 0.6s 0111 = 7 = 0.7s 1000 = 8 = 0.8s 1001 = 9 = 0.9s
40011	10 (000A)	Number of Cycles for Period Measurement (Both Inputs, 0-100Hz, 0-1KHz Ranges Only) **Default=8**	Bits 15-8: Zero Bits 7-0: An 8-bit count from 1-255 that is the number of cycles per period for encoders. Your measurement will represent an average period of this number of cycles. This is useful in minimizing jitter when monitoring an encoder output with varying cycle widths in a single period (revolution).

REGISTER MAP

Ref.	Addr.	Description	Data Type/Format
Holding Registers (4x References, Read/Write)			
40012	11 (000B)	Event Counter Debounce Time (Both Inputs, Event Counter Only) **Default=1, 5ms**	Bits 15-10: Zero Bits 9-0: An 8-bit count from 0-200 that represents a debounce time multiple of 5 milliseconds to be applied to event counter inputs (0-1.0 seconds in 5ms increments possible).
40013	12 (000C)	Event Counter Trigger Edge (Both Inputs, Event Counter Only) **Default=0, Rising Edge**	Bits 15-1: Zero Bit 0: Event Trigger Edge 0 = 0 = Rising Edge 1 = 1 = Falling Edge Specifies which edge of the pulse will trigger an event count.
40014	13 (000D)	Acquire Count Enable and Event Count Termination (Both Inputs, Event Counter Only) **Default=0, Auto-Reset**	Bit 15: Acquire Count 0 = No (Default), 1 = Yes/enable Bits 14-1: Zero Bit 0: Terminate Count Action 0 = Auto-Reset 1 = Latching Specifies if the count total will reset to 0 upon reaching the setpoint, or latch at the setpoint. Auto-Reset will reset counter to 0 upon reaching the high limit and pulse the alarm output for about 100ms (alarm LED will turn on briefly and alarm output will go to the alarm state momentarily). Latching will make the counter latch at the limit value until the even counter is reset. The alarm will also remain latched (and the corresponding alarm output if enabled) until the event counter is reset.
40015	14 (000E)	Cutoff Frequency (Both Inputs, 0-100Hz & 0-1KHz Ranges Only) Default=5 (0.5Hz)	Bits 15-1: Cutoff Frequency, 0 to 10000 representing Hertz/10. Value is 0-10000 which is 0.0-1000.0 with 0.1Hz resolution. For the 0-100Hz and 0-1KHz ranges, input frequencies below the cutoff will read as 0Hz.

This is the time the event counter will wait after logging an event before allowing another event.

IMPORTANT: *If you choose to also acquire the running count rather than just relying on the high limit, then you do so at the expense of possibly missing events during the time it takes to report the count. Disabling the acquire count function will help maintain an accurate event count.*

Raising the Cutoff Frequency will reduce the detection time for under-range frequencies.

REGISTER MAP

Ref.	Addr.	Description	Data Type/Format
Holding Registers (4x References, Read/Write)			
40016	15 (000F)	Event Counter Reset (Both inputs, Event Counters Only) **Default=0, No Reset**	Bits 15-2: Zero Bit 0,1:Counter Reset 00 = 0 = Do Not Reset 01 = 1 = Reset CH0 Ctr 10 = 2 = Reset CH1 Ctr 11 = 3 = Reset Both Ctr Specifies which event counter is to be cleared, CH0 and/or CH1. This value is not stored and a read of this register will always return 0. This register is not maintained in EEPROM.
40017	16 (0010)	CH0 High Limit **Default=50KHz** or Counter Limit **Default=65535**	Count – 16-bit Unsigned, 0-65535
40018	17 (0011)	CH0 Low Limit **Default=1Hz** (Not for Event Counters)	Count – 16-bit Unsigned, 0-65535
40019	18 (0012)	CH0 Deadband Default=**500HZ (Not for Event Counters)**	Count – 16-bit Unsigned, 0-65535
40020	19 (0013)	CH0 Alarm Output State & Alarm Output Enable **Default=0, Disabled**	Bits 15-3: Zero Bit 2: Alarm Out State 0 = Failsafe (OFF) 1 = Non-Failsafe (ON) Bit 1: High Limit Output Enable 1 = Hi Output Enabled 0 = Hi Output Disabled Bit 0: Low Limit Output Enable (Not for Event Counters). 1 = Lo Output Enabled 0 = Lo Output Disabled
40021	20 (0014)	CH1 High Limit **Default= 50000**Hz or **65535** (Events)	Count – 16-bit Unsigned, 0-65535
40022	21 (0015)	CH1 Low Limit **Default=1Hz**	Count – 16-bit Unsigned, 0-65535, Does not apply to Event Counters
40023	22 (0016)	CH1 Deadband **Default=500HZ**	Count – 16-bit Unsigned, 0-65535, Does not apply to Event Counters

The High Alarm Output is auto-enabled for event counters with Auto-Reset Termination.

This output is non-failsafe only for event counters.

Ref.	Addr.	Description	Data Type/Format
Holding Registers (4x References, Read/Write)			
40024	23 (0017)	CH1 Alarm Output State & Alarm Output Enable **Default=0, Disabled**	Bits 15-3: Zero Bit 2: Alarm Out State 0 = Failsafe (OFF) 1 = Non-Failsafe (ON) Bit 1: High Limit Output Enable 1 = Hi Output Enabled 0 = Hi Output Disabled Bit 0: Low Limit Output Enable (Not for Event Counters). 1 = Lo Output Enabled 0 = Lo Output Disabled
40025	24 (0018)	Calibration Access And Alternate Method of Module Reset	Writing 24106 (5E2AH) here immediately removes write protection from the calibration registers that follow. All other values apply write protection to the calibration registers (except 41429). 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.
40026	25 (0019)	CH0 50KHz Cal High Value	Count – 16-bit Unsigned, 0-65535 Hz
40027	26 (001A)	CH0 1KHz Cal High Value	Count – 16-bit Unsigned, 0-65535 Hz
40028	27 (001B)	CH0 100Hz Cal High Value	Count – 16-bit Unsigned, 0-65535 Hz
40029	28 (001C)	CH1 50KHz Cal High Value	Count – 16-bit Unsigned, 0-65535 Hz
40030	29 (001D)	CH1 1KHz Cal High Value	Count – 16-bit Unsigned, 0-65535 Hz
40031	30 (001E)	CH1 100Hz Cal High Value	Count – 16-bit Unsigned, 0-65535 Hz
40032	31 (001F)	0-50KHz Input Range High Val.	Ideal Count – 16-bit Unsigned, 0-65535 Hz
40033	32 (0020)	0-1KHz Input Range High Val.	Ideal Count – 16-bit Unsigned, 0-65535 Hz
40034	33 (0021)	0-100Hz Input Range High Val.	Ideal Count – 16-bit Unsigned, 0-65535 Hz
41001 **.** **.** **.**		This block Mirrors 1xxxx Registers where applicable.	Refer to Note 5. 1xxxx Input Registers are mapped to the 41xxx Holding Register space using an address offset of 41000.

REGISTER MAP

The High Alarm Output is auto-enabled for event counters with Auto-Reset Termination.

This output is non-failsafe only for event counters.

This register is not maintained in EEPROM. *After a reset, this register reads 0 (write protection enabled and no reset).*

IMPORTANT: *Access to shaded calibration registers 40026 through 40034 is not normally required and writes to these registers should be avoided to prevent module miscalibration.*

REGISTER MAP

Ref.	Addr.	Description	Data Type/Format
Holding Registers (4x References, Read/Write)			
42001 . . .		This block Mirrors 0xxxx Registers where applicable.	Refer to Note 5. 0xxxx Input Coil Registers are mapped to the 42xxx Holding Register space using an address offset of 42000.
43001 . . .		This block Mirrors 3xxxx Registers.	Refer to Note 4. 3xxxx Input Registers are mapped to the 43xxx Holding Register space using an address offset of 43000.

Notes (Register Map):

1. The Report Slave ID and Reset Slave functions do not operate on Register Map locations. An alternate method of reset is provided if your software does not support the Reset Slave function (Register 40025).
2. Configuration data stored in holding registers (4xxxx reference addresses) is maintained in EEPROM, unless otherwise noted. Changes to these registers do not take effect until the next software or power-on reset of the module, except for Calibration Access & Reset Register 40025 which takes effect immediately.
3. Frequency input values are represented via 16-bit unsigned integers with a possible range of 0 to 65535Hz. Default limits are set to the input range endpoints: 1Hz (0-50KHz) or 0.5Hz (0-100, 0-1KHz) for the Low Limit, and 100Hz, 1KHz, or 50KHz for the High Limit, according to the range selected. Default deadband is set to 1% (1Hz, 10Hz, or 500Hz according to selected range). Limit checking is always active.
4. For your convenience, this module mirrors the contents and operation of 3xxxx registers into 43xxx holding register space for systems and controllers that cannot directly access 3xxxx registers. That is, the 3xxxx registers of this model can be written to, or read from, using either the standard methods described in the Modbus specification, or through mapping (mirroring) to the Holding Register space. The format of the registers are identical and you only need to offset your address by 43000. For example: if you want to read Input Register 1 through the Holding Registers, you would use the "Read Holding Registers" function with an address of 43001.
5. For 942MB modules with a firmware revision later than 9300-043D or 9300-095B, the mirroring function as described in Note 4 is augmented as follows (0xxxx also maps to 42xxx space, and 1xxxx also maps to 41xxx space, where applicable):

   For 1xxxx Input Status Registers (where supported), the return data is reformatted to match the Holding Register format. For example, if you request Input Status for 12 digital inputs, instead of getting 2 bytes returned with the first 12 bits representing 12 digital inputs, you will get 12 separate words (2 bytes) instead, with each set to 0000H (OFF) or FFFFH (ON).

   For 0xxxx Coil Registers (where supported), reads are handled in the same way as noted for 1xxxx Input Status Registers. That is, you may write to the coil registers using the "Preset Single Register" function with an address offset of 42000. Setting the data to 0000H will turn the coil OFF, while setting the data to FF00H will turn the coil ON.

Summary Of Data Types Used By 900MB Modules

Data Types	Description
Count Value	A 16-bit signed integer value representing an A/D count, a DAC count, time value, or frequency with a range of –32768 to +32767.
Count Value	A 16-bit unsigned integer value representing an A/D count, a DAC count, time value, or frequency with a range of 0 to 65535.
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).

Data Types

I/O values for this model are represented by the simple data types shown at right for temperature, percentage, and discrete on/off.

SPECIFICATIONS

The Model 942MB-0900 is a DC-powered, or 24VAC powered, transmitter which conditions two channels of Frequency or Event Counter inputs, and provides an isolated RS485/Modbus network interface, plus two solid-state outputs. The outputs may operate as independent ON/OFF switches, or as limit alarm controls. Isolation is supplied between inputs, the network, power, and the outputs. This network transmitter is DIN-rail mounted.

The unit is configured, calibrated, and controlled with an Acromag Windows® Configuration Program, or any software that adheres to the Modbus command/response format for supported commands. Non-volatile reprogrammable memory in the module stores calibration and configuration information. A push button on the module allows communication with a module when its address, baud rate, and parity settings are unknown.

Model Number (942MB-0900)

Input transmitters are color coded with a white label. The prefix "900" denotes the Series 900. The "MB" suffix denotes ModBus. The four digit suffix of this model number represents the following options, respectively: 0 = No Options; 9 = Output: RS485/Modbus; 0 = Enclosure: DIN rail mount; 0 = Approvals: CE marked, UL Listed, and cUL Listed.

Default (Factory) Configuration

PARAMETER	CONFIGURATION
Module Address	247
Baud Rate	9600bps
Parity	None
Response Delay	0 (No Delay)
Watchdog Timer	0 (Disabled)
Output Timeout States	Both ON (Timer Disabled)
Input Range (Each Input)	Frequency, 0-50KHz
Samples	1 (No Input Averaging)
Threshold/Hysteresis	Bipolar 0V ±25mV Hysteresis
Event Debounce	5ms
Event Edge	Rising
Event Count Termination	Auto-Reset
Input Resistor	None (Not Connected)
0-50KHz Gate Time	1.0 seconds
Number of Cycles	8 cycles
Cutoff Frequency	0.5Hz
Limits (Each Input)	Alarm Outputs Disabled
High Limit (Each Input)	50KHz (High Endpoint)
Low Limit (Each Input)	1Hz (Low Endpoint)
Deadband (Each Input)	500Hz

Inputs

Frequency: Select 0 to 100.00Hz, 1000.0Hz, or 50KHz. Unit accepts unipolar or bipolar (zero crossing) input signals. Frequency is accurately measured to a minimum of 1Hz (50KHz range), or 0.5Hz (100Hz & 1KHz ranges). Un-measurable frequencies below 1Hz (or 0.5Hz) are indicated as 0Hz. The Status LED will flash if input frequency is un-measurable (below 1Hz), or if the signal amplitude is too low for detection.

Pulse/Event Counter: Upward 0 to 65535, up to 100Hz (debounce = 0), unipolar or bipolar input pulses. Totalized counts are volatile and not retained following loss of power.

Inputs

Unipolar Signal Configuration

Threshold/Hysteresis: Select 1.5V/±25mV or 5.0V/±83mV, typical.

Amplitude: 0 to 3V minimum, 200V peak.

Bipolar (Zero-Crossing) Signal Configuration

Threshold/Hysteresis: Select 0.01V/±25mV or 0.03V/±83mV, typical.

Amplitude: 0-20KHz ±50mV minimum with ±25mV hysteresis, or ±150mV minimum with ±83mV hysteresis, to ±200V peak maximum;
20K-50KHz: ±100mV minimum with ±25mV hysteresis, or ±200mV minimum with ±83mV hysteresis, to ±200V peak maximum.

Minimum Pulse Width: Frequency-10us; Event Counter-5ms (5ms ON + 5ms OFF = 10ms period or 100Hz).

Overvoltage Protection: Bipolar Transient Voltage Suppression (TVS).

Inputs

Resolution: The effective resolution is generally better than the display resolution indicated in the Table below. The sampling mechanism used for the 100Hz & 1000Hz ranges will result in decreased internal resolution with increased frequency. As the input frequency approaches the upper end of the 100Hz & 1000Hz ranges (higher number of cycles), the reduced internal resolution can approach twice the display resolution noted below for these ranges, increasing error.

Input Range	Display Resolution
0 to 100.00Hz	0.01Hz
0 to 1000.0Hz	0.1Hz
0 to 50000Hz	1Hz
0 to 65535 Pulses	1 Pulse

Input & Alarm Accuracy: See Table. Internal timing is crystal-based for best accuracy, temperature stability, and minimum long term drift. Note the sampling mechanism used for the 100Hz and 1000Hz ranges will result in decreased resolution near the upper end of the range, decreasing the effective accuracy in this region.

Input Range	Accuracy at 25°C	Accuracy (-25 to 70°C)
0 to 100.00Hz	±0.02Hz (f ≤ 50Hz) ±0.04Hz (f > 50Hz)	±0.04Hz (f ≤ 50Hz) ±0.06Hz (f > 50Hz)
0 to 1000.0Hz	±0.2Hz (f ≤ 500Hz) ±0.4Hz (f > 500Hz)	±0.4Hz (f ≤ 500Hz) ±0.6Hz (f > 500Hz)
0 to 50000Hz	±10Hz	±15Hz
0 to 65535 Pulses	±1 pulse	±1 pulse

Input Impedance: 36KΩ, typical.

Input Response Time/ Input Filter Bandwidth: -3dB at 35KHz, typical. See Input Acquisition and Output Response times for more information.

Input Acquisition Time (Frequency Inputs): Varies from 100ms to 1 second with input frequency for 0-50KHz range. For 0-1KHz & 0-100Hz ranges, acquisition time is a function of the number of Cycles and the input frequency. For example, a 2Hz signal with Cycles set to 8 will take 4 seconds to acquire (8 Cycles / 2 cycles/second).

Input Pull-Up/Pull-Down (Internal): Select 2.7KΩ input pull-up to +5V, a 1KΩ input pull-down to RTN, or none to disconnect the internal resistor. **WARNING:** Do not exceed 11V with internal pullup or pulldown resistors enabled, or damage to the circuit will result. Limit internal pullup/pulldown resistor power to less than 0.125W. Disable the internal pull resistors with AC voltages.

Input Debounce (Event Counter Only): Set from 0 (disabled) to 1 second in 5ms increments. Set appropriately with respect to input signal bandwidth and characteristics.

Input Averaging (0-100Hz & 0-1KHz inputs only): Specify the number of wave cycles to sample while tracking total time to determine the input period. Increasing Cycles will increase the response time.

Noise Rejection (Common Mode): 80dB @ 60Hz, typical.

Reference Test Conditions: 25°C ambient; 24VDC power.

Digital Outputs (SSR's)

To control higher voltages and/or currents, or for controlling AC, an interposing relay may be used. Refer to Optional Wiring.

Output Channels: Two Solid-State Relays (SSR), Form A (SPST-NO). Outputs share a common return at the RTN terminals.

Output Control: Discrete on/off control, alarm control, or watchdog timeout control. Alarm control of output state has a higher priority than direct control, while watchdog timeout control has the highest priority when enabled. Disable the alarm outputs if direct control is required. Outputs are turned OFF following a software or power-on reset.

Note: When the outputs are used to control interposing relays for switching AC & DC devices of higher voltage & current, the coil ratings for the interposing relay shall not exceed 24V DC, 100mA.

Output "OFF" Voltage Range: 0 to +48V DC.

Output "OFF" Leakage Current: 1uA typical at 48VDC.

Output "ON" Current Range (each output): 0 to 1A DC (to 40°C).

Output Deration: Derate"ON" current above 40°C at 10mA per °C.

Output "ON" Resistance: 0.4Ω Maximum.

Output "ON" Voltage: 0.4V DC Maximum at 1A DC.

Output Response Time: 5ms typical, from receipt of force coil command to switch transfer. Effective time will vary with output load.

Enclosure and Physical

Dimensions: 1.05 inches wide, 4.68 inches tall, 4.35 inches deep. Refer to the dimensions drawing at the front of this manual.

DIN Rail Mount: Type EN50022; "T" rail (35mm).

Connectors: Removable plug-in type terminal blocks rated for 15A/300V; AWG #12-24 stranded or solid copper wire.

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.

Agency Approvals

Approvals: CE marked, per EMC Directive 2004/108/EC. UL Listed (USA & Canada). Hazardous Locations – Class I, Division 2, Groups A, B, C, D. Consult Factory.

Environmental

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 12-36V DC SELV (Safety Extra Low Voltage), or 22-26 VAC. See table for current.

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

Supply	942MB-0900 Current Draw
10V	124mA Typical, 135mA Maximum
12V	100mA Typical, 110mA Maximum
15V	80mA Typical, 90mA Maximum
24V	52mA Typical, 60mA Maximum
36V	38mA Typical, 45mA Maximum
24VAC	94mArms Typical, 100mArms Maximum

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

Power Supply Effect:

DC Volts: ≤ ±0.001% of output span change per volt for rated variation.

60/120 Hz Ripple: ≤ ±0.01% of output span per volt peak-to-peak of power supply ripple.

IMPORTANT – External Fuse: If unit is powered from a supply capable of delivering more than 1A to the unit, it is recommended that this current be limited via a high surge tolerant fuse rated for a maximum current of 1A or less (for example, see Bel Fuse MJS1).

Environmental

Isolation: Inputs, network, power, and outputs, 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). Complies with test requirements of ANSI/ISA-82.01-1988 for voltage rating specified.

Note that input and output channel pairs are not isolated channel-to-channel.

Installation Category: Designed to operate in an installation in a Pollution Degree 2 environment with an installation category (Over-voltage Category) II rating.

Electromagnetic Interference Immunity (EMI): Measurement and alarm shift is less than ±0.25% of input span for interference from switching solenoids, commutator motors, and drill motors.

Immunity per BS EN 61000-6-1:

1) Electrostatic Discharge Immunity (ESD), per IEC 61000-4-2.
2) Radiated Field Immunity (RFI), per IEC 61000-4-3.
3) Electrical Fast Transient Immunity (EFT), per IEC 61000-4-4.
4) Surge Immunity, per IEC 61000-4-5.
5) Conducted RF Immunity (CRFI), per IEC 61000-4-6.

These limits represent the minimum requirements of the standard, but product typically complies to a higher standard.

Emissions per BS EN 61000-6-3:

1) Enclosure Port, per CISPR 16.
2) Low Voltage AC Mains Port, per CISPR 14, 16.
3) DC Power Port, per CISPR 16.
4) Telecom / Network Port, per CISPR 22.

Note: This is a Class B product.

These limits represent the minimum requirements of the standard, but product typically complies to a higher standard.

IMPORTANT: Power, input, and output (I/O) wiring must be in accordance with Class I, Division 2 wiring methods of Article 501-4(b) of the National Electrical Code, NFPA 70 for installations in the US, or as specified in section 18-1J2 of the Canadian Electrical Code for installations within Canada and in accordance with the authority having jurisdiction.

This equipment is suitable for use in Class I, Division 2, Groups A, B, C, and D, or non-hazardous locations only.

WARNING – EXPLOSION HAZARD – Substitution of components may impair suitability for Class I, Division 2.

WARNING – EXPLOSION HAZARD – Do not disconnect equipment unless power has been switched off or the area is known to be non-hazardous.

Communication Interface

Interface Standard: 3-wire RS-485, half-duplex (D, D-bar, and Common).

Command/Response Protocol: Standard Modbus RTU protocol as defined under "Modicon Modbus Reference Guide" PI-MBUS-300 Rev J (reference www.public.modicon.com).

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

Parity: Odd, Even, or None.

Stop Bits: One for Even or Odd parity, two for no parity. Module will work with 1 or two stop bits with no parity.

Response Delay: 0 to 65500 ticks (1 tick = 1.085us). The minimum communication delay the module waits before sending a reply to the host. As a minimum, it must be set greater than the inherent delay already present to be effective. Some signal converters or host/software systems will not accept an immediate response from a slave without added delay.

Module Address: 0 to 247 (01H-F7H). Default Mode address is 247 (F7H).

Network Capacity: Multi-drop up to 31 modules, plus a host, without a repeater. Up to 247 modules total if a repeater is used for every 31 nodes plus a host computer.

Communication Distance: Up to 4000 feet without a repeater.

Default Communication Mode: Sets communication address to 247, baud rate to 9600bps, and no parity. Used to communicate with a module when its internal address, baud rate, and parity settings are unknown. Enter this mode by pressing the DFT push-button until the yellow ST LED flashes. Exit this mode by resetting the module or by pressing the DFT button until the Status LED stops flashing. Programmed settings for address, baud rate, and parity take effect outside of Default Mode.

I/O Watchdog Timer: Set for periods up to 65534 seconds (18.2 hours). Timeout is indicated by a rapidly flashing ST status LED, a set bit in the Module Status Register, and optionally via defined digital output timeout states. The timer is reinitiated via a read or write to any input/output channel. Note that clearing a timeout will not automatically restore the outputs to their initial state—outputs have to be driven manually or under alarm control. Another watchdog timer is built into the microcontroller that causes it to initiate a self reset if it ever fails to return from an operation or "locks up".

Supported Modbus Commands: Per Modbus/RTU standard for Modbus Functions below (Reference refers to the register addresses the function operates on):

Code	Function	Reference
01 (01H)	Read Coil (Output) Status	0xxxx
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
15 (0FH)	Force Multiple Coils (Outputs)	0xxxx
16 (10H)	Preset Multiple Registers	4xxxx
17 (11H)	Report Slave ID	*Hidden*
08 (08H)	Reset Slave	*Hidden*

Controls & Indicators

Module Push Button (See Dwg. 4501-906 For Location):

Default (DFT) - Push to engage or disengage the default communication mode. Default mode sets baud rate to 9600bps, module address to 247, and no parity. Status LED flashes in default mode. A module will leave the default mode following a software or power-on reset.

LED Indicators:

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

Status (Yellow) – Indicates Default Mode (slow flash), Watchdog Timeout (rapid flash), and input over-range (constant ON).

Output (Yellow, One Per Output) – ON if output relay is ON (closed).

IMPORTANT: *Over-range indication may mask timeout and default mode indication.*

ACCESSORIES

Series 900MB Configuration Software (Model 5034-186)

A Windows® utility used to configure Series 900MB modules that makes getting started much easier. All module functions can be set with this software. This software may be optionally downloaded from our website (www.acromag.com) to registered module owners.

RS-232 to RS-485 Serial Adapter (Model 5034-214)

A non-isolated, port-powered, RS232-to-RS485 signal converter used with the Configuration Software to communicate with Series 900MB modules. Signal isolation is already provided by the RS485 network port of Series 900MB modules. The adapter has DB-9F connectors at both ends and plugs directly into the DB-9M serial port connector of most personal computers. Module connects to the RS-485 side of this adapter via a separate interconnecting cable (5034-202 below). This converter is not intended for driving fully loaded RS-485 networks over long distances and does not have enough power to drive terminated networks.

Interface Cable (Model 5034-202)

A 3-wire cable used to connect the RS-485 side of Signal Converter 5034-214 to the RS-485 network terminals of Series 900MB modules. This 8 foot long cable has a DE-9M connector on one end, and three stripped and tinned wires on the other end. These wires are labeled A, B, & C for connection to the D, Dbar, & COM module terminals, respectively.

Series 900MB Software Interface Package (Model 900C-SIP)

This package combines the 900MB Configuration Software (5034-186), RS-232 to RS-485 Serial Converter (5034-214), Interface Cable (5034-202), and Instructions (8500-649), into a complete kit for interfacing with Series 900MB I/O Modules.

Revision History

The revision history for this document is summarized in the table below.

Release Date	Version	EGR/DOC	Description of Revision
29 MAY 2019	H	FJM/ARP	The Connections information doesn't match the drawings.

Notes: