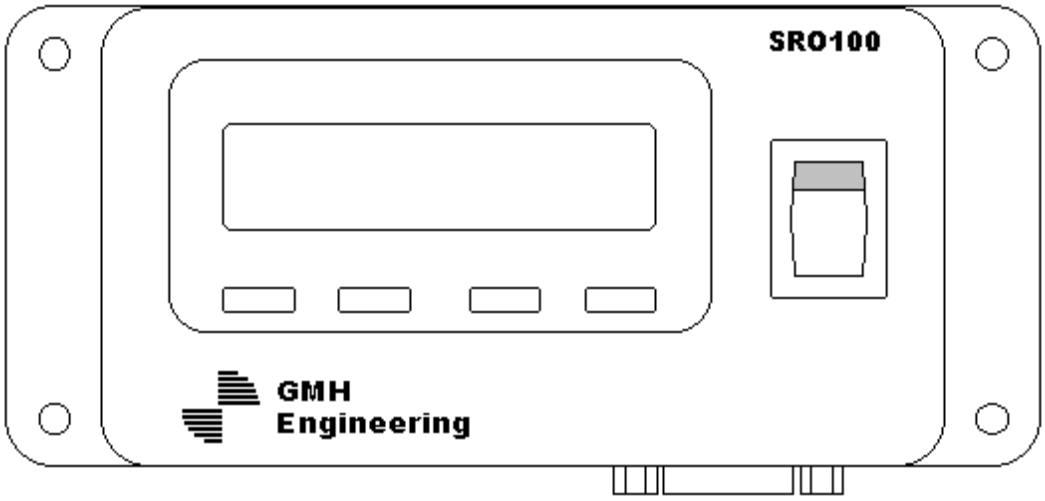
GMH Engineering



USERS MANUAL

SRO100

Programmable Digital Indicator And Frequency Counter

Introduction

The SRO100 Programmable Digital Indicator/ Frequency Counter may be used in any application requiring a programmable frequency counter with a scaled output. The SRO100 also includes a configurable power supply and measurement interface for use with other GMH Engineering products including the Delta DRS1000 Non-Contact Speed Sensor and the HFW80 Fifth Wheel.

The SRO100 has an easy-to-read, backlit LCD display with six large digits. Besides displaying the measured value, the unit can record Max/Min readings and register Hi/Lo alarms with an audible beeper. The easy-access front keyboard provides straightforward menu navigation. Multiple configurations may be saved in non-volatile memory with password protection.

The SRO100 can communicate with other intelligent systems via its built-in RS-232 and RS-485 serial communication ports, enabling an external device to receive measurements and to control multiple SRO100 units.

Setup

The SRO100 may be configured either by using the Menu Functions which are accessed using the front panel display and keypad buttons or by Serial Communication with another intelligent device.

Settings may be saved in one of four non-volatile memory files to avoid losing them. These settings may then be retrieved as desired to quickly configure the SRO100. The unit will remember current settings for as long as it receives a correct supply voltage. When the power is cycled, all unsaved settings are lost and the SRO100 powers up to the last saved settings. If none were saved, default settings will be used.

Depending upon arrangements made when the device was ordered, the SRO100 may be supplied with sample settings saved in one or more of the non-volatile memory files. These settings may be for use with other GMH Engineering products such as the Delta DRS1000 Non-Contact Speed Sensor or the HFW80 Fifth Wheel, and include features such as scale factors and custom display annunciators (engineering units). Refer to literature included with the unit for more information.

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Front Panel Operation

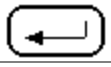
The front panel consists of a display, keypad and on/off switch. The functions of the display indicators and keypad buttons are shown in Tables One and Two.

There are two modes of operation: Normal Mode and Menu Mode. Pressing the ENTER button while in Normal Mode changes to Menu Mode, which is used for setting up the unit.

Table 1 - Display Indicator Functions

Display Indicator	Normal Mode	Menu Mode
6 Large Digits	Displays measured input value	Menu functions
3 Small Digits	Engineering units of input value	Menu options
Up Arrow	Displayed reading exceeds high alarm level	Indicates that one or more menu options are available by pressing UP button
Down Arrow	Displayed reading exceeds low alarm level	Indicates that one or more menu options are available by pressing DOWN button

Table 2 - Keypad Functions

Button	Normal Mode	Menu Mode
ESC 	Toggles display backlighting on/off and exits from MAX and MIN readings	Escapes the operator to the previous menu level or progresses to the next digit when entering values
UP 	Displays the highest encountered input value since power-up (MAX reading)	If Up Arrow displayed, scrolls upward through available menu options
DOWN 	Displays the lowest encountered input value since power-up (MIN reading)	If Down Arrow displayed, scrolls downward through available menu options
ENTER 	Enters Menu Mode at password level	Toggles between available menu options, or selects current option

Menu Functions

Menu functions used for configuring the SRO100 are accessed by pressing the ENTER button while in Normal Mode. Upon doing so, the operator will be prompted to enter the CODE, or 4-digit password. The default password is 0000. Pressing ENTER again after entering the password will continue to the next menu function.

The following is a brief description of each of the menu functions and available menu options. Refer to the Menu Map shown in Figure One and to the keypad button functions shown in Table Two.

LCD Backlighting
The SRO100 display has backlighting to illuminate the LCD display under low-light conditions
- Default state: ON
- Press ENTER to toggle backlighting ON/OFF. (when saved, this determines the power-up condition)
Note: in Normal Mode, ESC toggles the backlighting ON/OFF

Leading Zeros
Allows blanking of leading zeros of display reading when not required (i.e. 215 instead of 000215)
- Default state: ON (all leading zeros visible)
- Press ENTER to toggle leading zeros 0N/0FF

Decimal Point Selection
Allows placement of the decimal point in the display reading
- Default state: No decimal point
- Press ENTER to go to the Decimal Point submenu
- UP and DOWN buttons scroll through available options (No DP, DP1 … DP5)
- Press ENTER to select the required decimal point

Calibration
The display reading can be scaled to the appropriate value for the input frequency count. When using the front panel, the scale factor is achieved via a linear, two-point calibration method where one point is fixed at 0Hz input = zero on the display; the second point is set by presenting a known frequency at the SRO100 input terminals and entering the desired reading at that frequency.

- Default value: Factory Default Value
- Press ENTER to go to the Calibration submenu
- UP and DOWN buttons scroll between DEFault or CUStom calibration
- Press ENTER again to select choice.
- If using custom calibration, then use UP and DOWN to change digits to required value. ESC progresses to next digit. Press ENTER to accept calibration value. Press ENTER again to confirm acceptance. Press ESC to cancel the calibration operation

For example: Desired Scale Factor = 10 Hz/Unit (where Unit is displayed on annunciator)
Present known input frequency = 1000Hz at input terminals.
While input frequency is active, enter calibration menu and choose CUStom calibration.
Change display to read 100 and ENTER. SRO100 displays “WAIT” and stores value.
ENTER again to confirm. Exit Menu Mode by pressing ESC
SRO100 will now display 1 at 10Hz input, 23 at 230Hz input, etc.

Note that this method differs from setting the calibration by means of serial communication and does not allow for a null offset (or non-zero reading at 0Hz). See section on Serial Communications.

Alarm Levels and Hysteresis

Preset two alarm levels, or trip points with hysteresis. When an alarm is tripped, the UP or DOWN arrow will be displayed on the LCD and the beeper will sound if enabled. The hysteresis value is the difference in reading between an alarm switching on and switching off. Set levels of any unused alarms to a value that can never be reached in practice, for example 999999 for High Alarm or -1 for Low Alarm.

For example: Hysteresis = 100, High Alarm = 10000, Low Alarm = 200
High Alarm switches on at 10000 and off at 9900
Low Alarm switches on at 200 and off at 300

- Default state: No alarm levels set, hysteresis is zero
- Press ENTER to go to the Alarms submenu
- UP and DOWN buttons scroll through the available options:
  - AL ON/OFF - Press ENTER to toggle the alarms ON/OFF
  - HI AL - Set a value for the High Alarm value between 0 and 999999 (default is 100000). Press ENTER to see any previously set value then use UP and DOWN to change polarity or digits to required value. ESC progresses to next digit. Press ENTER to accept value.
  - LO AL - Set a value for the Low Alarm value between 0 and 999999 (default is 010000). Press ENTER to see any previously set value then use UP and DOWN to change polarity or digits to required value. ESC progresses to next digit. Press ENTER to accept value.
  - HYST - Set a value for the Hysteresis value between 0 and 999999 (default is 000000). Press ENTER to see any previously set value then use UP and DOWN to change polarity or digits to required value. ESC progresses to next digit. Press ENTER to accept value.

Note: There are no criteria for the setting of alarm levels. Values may be equal or inverted, hysteresis levels may overlap. Changes to settings take effect when exiting Menu Mode. Alarms are evaluated after every display update, depending upon Filter settings (below).

Filter Selection

The SRO100 can be configured with a smoothing filter to average display readings. Select the number of readings to average from 1 to 8 before updating display.

- Default value: 1
- Press ENTER to enter Filter submenu
- UP and DOWN buttons scroll through available options (1,2,4,8 sample averaging)
- Press ENTER to select desired value, ESC to cancel

Max/Min Readings

The SRO100 can memorize the highest, MAX, and lowest, MIN, readings encountered since power-up.

- Press ENTER to reset the MAX and MIN values

Annunciator Selection

Engineering units corresponding to measured input values can be displayed on the SRO100. This Menu Function may be used to select the desired annunciator.

- Default value: None
- Press ENTER to enter Annunciator submenu
- UP and DOWN buttons scroll through available options (Current, Hz, kHz, MHz, x10, 000, QTY, deg, kWh, m/s, l/m, l/s, None)
- Press ENTER to select desired value

Note: Custom annunciators may be programmed by means of serial communication and saved in a configuration file. See section on Serial Communications.

Audible Feedback (Beeper)
If enabled, a beeper emits a tone when a keypad button is pressed or when an alarm level is reached.
- Default state: OFF
- Press ENTER to toggle the beeper ON/OFF

Password Protection (CODE)
Password protection by means of a four digit code allows the unit configuration to be protected if required.
- Default value: 0000
- Press ENTER to see current code value. Use UP and DOWN buttons to change digits if desired. ESC progresses to next digit. Press ENTER to accept value.
Note: DO NOT FORGET YOUR CODE or you will be unable to access the menu system

Address Selection
Each SRO100 can be assigned its own unique address from 0 to 31. This is especially useful if networking multiple units together under RS-485 serial communications.
- Default address: 00
- Press ENTER to see current address. Use UP and DOWN buttons to select desired address. Press ENTER to accept address value.
Note: To avoid communication conflicts, no two modules in a networked system may share same addresses.

Baud Rate
Select an appropriate Baud (bits per second) rate for serial communications.
- Default value: 9600
- Press ENTER to enter Baud Rate submenu. Use UP and DOWN buttons to select baud rate from available values (1200, 2400, 9600, 19200). Press ENTER to accept baud rate value.

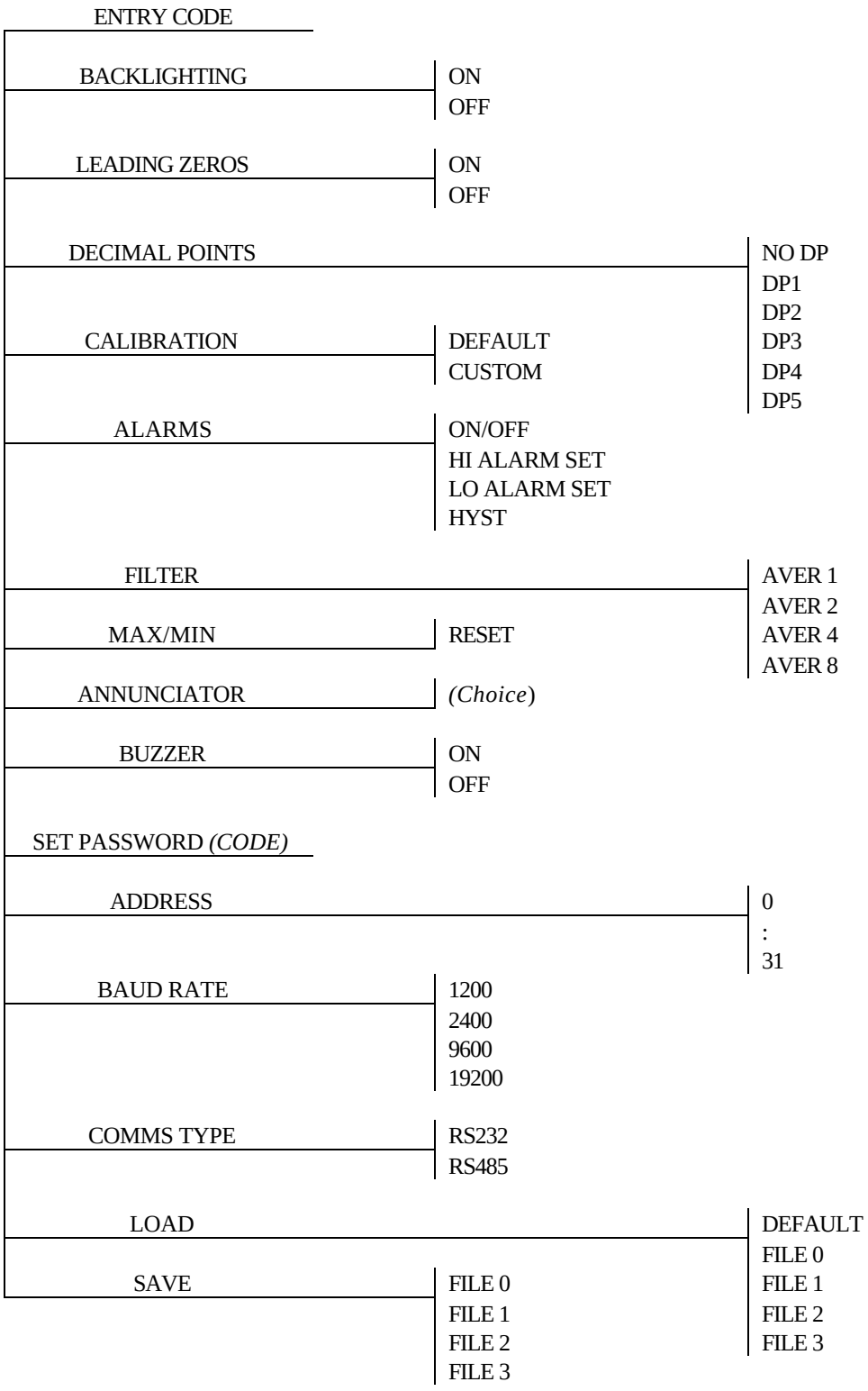
Communication
Select an appropriate type of serial communication.
- Default value: RS-232
- Press Enter to enter Communication submenu. Use UP and DOWN buttons to select required form of communication. Press ENTER to accept choice.

Load Configuration Setup File
Set up the SRO100 by loading a configuration file from memory.
- Press ENTER to enter File Loading submenu. Use UP and DOWN buttons to select from files 0-3 or the default file. Press ENTER to accept choice.

Save Configuration Setup File
SRO100 configuration values may be stored in one of four setup files, allowing the unit to be easily set up by loading a configuration file from memory (above) even when the unit power has been cycled.
- Press ENTER to enter File Saving submenu. Use UP and DOWN buttons to select from files 0-3. Press ENTER to accept choice and save configuration information to file.

Figure 1 - Menu Map

Menu Map



Serial Communications

The SRO100 can communicate with other intelligent devices by means of RS-232 and RS-485 serial communication. This provides a convenient way to set up the device and also to interface to an existing system. In addition, features such as custom annunciators (engineering units) and a null offset calibration value are only configurable in this way.

Under RS-485 communications, multiple units may be networked together as shown in Figure Two and are distinguished by the unique address assigned to each device. Under RS-232 communications, only a single unit should be connected to a personal computer or other device as shown in Figure Three.

Figure 2 - RS-485 Network

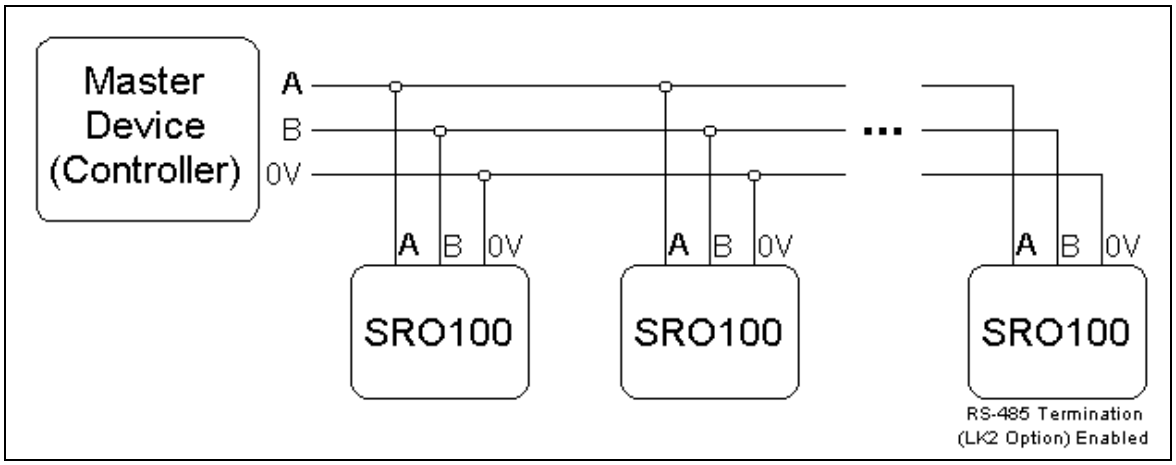
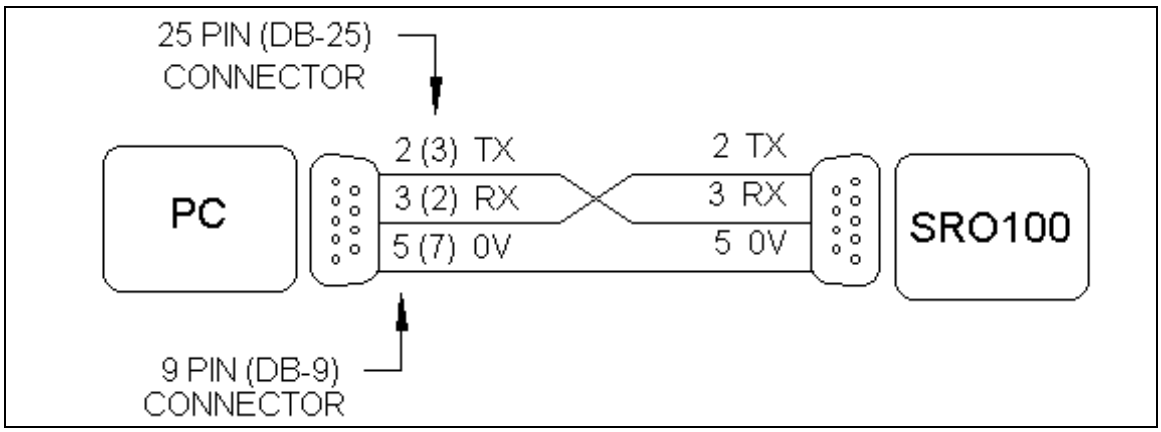


Figure 3 - RS-232 Communication With A Personal Computer



A personal computer can interface with the SRO100 through one of the computer's serial ports by means of a terminal program. Examples of terminal programs include Hyperterminal, included with the Microsoft® Windows® operating systems, or Kermit, which can be obtained for many different operating systems. The receive data (RX) and transmit data (TX) lines must be interchanged between the SRO100 and the computer as shown in Figure Three (null modem cable) and the terminal program must be set to transmit a CR/LF (carriage return, or line end, and line feed) rather than a simple CR for the computer's ENTER key.

Serial commands are shown in Table Three. All commands are ASCII characters and are case-sensitive. Each command consists of a two digit address *aa*, corresponding to the unit's address, followed by the command and then the ASCII CR/LF characters (ENTER key). In Table Three, *x* corresponds to a digit value or a decimal point, representing the desired value and *c* corresponds to an uppercase character or a space. Here are some example commands *(all commands followed by a CR/LF)*:

00J2	(set the decimal point at place two on unit with address 0)
23V	(get current LCD reading on unit with address 23)
01EMPH	(set annunciator to display MPH on unit with address 1)
31G0	(turn off backlighting on unit with address 31)
14UL3	(load setup file 3 on unit with address 14)
11X	(get device info on unit with address 11)
**R	(any device out there?)

If the address of the unit is unknown, then use the characters ** to cause any connected unit to reply (to avoid confusion, only one unit should be connected under RS-485 when using this command).

Baud rate should match SRO100 configuration. Both RS-232 and RS-485 require 8 Data Bits, No Parity and 1 Stop Bit. No flow control is used.

Device Info returned using the *aa*X command is formatted as follows:

FIRMWARE VERSION
ALARM ON/OFF
HIGH ALARM VALUE
LOW ALARM VALUE
HYST VALUE
CALIBRATION m VALUE
CALIBRATION c VALUE
AVERAGING (1=1 Sample, 2=2 Samples, 3=4 Samples, 4=8 Samples)
LEADING ZEROS ON/OFF
DP SELECTION
ANNUNCIATORS
BACKLIGHT ON/OFF
BEEPER ON/OFF

Here is an example showing how to enter and save a calibration and custom engineering units through serial communication for a given application:

Desired Scale Factor = 131.4 Hz/KPH with no offset SRO100 Address = 3

Linear equation will be in form y=mx+c, where m = 1/(131.4)=0.007610, c = 0.0

(all commands followed by a CR/LF)
Connect to SRO100 and verify communication by sending 03R, responses is a 1
Setup annunciator to read KPH by sending 03EKPH, response is a 1
Enter m value by sending 03D0.00761, response is a 1
Enter c value by sending 03C0, response is a 1
Verify calibration by sending 03X, response is Device Info, including m and c values
Save to file number 0 by sending 03US0, response is a 1
SRO100 will now display 10KPH at 1314 Hz input, 20 at 2628 Hz input, etc.

Note: The apparent precision of the displayed value is influenced by the position of the decimal point.

Table 3 - Serial Commands

Description	Address	Command	Response
ALARMS			
Alarms ON=1, OFF=0	aa	A*x*	1
Set Low AlarmValue	aa	AL*xxxxxx*	1
Set High Alarm Value	aa	AH*xxxxxx*	1
Set Hysteresis Value	aa	AY*xxxxxx*	1
COMMUNICATIONS			
Baud Rate 1200BPS	aa	B0	1
Baud Rate 2400BPS	aa	B1	1
Baud Rate 9600BPS	aa	B2	1
Baud Rate 19200BPS	aa	B3	1
(Response will be at new baud rate)			
Set Address	aa	N*xx*	1
Select RS-232 Communications	aa	I0	1
Select RS-485 Communications	aa	I1	1
(Response will be in newly selected mode)			
INPUTS			
Current LCD Reading	aa	V	LCD Value
Read MAX Value	aa	M0	MAX Value
Read MIN Value	aa	M1	MIN Value
Reset MAX/MIN Values	aa	M2	1
CALIBRATION			
Set Slope, m Value (y=mx+c)	aa	D*xxxxxxxx*	1
Set Intercept, c Value (y=mx+c)	aa	C*xxxxxxxx*	1
INPUT AVERAGING			
Update every 1 Sample	aa	K0	1
Update every 2 Samples	aa	K1	1
Update every 4 Samples	aa	K2	1
Update every 8 Samples	aa	K3	1
FORMAT			
Leading Zeros ON=1,OFF=0	aa	Z*x*	1
Decimal Point OFF	aa	J0	1
Decimal Point Place *x* (places 1 through 5)	aa	J*x*	1
DISPLAY			
Backlighting ON=1, OFF=0	aa	G*x*	1
Beeper ON=1, OFF=0	aa	Q*x*	1
Set Annunciator (Engineering Units)	aa	E*ccc*	1
FILE			
Load Default Setup	aa	UD	1
Load Setup File *x*	aa	UL*x*	1
Save Setup File *x*	aa	US*x*	1
GENERAL			
Hello? (Any units attached?)	aa	R	1
Read Module Serial Number	aa	F0	Serial Number
Read Device Info	aa	X	Device Info

Notes: *aa* = device address (0-31) *x* = digit value or decimal point (i.e. 1-9 or .) *c* = uppercase character or a space (i.e. M); Response is ASCII character 1 if command successful, 0 if incorrect or unsuccessful

Wiring

The wiring connections for the SRO100 are located inside the protective enclosure which may be opened by removing the four hex head screws on the back of the unit. Inside is a printed circuit board with two screw terminal blocks as shown in Figure Four.

Terminal Block One is for connecting the input to the SRO100 and also contains two terminals for the External Sensor Power Port (see next section). It has color code labels for easy connection to certain other GMH Engineering Products, such as the DRS1000 Non-Contact Speed Sensor. Terminal Block Two is for SRO100 supply power and RS485 serial communications (RS-232 serial communications are accessed through the DB-9 connection on the outside of the enclosure). Pin connections for both terminal blocks are given in Tables Four and Five.

The SRO100 input is normally a single-ended signal, 0-12V, but the SRO100 is also compatible with a differential input signal, 0-5V nominal (An optional full differential input may be factory-installed, contact GMH Engineering for details). For a single-ended input use pin 3 only of Terminal Block One and leave pin 4 unconnected; the signal on pin 3 is then referenced to the External Sensor Ground on pin 1 of Terminal Block One. For a differential signal, connect as shown in Table Four.

Table 4 - Input Connections

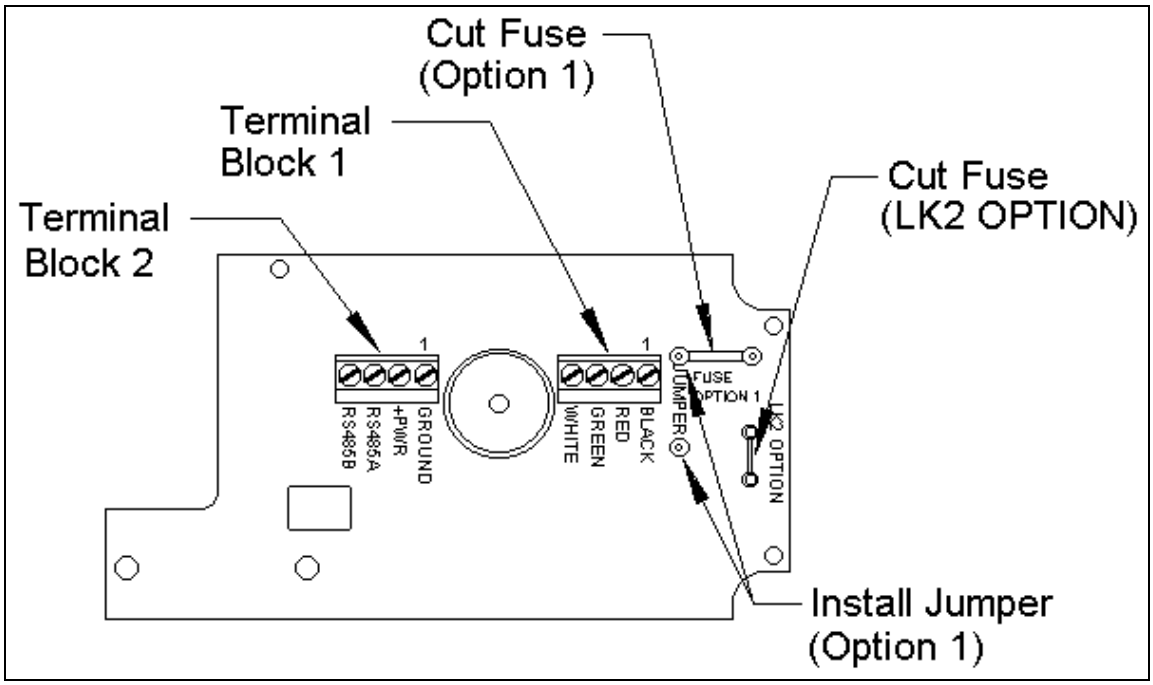
INPUT (Screw Terminal Block 1)		
Pin Number	Label	Function
1	BLACK	External Sensor Ground
2	RED	External Sensor + Power
3	GREEN	+ Signal Input
4	WHITE	- Signal Input

Table 5 - Output Connections

Power/RS485 Serial Communications (Screw Terminal Block 2)		
Pin Number	Label	Function
1	GROUND	Supply Ground
2	+PWR	+ Power
3	RS485A	RS485-A Serial Communications
4	RS485B	RS485-B Serial Communication

--- TO AVOID INJURY AND/OR DAMAGE TO THE SRO100, PLEASE MAKE SURE SUPPLY POWER IS TURNED OFF AT THE SOURCE WHENEVER THE SRO100 ENCLOSURE IS OPEN ---

Figure 4 - Circuit Board and Wiring Connections



Optional Configurations

The SRO100 can be user configured with two available options by making minor changes to the printed circuit board inside the enclosure (see Figure Four). In order to do this, it may be necessary to solder a jumper wire between two points or to break one of the circuit connections by using a razor blade or similar implement to cut across a fuse trace on the printed circuit board. When cutting a fuse trace, the depth of the cut should only extend through the copper layer on the top side of the printed circuit board and need only be wide enough to break the electrical connection between the two points. Proper connections may be verified using the continuity checking feature of a voltmeter.

Following is a description of the available options and the required modifications (all options refer to changes which affect characteristics of connections on Terminal Block One):

Default Configuration (No Modifications): The same supply voltage presented to the SRO100 is available at the External Sensor Power Port (Pins 1 and 2).

Option 1: Cut Fuse and install Jumper to cause the voltage at the External Sensor Power Port (Pins 1 and 2) to be 5Vdc regulated. Note: the maximum current available to the external sensor is 100mA with this option enabled.

LK2 Option: Cut Fuse to disable terminating resistor for RS-485 Serial Communications. This would normally only be done to network multiple SRO100 units together. In any case, the resistor should remain in place on the last SRO100 unit in an RS-485 bus. See Figure Two.

Specifications and Physical Dimensions

Input: Pulse 0-12 V single-ended,
0-5V nominal differential;
2V nominal switching threshold

Frequency Measurement:
Range: 1-999999 Hz
Resolution: 1 Hz
Accuracy: 20 ppm (overall error)
Transition Rise/Fall Time: 30 ms max
Update Rate: 1 Sample/sec
Smoothing: 1,2,4,8 Sample averaging

Scale Factor Calibration: 2 pt linear

Serial Communication:
Baud Rates: 1200,2400,9600,19200
Protocols: RS-232 and RS-485
32 unique, user-selectable addresses

Display Options: Lead zero blanking; decimal pt.; engineering units; beep on/off; backlighting on/off

Supply Voltage: 6.0 - 16.0 Vdc (match sensor if using External Sensor Power Port without Option 1)

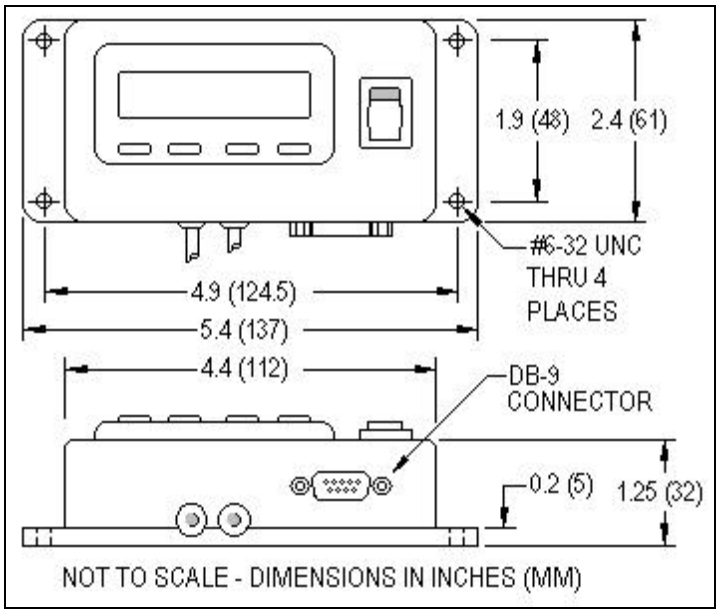
Supply Current: 30 mA; 50 mA w/backlighting (not including external sensor requirements):

External Sensor Power Port:
SRO100 Supply voltage (1A max) or
optional 5Vdc regulated (100mA max)

Temperature Range: 32°F to 120°F (0°C to 50°C)

Weight: 0.5 lb. (.227 kg.)

Figure 5 - Physical Dimensions



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