Operating Manual

GTI Bi-Fuel®

SMALL ENGINE CONTROL SYSTEM

Form GPN0100 with VSM+ OM 9-15

altronic
HOERBIGER Engine Solutions

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1.0 OVERVIEW

1.1 **This manual applies to GPN0100, and GPN0100-12 panels used with Series 25 and 50 gas trains, S/N 1004 and up, kits for small, in-line engines.**

1.2 The GPN0100 and GPN0100-12 control panels consist of the GCN0100 instrument, VSM+, wiring terminals, relay and fuse installed in an industrial polyester enclosure.

1.3 The GPN0100 and GPN0100-12 controllers are dedicated electronic microprocessor-based systems designed to sense manifold air pressure (MAP), exhaust gas temperature (EGT), and engine vibration (VIB) or a digital input point to control and monitor the GTI Bi-Fuel® natural gas fumigation system for diesel engines. A front mounted keypad serves as the user interface for all required system configuration. A backlit 128 x 64 character graphic display shows system status, programmed controller parameters and channel labels. The controller provides ON/OFF control function for the gas supply to the engine and provide complete supervisory and alarm annunciation capability in a low cost package dedicated to bi-fuel fumigation of diesel engines.

WARNING: Deviation from these instructions may lead to improper engine operation which could cause personal injury to operators or other nearby personnel.

NOTE: Engine must be equipped with an full authority governor to operate properly with the GTI Bi-Fuel system.

2.0 GPN0100/GPN0100-12 PANEL

2.1 The panel contains all the necessary hardware and provides the wiring interface to external sensors. Conduit openings at the bottom of the enclosure provide access for supply power, sensor and other necessary wiring.

2.2 The GPN0100 must be powered by 24 vdc, and the GPN0100-12 must be powered by 12 vdc.

WARNING: The controller system must be configured prior to use. Reference section 8.0, INITIAL CONFIGURATION, for instructions describing how to configure the controller for the specific application. Verify the program in nonvolatile memory (the eeprom) prior to starting the system.

3.0 GCN0100 DISPLAY MODULE

3.1 The GCN0100 display module provides for monitoring the manifold air pressure (MAP), exhaust temperature (EGT), and engine vibration (VIB) or a normally closed digital input permissive. The output of the GCN0100 instrument pilots a control relay to open and close the gas supply solenoid valve.

3.2 The keypad is a sealed membrane unit containing MENU/ESC, UP, DOWN and ENTER keys, used to navigate through channel status and description and to edit the setpoints.

3.3 The LCD has a Home Screen that displays a Status Line, BI-FUEL OFF, BI-FUEL FAULT, TIMERS ACTIVE, BI-FUEL INHIBIT, or BI-FUEL ON, along with Manifold Air Pressure and Exhaust Temperature.

3.4 The keypad and display are used to navigate through channel status and descriptions, view screens, and to view or edit the system's configuration. Pressing the MENU/ESC key advances the display to the menus. All menu adjustments are saved in non-volatile EEPROM memory by pressing the ENTER key. The EEPROM memory retains the current configuration during normal operation, after engine shutdown and a system power-down.

3.5 The GCN0100 has serial communications compliant to Modbus RTU standard and uses RS-485 for its hardware communication format.

4.0 MOUNTING THE PANEL (FIG. 1)

4.1 Mount the control panel(s) to a post or to a suitable flat surface so that the display is at a convenient viewing height.

NOTE: Avoid mounting the panel with the LCD display facing direct sunlight. The display operating temperature range is -31°F to +176°F (-35°C to +80°C). The panel(s) should be mounted within 10–20 feet of the engine, the fuel solenoid valve and sensors.

5.0 WIRING (SEE WIRING DIAGRAMS, FIG. 2)

5.1 Wire Cable Assembly 693136-x, where x may be either 1 (for 10-foot) or 2 (for 20-foot) cabling, into the panel. This assembly contains the wiring for the MAP, Exhaust Temperature, NC Digital Input, Power and Gas Solenoid Valve.

Feed the cable through the bottom of the panel and connect each wire to its appropriate position on the terminal strips.

5.2 VSM+ Sensor Harness consists of three main components, (662031 Conduit, 615107 VIB Sensor, and 693134-XX VIB Sensor Harness). These three components are assembled by the installer to create the VIB harness. Up to 8 sensors can be utilized at a length of up to 100 feet.

NOTE: All furnished drawings and instructions assume (–) ground DC system. In the case of a floating ground, or (+) ground DC system, please contact Altronic Factory for support.

6.0 KEYPAD DESCRIPTION

6.1 The GCN0100 gauge features a four-key front keypad which is used to view or change the setpoint values, configure and calibrate the gauge. The front panel keys are MENU/ESC, ENTER, and ▲, ▼ (up and down arrow keys).

6.2 MENU/ESC
The MENU/ESC key is used to enter the main menu and to return to the home screen at any time. **If the MENU/ESC key is used to return to the home screen prior to pressing the ENTER key, changes are not stored in the memory and do not take effect.**

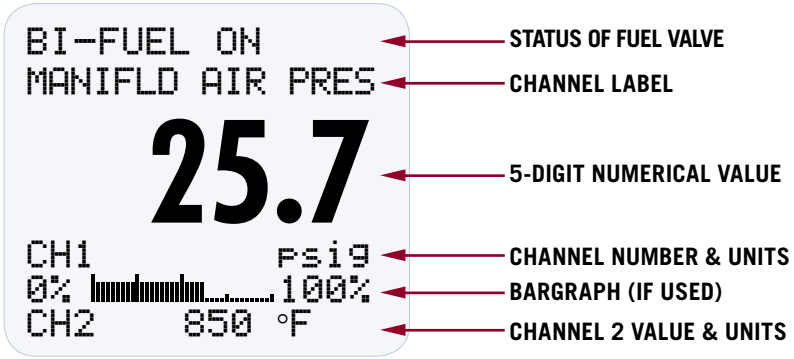
6.3 ENTER
The ENTER key is used throughout the menu to proceed through the configuration and to accept the data to be saved. Throughout configuration when a change has been made and is to be saved to memory, press ENTER and the display will read SAVED, and the new data or configuration will be stored in the nonvolatile memory.

6.4 ▲ AND ▼
The up and down arrow keys are used to scroll through the selections in the menu and to increase or decrease values during configuration and calibrations. Values can be changed incrementally using individual key presses or more rapidly by holding the key down.

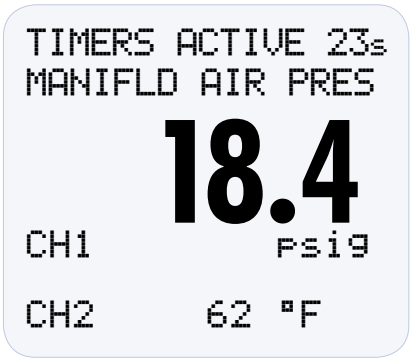
7.0 UNDERSTANDING THE HOME SCREEN

7.1 The Home Screens shows the operating parameters on one screen.

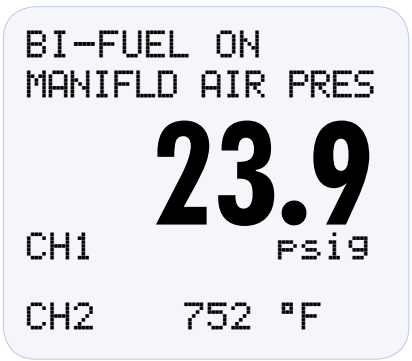
The status line will read one of the following: BI-FUEL ON, BI-FUEL OFF, BI-FUEL FAULT, BI-FUEL INHIBIT, or TIMERS ACTIVE.



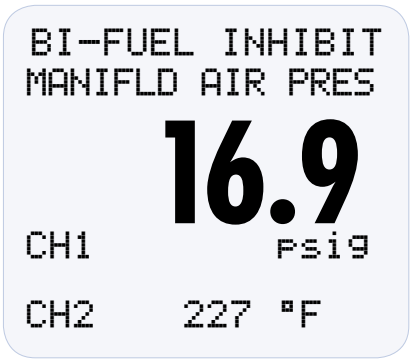
7.2 To activate the Bi-Fuel® system, turn on the power; the unit automatically resets.



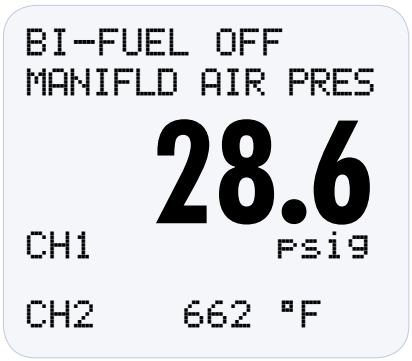
Upon a power-up, or exiting a setpoint violation, the GCN0100 counts down until the time expires.



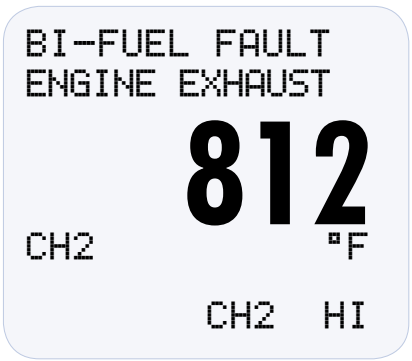
Once the fuel delay timer expires, and there are no setpoint violations on either channel and the digital input is closed, the GCN0100 turns on the relay, providing power to the solenoid valve.



If the normally-closed input is open, the GCN0100 displays BI-FUEL INHIBIT. The solenoid valve will not be powered with this message displayed.



In this example, the Bi-Fuel® system is off because the manifold pressure has violated the high setpoint.



If the engine exhaust temperature exceeds the high setpoint, BI-FUEL FAULT will be displayed and the gas supply will be closed. To clear this fault, power must be cycled via the on/off switch on the front panel.

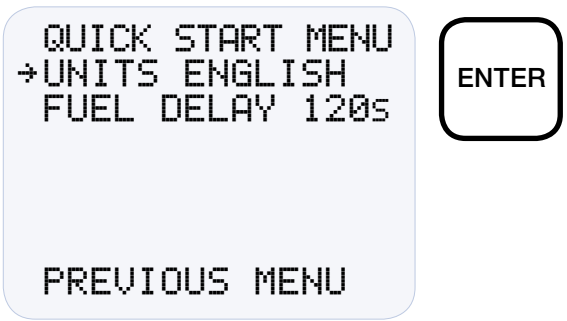
8.0 INITIAL CONFIGURATION

8.1 This section will guide the user through the minimum screens required to set-up the controller. A more detailed description of all user parameters is provided in section 10.

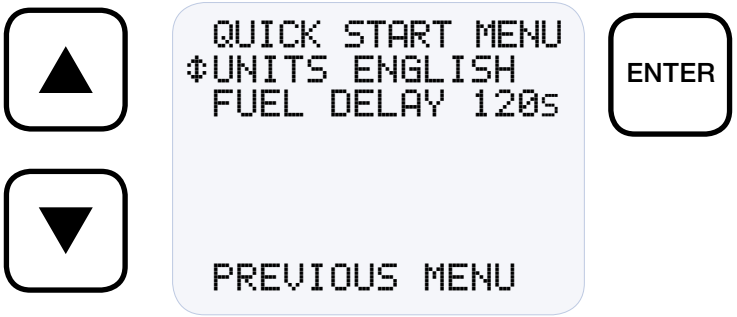
This system is shipped with factory default settings. SEE FIGURE 5. Upon power-up a splash screen displays: GTI logo, GCN0100, the firmware Rev. Level and date.

NOTE: The splash screen can be displayed at anytime from a home screen by pressing both the up and down arrow keys together.

Press the following keys to enter the QUICK START MENU:

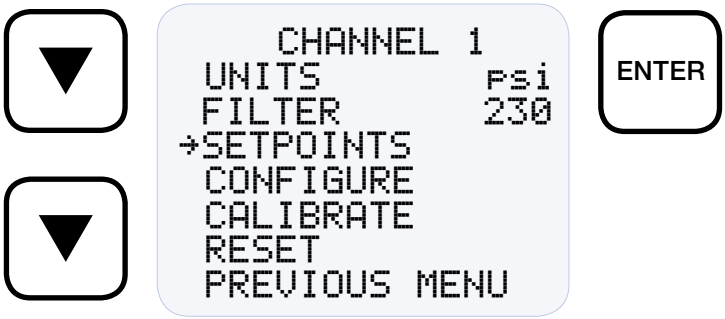


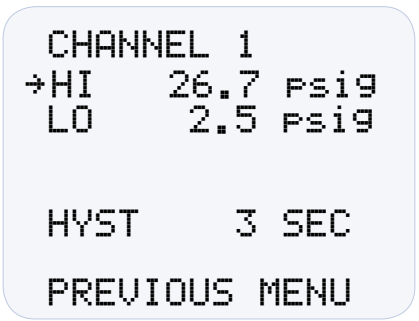
Once the arrow cursor is adjacent to the line to be changed, pressing the ENTER key changes the icon to ⇕. Now the up and down arrow keys can be used to change the selection. Once the desired change is made, pressing the ENTER key saves the change and returns the arrow cursor.



The up and down arrow keys can be used to move the cursor down to the PREVIOUS MENU. Pressing ENTER then returns the display to the main menu. Move the cursor adjacent to CHANNEL 1 and press ENTER.

Next, press the DOWN ARROW twice, to move the arrow cursor adjacent to SETPOINTS as shown, followed by ENTER.





Press ENTER again to change the cursor to the ⇳ icon. Use the UP and DOWN arrow buttons to make the desired setpoint changes. The procedure is repeated to change the second setpoint value.

8.2 HYSTERESIS

Hysteresis can be used when the output switch is configured as nonlatching to prevent the output switch from oscillating or turning on and off around the setpoint. The hysteresis is implemented as a time, in seconds, that begins when the sensor input value returns to within the setpoint value limits. When the input value returns to within the setpoint value limits, the hysteresis timer starts and the switch stays tripped for the configured hysteresis time. If during the hysteresis time the setpoint is violated again, the hysteresis timer starts over. The hysteresis value can be set from 0 to 99 seconds. To set the hysteresis value, point to HYST and press the ENTER key. Use ▲ or ▼ to increase or decrease the hysteresis time and press ENTER to save the new value.

9.0 VSM+ GENERAL

9.1 The VSM+ senses shock and vibration from remote mounted sensors and outputs a velocity amplitude number in the range of 0 to 1023. The velocity amplitude number is unit-less and is referred to as the vibration reference number or VIB.

The VSM+ vibration sensor is an automotive type accelerometer. It generates a low voltage signal proportional to vibration intensity. The sensor inputs to the VSM+ are differential and are not referenced to ground.

Each of the eight (8) channels can be configured with its own unique control and safety shutdown set point, startup delay timer, sensor gain, and trip delay value.

The VSM+ utilizes two output switches. Switch 1 is used for "Control" shutdown and switch two is used for "Safety" shutdown.

The VSM+ can communicate to other instruments, PC's, or PLCs via the Ethernet communications port. Use data grade Category 5E Shielded Twisted Pair (STP) or Unshielded Twisted-Pair (UTP) cable that has a 100Ω characteristic impedance that meets the EIA/TIA Category Five (CAT-5) wire specifications. Maximum wire length is 100 meters (325 feet).

NOTE: The use of Category 5E STP (Shielded Twisted Pair) cable with shielded RJ45 plug connectors is strongly recommended for installation in harsh industrial environments and/or in the presence of strong electrical fields.

9.2 **POWER** – The VSM+ requires 10-32Vdc, .20Amps. When powered, the green "POWER" LED will be on.

STATUS – The status indicator is multi-purpose. It contains several "blink" patterns.

EtherNet/IP communications mode – one long, one short blink at ¼-second rate

Modbus/TCP communications mode – short blinks at ¼-second rate

"wink" mode – steady short blinks at ⅛-second for the selected time

ETHERNET – The Ethernet port contains two LEDs that are built into the RJ45 connector. The green LINK LED will be on solid if the Ethernet port has successfully established a connection. The yellow RX/TX LED signals network activity.

OUTPUT SWITCH – Each of the built-in switches (SW1 and SW2) have an LED indicator. The led turns on when the switch is activated. When faulted, the GPN0100 display will read Bi-Fuel Inhibit.

NOTE: To use the embedded web server, "Internet Protocol Version 4 (TCP/IPv4) Properties" will have to be changed. Please consult your IT department on how to configure your computer properly.

Select "Use the following IP address". For "IP address:" enter "10.1.100.XXX" XXX must be something other than 100 or another used identifier. For "Subnet mask:" enter "255.255.255.0"

EDS File (Electronic Data Sheet) – The EDS file is used for Monitor configuration. This will be utilized if remote monitoring is required. Please reference VSM+ IOM for further detail.

Embedded Web Server – The VSM+ has a built in web server that must be used for VSM+ configuration. The embedded web server can also be used to view and set the network and protocol settings.

Once connected and powered, open your web browser and type the IP address assigned to the monitor. The default address is "http://10.1.100.100"

9.3 OUTPUT SWITCH 1 is designed to be used as CONTROL HIGH. The switch is activated when a control set point value is violated for any monitored sensor. Each sensor can be configured with a CONTROL HIGH set point.

Switch 1 can be configured as normally open (N/O) or normally closed (N/C).

Switch 1 should be configured N/O "FAILSAFE" to allow for normal bi-fuel operation.

OUTPUT SWITCH 2 is designed to be used as SAFETY HIGH. The switch is activated when a safety set point value is violated for any monitored sensor. Each sensor can be configured with a SAFETY HIGH set point.

Switch 2 can be configured as normally open (N/O) or normally closed (N/C).

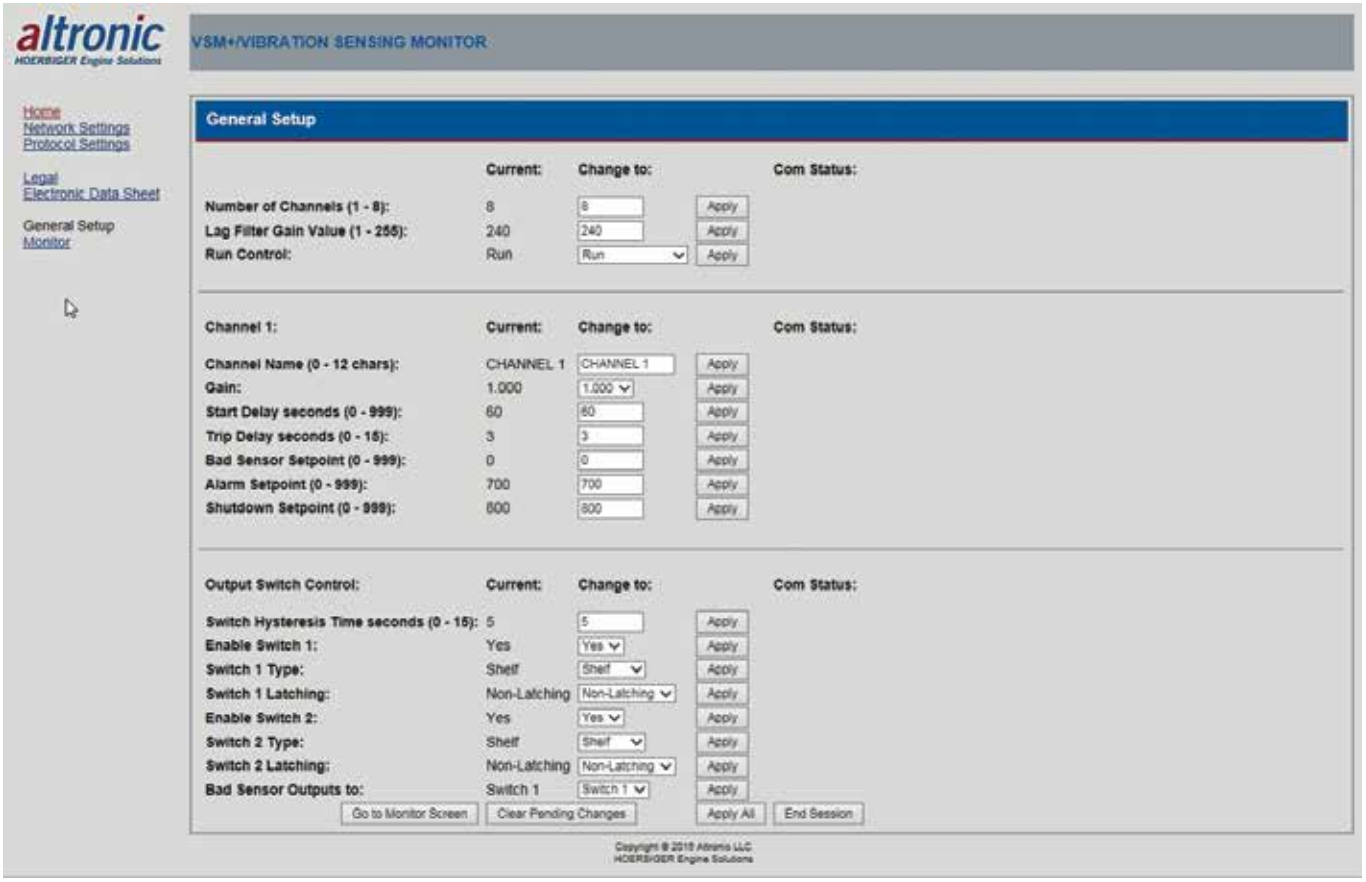
Switch 2 should be configured N/O "SHELF" to allow for normal bi-fuel operation.

Switches 1 and 2 can be configured as Latching or Non-Latching. To configure channels to be use as a CONTROL HIGH set point, NON-LATCHING should be selected. To configure channels to be used as a SAFETY HIGH set point, LATCHING should be selected.

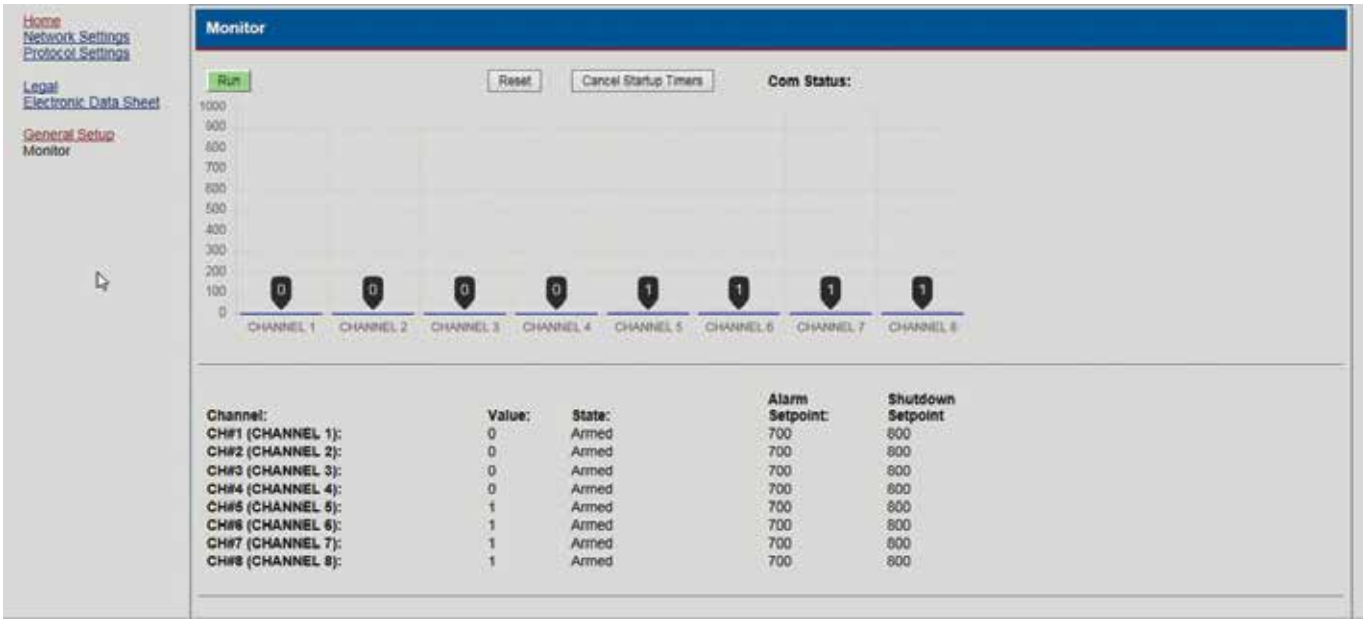
NOTE: Nomenclature translation on the embedded VSM+ configuration page.
Alarm and Non-latch is Control
Shutdown and Latch is Safety
CH1 Shelf is N/C
CH1 Failsafe is N/O
CH2 Shelf is N/O
CH2 Failsafe is N/C

9.4 To configure the VSM+, connect to the embedded web server as describe in the note above. Select "General Setup" which is located in the menu bar on the left hand side of the screen. The General Setup screen will display on the computer. This screen is used to configure the VSM+ for the specific engine application.

- Number of Channels (1-8) – allows the user to select between 1 and 8 vibration inputs.
- Lag Filter Gain Value (1-255) – should not be changed (default value is 240)
- Run Control – should be in the Run position. This tells the VSM+ to act or ignore exceeded set points.
- Channel Name (0-12 chars) – allows the user to name each individual channel up to 12 characters
- Gain – allows the user to bring the sensor value into a desired range. A starting value of .296 is recommended
- Start Delay seconds (0-999) – allows the user to delay when the VSM+ starts looking for values above the programmed set point. A starting value of 0 is recommended.
- Trip Delay seconds (0-15) – allows vibration values to exceed the programmed set point for a specified amount of time before an output switch is tripped. It is recommended that this value be 3 seconds or less.
- Bad Sensor Setpoint (0-999) – is a value that is programmed to notify the user of a broken, bad, or disconnected sensor. A recommended starting value is 50.
- Alarm Setpoint (0-999) – allows the user to set a Control Off set point
- Shutdown Setpoint (0-999) – allows the user to set a Safety Shutdown setpoint



9.5 To view the VSM+ readings through computer select "Monitor" which is located in the menu bar on the left hand side of the screen. The Monitor screen will display on the computer. This screen is used to view the inputs to the VSM+.



For information on Network Settings and Protocol Settings, please consult the VSM+ IOM.

10.0 ADVANCED CONFIGURATION

THE FOLLOWING REPRESENTS ADVANCED PROGRAMMING FEATURES WHICH SHOULD ONLY BE ATTEMPTED BY TRAINED PERSONNEL.

WARNING: Section 10 presents advanced programming features which, if used improperly, can prevent the GPN0100 from operating correctly. This should only be attempted by trained personnel.

10.1 To change either selection, use the ▲ or ▼ arrow keys to select which parameter to change, and press ENTER. The ▶ changes to ▲▼. Use the ▲ or ▼ arrow keys to change the selection and press ENTER. The value will be saved.

GENERAL INFORMATION WHEN NAVIGATING THE MENUS
Press the MENU/ESC key to enter the main menu (shown below) from the home screen. In the main menu are submenus for channel 1 and for channel 2. When navigating the gauge menus, use the ▲ or ▼ arrow keys to point to a menu selection and press ENTER, the → (arrow) will change to ⇕. Use the ▲ or ▼ arrow keys to increase or decrease values or to scroll through the selections. After making a change, press the ENTER key to save the configuration to memory; the display will read SAVED. It is at this time the new data is saved. The MENU/ESC (escape) key can be used at any time to abort the menu and return to the home screen. During configuration, the gauge allows 15 seconds for first level and 2 minutes for other levels between keystrokes to change or save a new configuration. If the time lapses without a keystroke, the gauge will automatically return to the home screen without making any changes. The new information is saved only if the ENTER key is pressed and the gauge reads SAVED. A flowchart (fig. 4) is provided that shows step-by-step progression through the gauge configuration procedure.

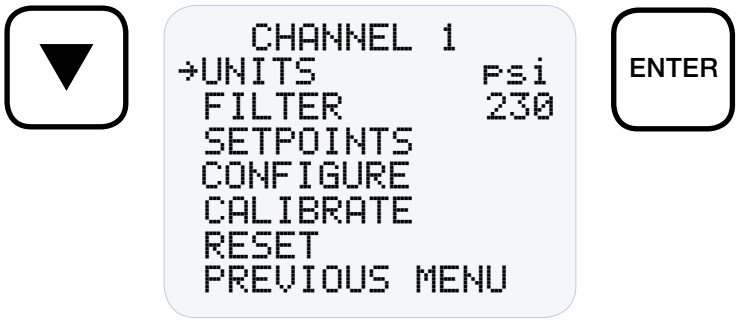
10.2 AUTOSCAN — AUTOSCAN 1–30s /OFF
Autoscan allows the user to scroll automatically between the two channels. Autoscan can be set from 1 to 30 seconds or OFF. With AUTOSCAN turned on, when in the home screen, the gauge will display each channel for the selected time before automatically switching to the next channel. The ▲ arrow key can be used to quickly advance to the other channel. With AUTOSCAN turned OFF, the scanner continually displays one channel at a time. Press ▲ to display the next channel.

REFER TO SECTION 8 FOR A DESCRIPTION OF THE QUICK START-UP MENUS.

10.3 CHANNEL 1 (2)/CONFIGURATION MENUS

Each of the following items: type of units, filter value, setpoint values, calibration. To view or change the listed items for the respective channel, from the main menu, use the ▲ or ▼ arrow key to select channel 1 or 2 and press ENTER. Use ▲ or ▼ to point to the item to be viewed or changed and press ENTER. Following is a description of each item.

CHANNEL 1 MENU



10.4 UNITS

There are several units-of-measure available as standard selections in the gauge. Only the units relevant to the selected input sensor type will be available. Following are the available units for each type of input sensor.

- Pressure units: psi, psig, psia, KPa, bar, mbar, inH2O, inHg, mmH2O, mmHg, kg/cm², and torr
- Temperature units: °F, °C, and °K

The unit indicators appear on the right side of the display. When changing to a new unit indicator, the displayed numeric value is automatically converted to the new unit value. To change the units, use the ▲ or ▼ key to point to UNITS and press the ENTER key; the previously programmed unit indicator will appear. Use the ▲ or ▼ key to select one of the available indicators, and press ENTER to accept and save the change. The display will read SAVED. To return to the home screen press MENU/ESC. The new unit indicator selected and the numeric value converted to the selected units will be displayed on the home screen.

10.5 FILTER

The display filter can be used to stabilize the display reading of a changing input. Filtering is done in both hardware and software. The software filter is adjustable; the rate of change is less for large values. The filter value is read-out in a number from 1 to 255, 1 being no filter value and 255 being maximum filter value. Below are some typical filter values and their effect on the display reading. Settling values are approximate times in seconds to reach 90% of new reading. To set the filter value, use the ▲ or ▼key to point to FILTER and press ENTER. The display will read the previously set filter value. Use the ▲ or ▼ keys to increase or decrease the filter value and press ENTER to save the new filter value.

FILTER VALUE:	1	128	200	210	220	230	240	250	252	253	254	255
SETTLING, SEC.	.20	.33	.60	1	1.5	2	3	9	14	19	28	55

10.6 SETPOINTS

The SETPOINTS menu allows the user to set a setpoint value for Low and High, and set the hysteresis value for each channel.

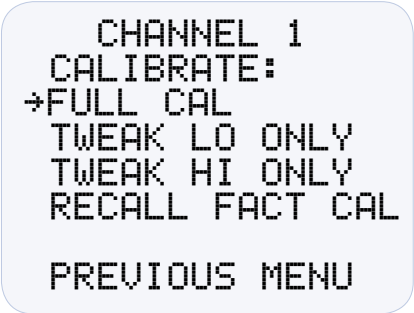
REFER TO SECTION 8 FOR DETAILS ON SETPOINTS

10.7 CALIBRATE

The gauge is calibrated at the factory and should not require additional calibration. However, calibration can be performed in the field many times over the life of the gauge. Each channel is calibrated separately to the type of input transducer selected. The calibration mode is used to calibrate the zero

NOTE: During calibration, the unit allows 2 minutes between keystrokes to change or save a new calibration. If 2 minutes lapse without a keystroke, the device will automatically return to the home screen with the previous values. The new calibration information is saved only if the ENTER key is pressed and the display reads SAVED.

and span values. Calibration can be performed from the front keypad without disassembling the gauge. A calibrator or simulator capable of outputting the correct signal for the type of transducer selected for that channel is required to provide a calibration reference.



10.7.1 CALIBRATION PROCEDURE

Connect the appropriate calibrator or simulator (for thermocouples use the proper type of thermocouple extension wire) to the gauge for channel 1 or 2, follow the hook-up drawing for that sensor type. Be sure that the sensor type and the engineering units of the calibrator match the type and engineering units of the instrument before performing a calibration.

To calibrate the gauge, select CALIBRATE from the channel 1 or 2 menu and press the ENTER key. Select FULL CAL and press ENTER. The display will read SET LO POINT ON CALIBRATOR AND PRESS ENTER. Adjust the calibrator/simulator at or near zero or a very low reading and press ENTER; the display will show SAMPLING, then ADJUST LO POINT TO MATCH CALIBRATOR. Use the ▲ or ▼ arrow keys to increase or decrease the display reading to match the setting of the simulator and press ENTER. The display will show SET HI POINT ON CALIBRATOR AND PRESS ENTER. Adjust the simulator at or near the span value of the transducer or a very high reading and press ENTER; the display will show SAMPLING, then ADJUST HI POINT TO MATCH CALIBRATOR. Again use the ▲ or ▼ arrow keys to increase or decrease the display reading to match the simulator and press ENTER. The display will read CALIBRATION VALUES SAVED!. The gauge will return to the home screen with the new calibration values stored in memory.

10.7.2 The GCN0100 gauge has a feature that allows a slight adjustment of either the zero or span values individually. This type of calibration can be used to “tweak” the readout to match that of a known value without actually performing a formal calibration procedure. This adjustment is independent for each channel and must be performed on that individual channel. Please note that this type of adjustment will invalidate calibration settings from the FULL CAL procedures.

TWEAK LO ONLY

To make a small adjustment on the zero calibration value of the gauge, enter the calibration mode by selecting CALIBRATE and press ENTER; select TWEAK LO ONLY from the menu and press ENTER. The display will show SET LO POINT ON CALIBRATOR AND PRESS ENTER. Adjust the calibrator/simulator at or near zero or a very low reading and press ENTER; the display will show SAMPLING, then ADJUST LO POINT TO MATCH CALIBRATOR. Use the ▲ or ▼ arrow keys to increase or decrease the display reading to match the calibrator and press ENTER. The display will read CALIBRATION VALUES SAVED!. The gauge will return to the home screen with the new zero calibration value stored in memory.

TWEAK HI ONLY

To make a small adjustment on the span calibration value of the gauge, enter the calibration mode by selecting CALIBRATE and press ENTER; select TWEAK HI ONLY from the menu and press ENTER. The display will show SET HI POINT ON CALIBRATOR AND PRESS ENTER. Adjust the calibrator/simulator at or near the desired span value and press ENTER; the display

will show SAMPLING, then ADJUST HI POINT TO MATCH CALIBRATOR. Use the ▲ or ▼ arrow keys to increase or decrease the display reading to match the calibrator and press ENTER. The display will read CALIBRATION VALUES SAVED!. The gauge will return to the home screen with the new span calibration value stored in memory.

10.7.3 RECALL FACTORY CAL VALUES

The user can at any time during the life of the gauge reinstate the factory calibration values for channel 1 or 2 independently. Select CALIBRATE from the CHANNEL 1 or CHANNEL 2 menu and press ENTER; select RECALL FACTORY CAL and press ENTER. The next screen will display the type and range for which the selected channel's input is currently configured. Select APPLY to confirm or CANCEL to decline and press ENTER. If APPLY is selected, the display will show CALIBRATION VALUES SAVED!. The gauge will return to the home screen with the factory default calibration values stored in memory. If CANCEL is selected, the gauge will retain the current calibration values. Press the ESC key to return to the home screen.

The *calibration values only*, will return to the factory default; all other settings will remain unchanged. If the transducer type or range is incorrect, press the MENU/ESC key to abort saving incorrect factory cal values. Configure the gauge for the desired input sensor type and range and then recall the factory cal values.

10.8 RESET

The reset selection in the menu is used to reset the min/max reading for channel 1 or 2 independently. To perform a reset, select either channel 1 or 2 from the menu, use ▲ or ▼ to scroll to RESET and press ENTER. The display will show RESET!. A reset can also be performed by sending a reset command via the RS-485 Modbus RTU communications register.

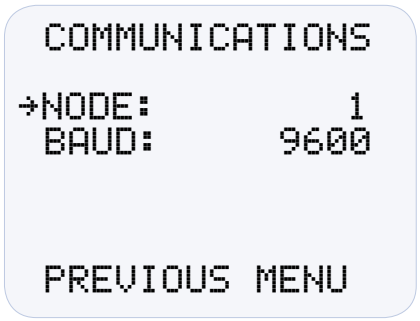
10.8.1 MIN/MAX READING

Use the ▲ or ▼ arrow key to point to MIN/MAX READING and press ENTER; The display will show RESET!. RESET resets both the min and max readings to the current reading.

10.9 COMMUNICATIONS

10.9.1 The GCN0100 gauge is part of a system that has been carefully designed to easily interface to popular computers, terminals, programmable controllers and Altronic instruments. Modbus RTU is the protocol used in the GCN0100. A Modbus register list with register numbers and descriptions of each register can be found in section 12.0. The serial communications are compliant to the Modicon Modbus RTU standard and uses RS-485 for its hardware communication format. To view or adjust the communication parameters, select COMMUNICATIONS from the main menu and press ENTER. Throughout the menu use the ▲ or ▼ arrow keys to make a selection and press ENTER to save the changes.

FOR **DETAILED COMMUNICATIONS INFORMATION SEE SECTION 11.0.**



10.9.2 NODE
The node number gives each gauge on the communications port an identity. Any node number from 1 to 99 can be used. Use the up and down arrow keys to select a node number and press ENTER to save.

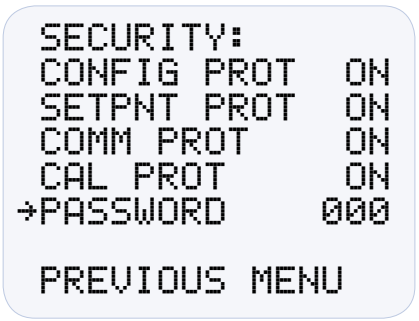
10.9.3 BAUD — Select the required baud rate and press ENTER to save.

SEE SECTION 11.3 FOR AVAILABLE BAUD RATES.

10.10 SECURITY

10.10.1 The security feature allows for a user to lock the gauge to secure chosen areas of the menu from being changed. There are several individual areas in the menu system that can be protected as well as two layers of protection. The menus that can be protected are the CONFIGURATION menu settings, the SETPOINT values, the ability to make changes via modbus COMMUNICATIONS, and CALIBRATION protection. When protection is ON, the user is able to view the menu values but not able to change them. If an attempt is made to change the values and the ENTER key is pressed when protection is on, the display will read PASSWORD PROTECTED! ENTER PASSWORD. This prompts the user to enter the password. If the correct password is entered, the requested configuration values can be changed.

To set or change a password, select SECURITY from the main menu and press ENTER. If the password is set to 000, the security menu will be available without entering the password. If the password is any number but 000, the proper password must be entered to enter the security menu. Each of the security selections can be turned ON or OFF individually. Use the ▲ or ▼ arrow key to point to the item to be protected and press ENTER, the ⇕ arrow will change to é. Use the ▲ or ▼ key to select either ON or OFF and press ENTER. The display will show SAVED and the change will be saved to memory. When a menu item is protected, the display will read ON, not protected will show as OFF. To enter a password, point to PASSWORD and press ENTER. Use the ▲ or ▼ arrow key to increase or decrease each of the 3-digit password numbers and press ENTER. The display will show SAVED and the change will be saved to memory. Any number from 000 to 999 can be used. Please note that Autoscan, Units, filter values, and reset cannot be locked out by security protection. Please note that SECURITY protects both channels.



10.10.2 CONFIGURATION PROTECTION:
When set to ON, prevents the user from changing items in the CONFIGURE menu. Items protected are TYPE (input sensor type), GAUGE LABEL, and BARGRAPH.

10.10.3 SETPOINT PROTECTION:
When set to ON, prevents the user from changing the items in the SETPOINTS menu. All setpoint values and configurations can be read but not changed.

10.10.4 COMMUNICATIONS PROTECTION:
When set to ON prevents the user from changing the Modbus registers via the serial communications. User can read, but not write data. If the user attempts to perform a write, the error message INVALID FUNCTION CODE will be sent.

10.10.5 CALIBRATION PROTECTION:
When set to ON, prevents user from changing calibration values.

10.10.6 PASSWORD:
The password is the second level of protection. When PASSWORD is selected, the user will be prompted to enter a 3-digit password. To enter a password, point to PASSWORD and press ENTER, the first digit will be underlined. Use the ▲ or ▼ arrow key to increase or decrease that digit from 0 to 9 and press ENTER. The next digit will be highlighted, use the same procedure to continue to enter a 3-digit password and press ENTER to save. Any number from 000 to 999 can be used. The default password is 330.

With a password in memory, and the security screen is accessed, the message PASSWORD PROTECTED! ENTER PASSWORD will appear. If the proper password is entered, the security screen will be displayed and changes will be allowed. To gain access to the protected menus without having to enter a password, turn protection OFF. If the incorrect password is entered, the display will return to the menu denying access to the protected menu.

11.0 RS-485 COMMUNICATIONS

The GCN0100 gauge is part of a system that has been carefully designed to easily interface to popular computers, terminals, programmable controllers and Altronic instruments. The gauge communicates in the Modbus RTU protocol.

11.1 MASTER/SLAVE OPERATION:
The gauge's RS-485 communication system is designed as a master/slave system; that is, each unit responds to its own unique address (node number) only after it is interrogated by the master (computer). One master and up to 32 slaves can communicate in the system. The units communicate with the master via a polling system. The master sends a command and only the polled slave responds. The slave modules can never initiate a communications sequence. A simple command/response protocol must be strictly observed.

11.2 NODE NUMBER:
The node number is used in the system to identify the desired slave unit being polled. The node number can be any numeric value from 1 to 99 although only 32 devices can be served on a single communications port. This number range (1 to 99) is allowed so that if device grouping by function or application is desired, it can be implemented using the first digit as the group or engine number and the second as the unit number. For example, 53 could be used to identify the number 3 slave unit mounted on engine number 5.

11.3 BAUD RATE:
Baud rates available are 9600, 19200, 38400, 57600, 115200.

11.4 HALF-DUPLEX OPERATION:
The RS-485 system employed uses two wires for communication and cannot send and receive data at the same time over the same two wires making it a half-duplex system. When the master is in the transmit mode, the slave is in the receive mode and vice-versa.

11.5 ELECTRICAL OPERATING RANGE:
RS-485 is a communications standard to satisfy the need for multi-dropped systems that can operate at high speeds over long distances. RS-485 uses a balanced differential pair of wires switching from 0 to 5 volts to communicate data. RS-485 drivers can handle common mode voltages from -7 to +12 volts without loss of data, making them an excellent choice for industrial environments.

11.6 COMMUNICATIONS PARAMETERS:
The following must be set by the master to communicate with the slaves:

- Baud Rate: 9600 (DEFAULT) others available, see section 10.3
- Data Bits: 8
- Stop Bits: 1
- Parity: None

11.7 COMMUNICATIONS WIRING:
The RS-485 wiring diagram illustrates the wiring required for multiple slave unit hookup. Note that every slave unit has a direct connection to the master. This allows any one slave unit to be removed from service without affecting the operation of the other units. Every unit must be programmed with a unique address or node number, but the addition of new units or nodes can be in any order. To minimize unwanted reflections on the transmission line, the bus should be arranged as a trunk line going from one module to the next. Random structures of the transmission line should be avoided. Special care must be taken with long busses (500 feet or more) to ensure error-free operation. Long busses must be terminated with a 120 ohm resistor between the terminals marked RS-485 A and RS-485 B at the master only. The use of twisted pair shielded cable will enhance signal fidelity and is recommended. To prevent ground loops, the shield should be connected to the shield terminal at the master only.

11.8 RX, TX INDICATORS:
RX and TX (receive and transmit) LEDs on the back of the gauge indicate when the unit is receiving or transmitting data.

11.9 CONNECTING TO A PC:
When connecting the gauge to the RS-232 port on a PC, an RS-232 to RS-485 converter must be used for the communication interface.

11.10 LOADING:
RS-485 uses a balanced differential pair of wires switching from 0 to 5 volts to communicate data. In situations where many units (32 max.) are connected together on a long run, voltage drop on the communications leads becomes a major problem. Voltage drops on the RS-485 minus lead appear as a common mode voltage to the receivers. While the receivers are rated to a maximum voltage difference of ±7 volts, -7 V to +12 V, a practical system should not have a voltage difference exceeding ±3 volts under normal conditions. The wire gauge used for the connections, therefore, limits the maximum number of units or the maximum length of wire between units in each application. The following formula can be used as a guideline to select the appropriate wire gauge.

- For 18 AWG wire No. of units = (4000)/(ft. of wire used)
- For 20 AWG wire No. of units = (2500)/(ft. of wire used)
- For 22 AWG wire No. of units = (1600)/(ft. of wire used)

NOTE: The maximum number of units connected in a system is 32.

12.0 MODBUS REGISTER LISTS

The maximum number of registers that can be read at one time is limited to 32. The maximum number of booleans that can be read at one time is limited to 256. All communications are at 9600 baud (default), see section 10.3 for other speeds 8 Data bits, No Parity, 1 Stop bit (9600 8N1).

NOTE: All temperatures are stated in 0.1 DEG. Kelvin (for universal compatibility). Therefore a register value of 2730 is 273.0° K, which is 0° C, or 32° F.

NOTE: Consult VSM+ IOM for a complete list of VSM+ Modbus registers.

12.1 00000 SERIES REGISTERS

ADDRESS	DESCRIPTION OF FUNCTION		
00001	PROTECT CONFIGURATION Protect configuration from being changed by keypad	0=OFF	1=ON
00002	PROTECT SETPOINT Protect setpoints from being changed by keypad	0=OFF	1=ON
00003	PROTECT COMMUNICATIONS Protect against Modbus writes	0=OFF	1=ON
00004	PROTECT CALIBRATION Protect against changing calibration values	0=OFF	1=ON
00006	CHANNEL 1 RESET MIN/MAX Reset MIN/MAX readings for CHANNEL 1		1=RESET
00007	CHANNEL 2 RESET MIN/MAX Reset MIN/MAX readings for CHANNEL 2		1=RESET
00008 ↓ ↓ 00016	RESERVED		
00017	SWITCH 1 RESET		1=RESET
00018 ↓ ↓ 00047	RESERVED		
00048	Config Override – Allow Modbus to override Channel Configuration		

12.2 10000 SERIES REGISTERS

The node number is the address of the controller being contacted. This number is programmed by the terminal program and can be viewed or edited in the menu screen. A two digit number from 01 to 99 can be used.

ADDRESS	DESCRIPTION OF FUNCTION	
10001	CHANNEL 1 signal OK	1=OK
10002	CHANNEL 1 signal low out of range	1=LOOR
10003	CHANNEL 1 signal hi out of range 1=HOOR	
10004	CHANNEL 1 thermocouple open	1=TCOPEN
10005 ↓ ↓ 10008	RESERVED	
10009	CHANNEL 2 signal OK	1=OK
10010	CHANNEL 2 signal low out of range	1=LOOR
10011	CHANNEL 2 signal hi out of range 1=HOOR	
10012	CHANNEL 2 thermocouple open	1=TCOPEN
10013 ↓ ↓ 10016	RESERVED	
10017	SWITCH 1 FAULT HI	
10018	SWITCH 1 FAULT LO	
10019 ↓ ↓ 10027	RESERVED	

12.3 30000 SERIES REGISTERS

ADDRESS	DESCRIPTION OF FUNCTION
30001	CHANNEL STATUS – same as 10001–10016
30002	SWITCH STATUS – same as 10017–10032
30004	CHANNEL 1 Analog Value (float msw)
30005	CHANNEL 1 Analog Value (float lsw)
30006	CHANNEL 2 Analog Value (float msw)
30007	CHANNEL 2 Analog Value (float lsw)
30008	RESERVED
30009	RESERVED
30010	Ambient Temp. DEGK (float msw)
30011	Ambient Temp. DEGK (float lsw)
30013	CHANNEL 1 Hi Hyst Timer (0.1s)
30014	CHANNEL 1 Lo Hyst Timer (0.1s)
30015	RESERVED
30016	CHANNEL 2 Hi Hyst Timer (0.1s)
30017	CHANNEL 2 Lo Hyst Timer (0.1s)
30018	RESERVED
30019	CHANNEL 1 MAX (float) (msw)
30020	CHANNEL 1 MAX (float) (lsw)
30021	CHANNEL 1 MIN (float) (msw)
30022	CHANNEL 1 MIN (float) (lsw)
30023	CHANNEL 2 MAX (float) (msw)
30024	CHANNEL 2 MAX (float) (lsw)
30025	CHANNEL 2 MIN (float) (msw)
30026	CHANNEL 2 MIN (float) (lsw)

12.4 40000 SERIES REGISTERS

ADDRESS	DESCRIPTION OF FUNCTION
40001	Coils 001-016
40002	Coils 017-032
40003	Coils 033-048
40004	Autoscan 0-30s
40005	Node Number 1-99
40006	Baud rate Index 0=9.6k 1=19.2k 2=38.4k 3=57.6k 4=115.2k
40007	Security Password 000-999
40008	Display Options BIT 1 RESERVED BITS 2&3 00=BARGRAPH OFF 01=BARGRAPH ON, SINGLE 10=BARGRAPH ON, INCREMENT SWITCH 2 DIFFERENTIAL BARGRAPH OPTIONS BITS 4&5 00=BARGRAPH OFF 01=BARGRAPH ON, SINGLE 10=BARGRAPH ON, INCREMENT
40009	RESERVED

ADDRESS	DESCRIPTION OF FUNCTION
40010	RESERVED
40011	CHANNEL 1 Lag Filter Gain (1-255)
40012	CHANNEL 1 SENSOR TYPE CUSTOM 0=Custom PRESSURE SENSORS 256=15psi 257=25psi 258=50psi 259=100psi 260=300psi 261=500psi 262=1000psi 263=2000psi 264=5000psI 265=10000psi 266=Custom Pressure TEMPERATURE SENSORS 512=JTC 513=KTC 514=DEG1 515=DEG2 516=Custom Temperature VIBRATION SENSORS Velocity 768=1ips 769=2ips 770=Custom Velocity Acceleration 1024=10g 1025=20g 1026=50g 1027=Custom Acceleration PERCENT 1280=0–100% (0–55Vdc) 1281=Custom Percent VOLTAGE 1536=0–5Vdc 1537=±160mVdc 1538=±80mVdc 1539=Custom Voltage
40013	CHANNEL 1 Units Index (class specific) PRESSURE SENSORS 0=psi 1=psig 2=psia 3=Kpa 4=bar 5=mbar 6=inH2O@20C 7=inHg 8=mmH2O 9=mmHg 10=kg/cm2 11=torr TEMPERATURE SENSORS 0=Kelvin 1=Celsius 2=Fahrenheit VIBRATION SENSORS Velocity 0=in/s 1=mm/s 2=cm/s Acceleration 0=G 1=ft/s/s 2=m/s/s
40014	CHANNEL 1 A/D Voltage Range 0=5V 1=±160mV 2=±80mV
40015	CHANNEL 1 SENSOR MAX (float) (msw)
40016	CHANNEL 1 SENSOR MAX (float) (lsw)
40017	CHANNEL 1 SENSOR MIN (float) (msw)
40018	CHANNEL 1 SENSOR MIN (float) (lsw)
40019	CHANNEL 1 Range HI (float) (msw)
40020	CHANNEL 1 Range HI (float) (lsw)
40021	CHANNEL 1 Volt HI (float) (msw)
40022	CHANNEL 1 Volt HI (float) (lsw)
40023	CHANNEL 1 Range LO (float) (msw)
40024	CHANNEL 1 Range LO (float) (lsw)
40025	CHANNEL 1 Volt LO (float) (msw)
40026	CHANNEL 1 Volt LO (float) (lsw)
40027	CHANNEL 1 Zero Band (float) (msw)
40028	CHANNEL 1 Zero Band (float) (lsw)
40029	CHANNEL 1 Custom Decimal Place (0-4)
40030	CHANNEL 1 Label Index 0=NONE 1=CUSTOM
40031	CHANNEL 1 Custom Label (char. 1:2)
40032	CHANNEL 1 Custom Label (char. 3:4)
40033	CHANNEL 1 Custom Label (char. 5:6)
40034	CHANNEL 1 Custom Label (char. 7:8)
40035	CHANNEL 1 Custom Label(char. 9:10)

ADDRESS	DESCRIPTION OF FUNCTION
40036	CHANNEL 1 Custom Label (char. 11:12)
40037	CHANNEL 1 Custom Label (char. 13:14)
40038	CHANNEL 1 Custom Label (char. 15:16)
40039	CHANNEL 1 Custom Unit Label Index 0=NONE 1=CUSTOM
40040	CHANNEL 1 Custom Unit Label (char. 1:2)
40041	CHANNEL 1 Custom Unit Label (char. 3:4)
40042	CHANNEL 1 Custom Unit Label (char. 5:–)
40043	CHANNEL 1 Bargraph type 0=Off 1=Single bar between low and high 2=Increasing bars between low and high 3=Single bar between setpoints for switch 1 4=Increasing bars between setpoints for switch 1
40044	CHANNEL 1 Bargraph Hi (float) (msw)
40045	CHANNEL 1 Bargraph Hi (float) (lsw)
40046	CHANNEL 1 Bargraph Lo (float) (msw)
40047	CHANNEL 1 Bargraph Lo (float) (lsw)
40048 ↓ ↓ 40054	RESERVED
40055	CHANNEL 2 Lag Filter Gain (1-255)
40056	CHANNEL 2 SENSOR TYPE CUSTOM 0=Custom PRESSURE SENSORS 256=15psi 257=25psi 258=50psi 259=100psi 260=300psi 261=500psi 262=1000psi 263=2000psi 264=5000psI 265=10000psi 266=Custom Pressure TEMPERATURE SENSORS 512=JTC 513=KTC 514=DEG1 515=DEG2 516=Custom Temperature VIBRATION SENSORS Velocity 768=1ips 769=2ips 770=Custom Velocity Acceleration 1024=10g 1025=20g 1026=50g 1027=Custom Acceleration PERCENT 1280=0–100% (0–55Vdc) 1281=Custom Percent VOLTAGE 1536=0–5Vdc 1537=±160mVdc 1538=±80mVdc 1539=Custom Voltage
40057	CHANNEL 2 Units Index (class specific) PRESSURE SENSORS 0=psi 1=psig 2=psia 3=Kpa 4=bar 5=mbar 6=inH2O@20C 7=inHg 8=mmH2O 9=mmHg 10=kg/cm2 11=torr TEMPERATURE SENSORS 0=Kelvin 1=Celsius 2=Fahrenheit VIBRATION SENSORS Velocity 0=in/s 1=mm/s 2=cm/s Acceleration 0=G 1=ft/s/s 2=m/s/s
40058	CHANNEL 2 A/D Voltage Range 0=5V 1=±160mV 2=±80mV
40059	CHANNEL 2 SENSOR MAX (float) (msw)
40060	CHANNEL 2 SENSOR MAX (float) (lsw)
40061	CHANNEL 2 SENSOR MIN (float) (msw)
40062	CHANNEL 2 SENSOR MIN (float) (lsw)

ADDRESS	DESCRIPTION OF FUNCTION
40063	CHANNEL 2 Range HI (float) (msw)
40064	CHANNEL 2 Range HI (float) (lsw)
40065	CHANNEL 2 Volt HI (float) (msw)
40066	CHANNEL 2 Volt HI (float) (lsw)
40067	CHANNEL 2 Range LO (float) (msw)
40068	CHANNEL 2 Range LO (float) (lsw)
40069	CHANNEL 2 Volt LO (float) (msw)
40070	CHANNEL 2 Volt LO (float) (lsw)
40071	CHANNEL 2 Zero Band (float) (msw)
40072	CHANNEL 2 Zero Band (float) (lsw)
40073	CHANNEL 2 Custom Decimal Place (0-4)
40074	CHANNEL 2 Label Index 0=NONE 1=CUSTOM
40075	CHANNEL 2 Custom Label (char. 1:2)
40076	CHANNEL 2 Custom Label (char. 3:4)
40077	CHANNEL 2 Custom Label (char. 5:6)
40078	CHANNEL 2 Custom Label (char. 7:8)
40079	CHANNEL 2 Custom Label(char. 9:10)
40080	CHANNEL 2 Custom Label (char. 11:12)
40081	CHANNEL 2 Custom Label (char. 13:14)
40082	CHANNEL 2 Custom Label (char. 15:16)
40083	CHANNEL 2 Custom Unit Label Index 0=NONE 1=CUSTOM
40084	CHANNEL 2 Cust Unit Label (char. 1:2)
40085	CHANNEL 2 Cust Unit Label (char. 3:4)
40086	CHANNEL 2 Cust Unit Label (char. 5:-)
40087	Bargraph type 0=Off 1=Single bar between low and high 2=Increasing bars between low and high 5=Single bar between setpoints for switch 2 6=Increasing bars between setpoints for switch 2
40088	CHANNEL 2 Bargraph Hi (float) (msw)
40089	CHANNEL 2 Bargraph Hi (float) (lsw)
40090	CHANNEL 2 Bargraph Lo (float) (msw)
40091	CHANNEL 2 Bargraph Lo (float) (lsw)
40092 ↓ ↓ 40098	RESERVED
40099	SWITCH 1 Setpoint Type 0=Off 1=High On 2=Low On 3=High and Low On
40100	CHANNEL 1 Hysteresis Time 1-99s
40101	CHANNEL 1 Setpoint Hi (float) (msw)
40102	CHANNEL 1 Setpoint Hi (float) (lsw)
40103	CHANNEL 1 Setpoint Lo (float) (msw)
40104	CHANNEL 1 Setpoint Lo (float) (lsw)
40105	RESERVED
40106	RESERVED

ADDRESS	DESCRIPTION OF FUNCTION
40107	RESERVED
40108	CHANNEL 2 Hysteresis Time 1-99s
40109	CHANNEL 2 Setpoint Hi (float) (msw)
40110	CHANNEL 2 Setpoint Hi (float) (lsw)
40111	CHANNEL 2 Setpoint Lo (float) (msw)
40112	CHANNEL 2 Setpoint Lo (float) (lsw)
40113	RESERVED
40114	RESERVED

FIG. 1 MOUNTING DIMENSIONS

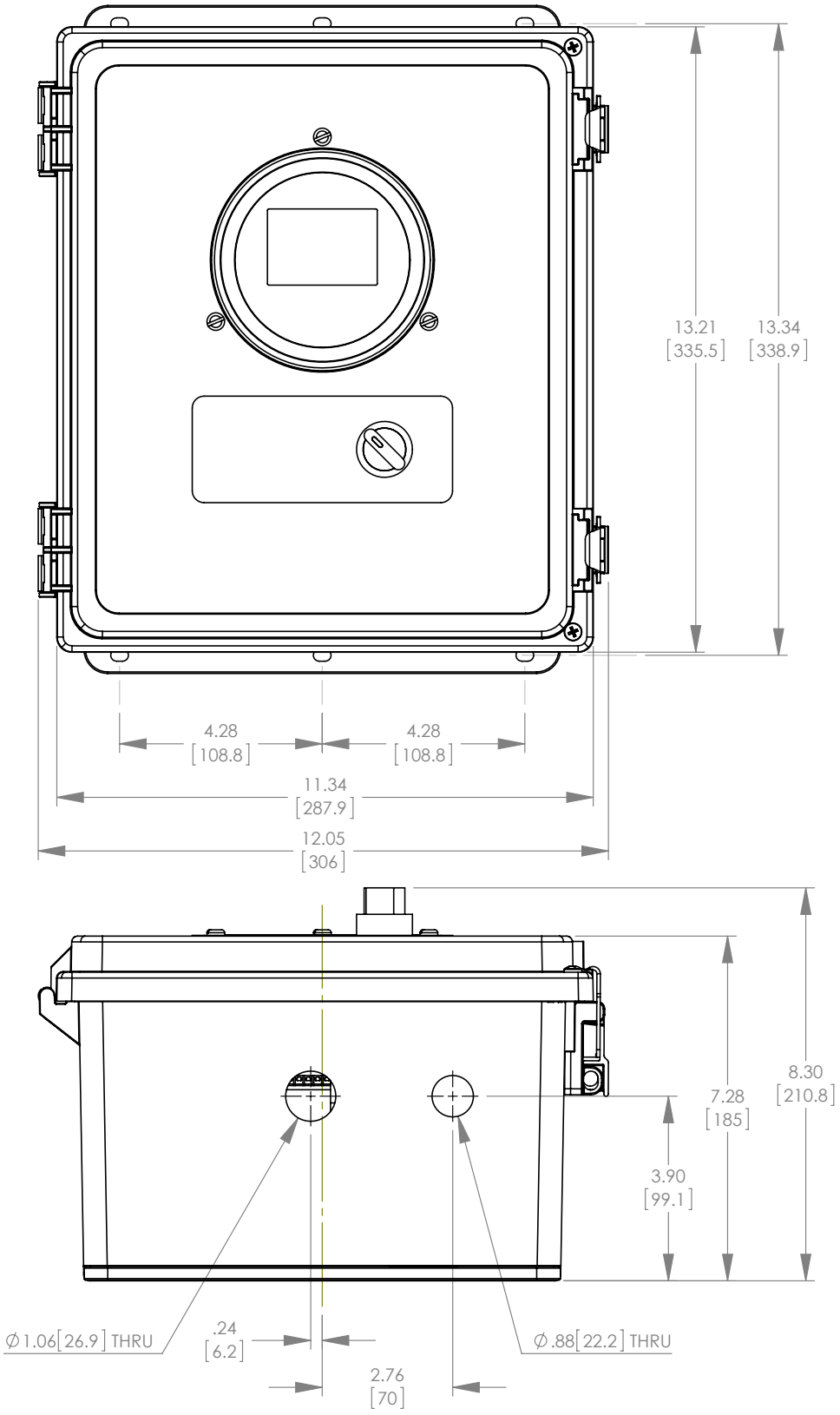


FIG. 2 WIRING DIAGRAM, CUSTOMER CONNECTIONS

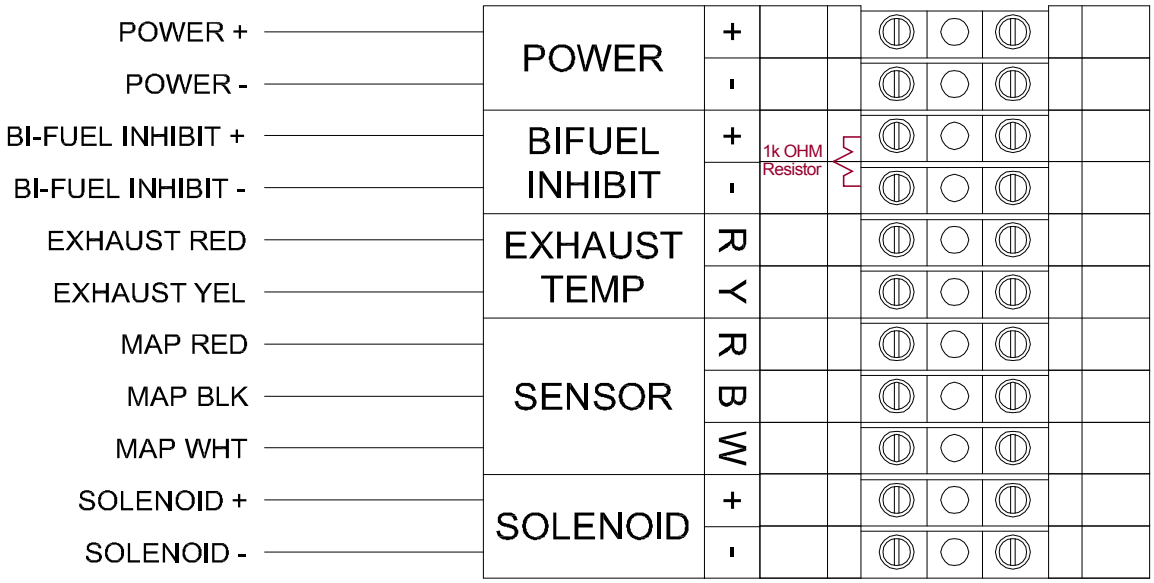


FIG. 3 CUSTOMER WIRING, VSM+

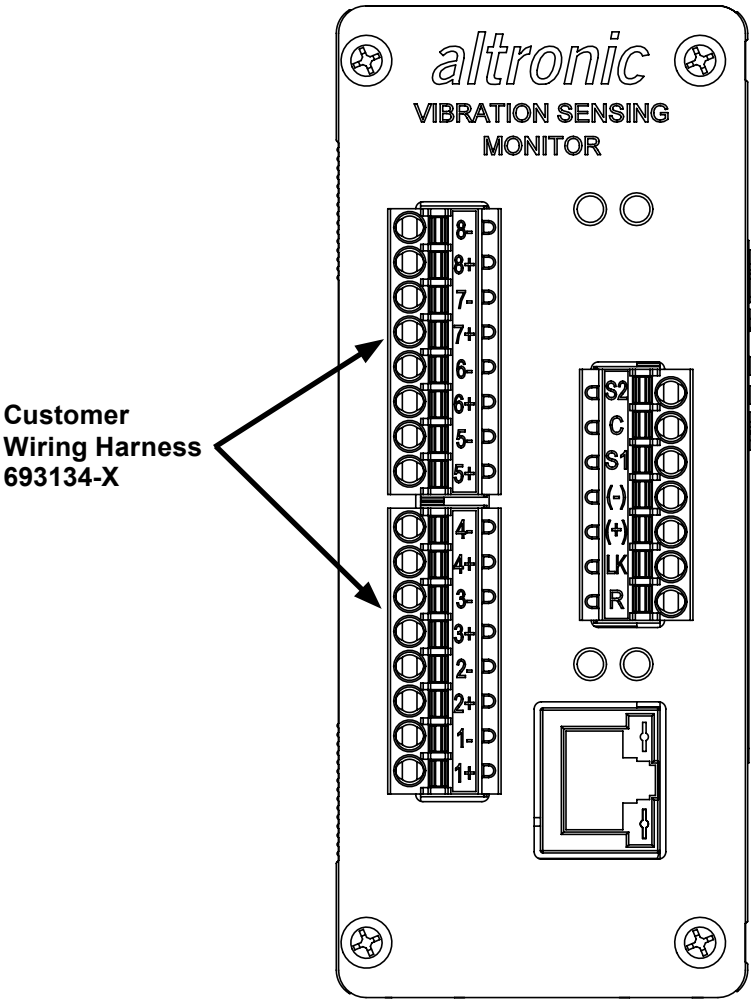
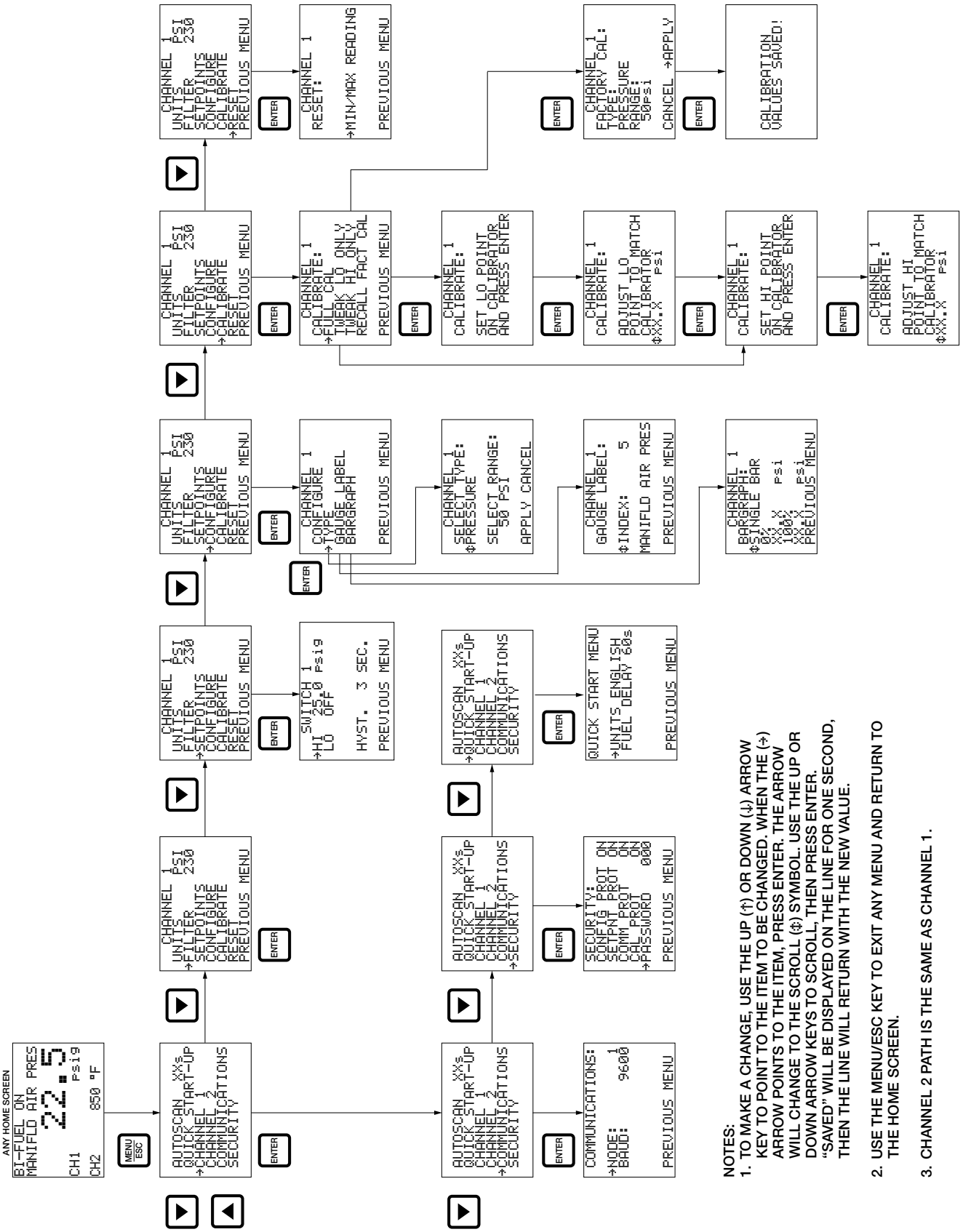
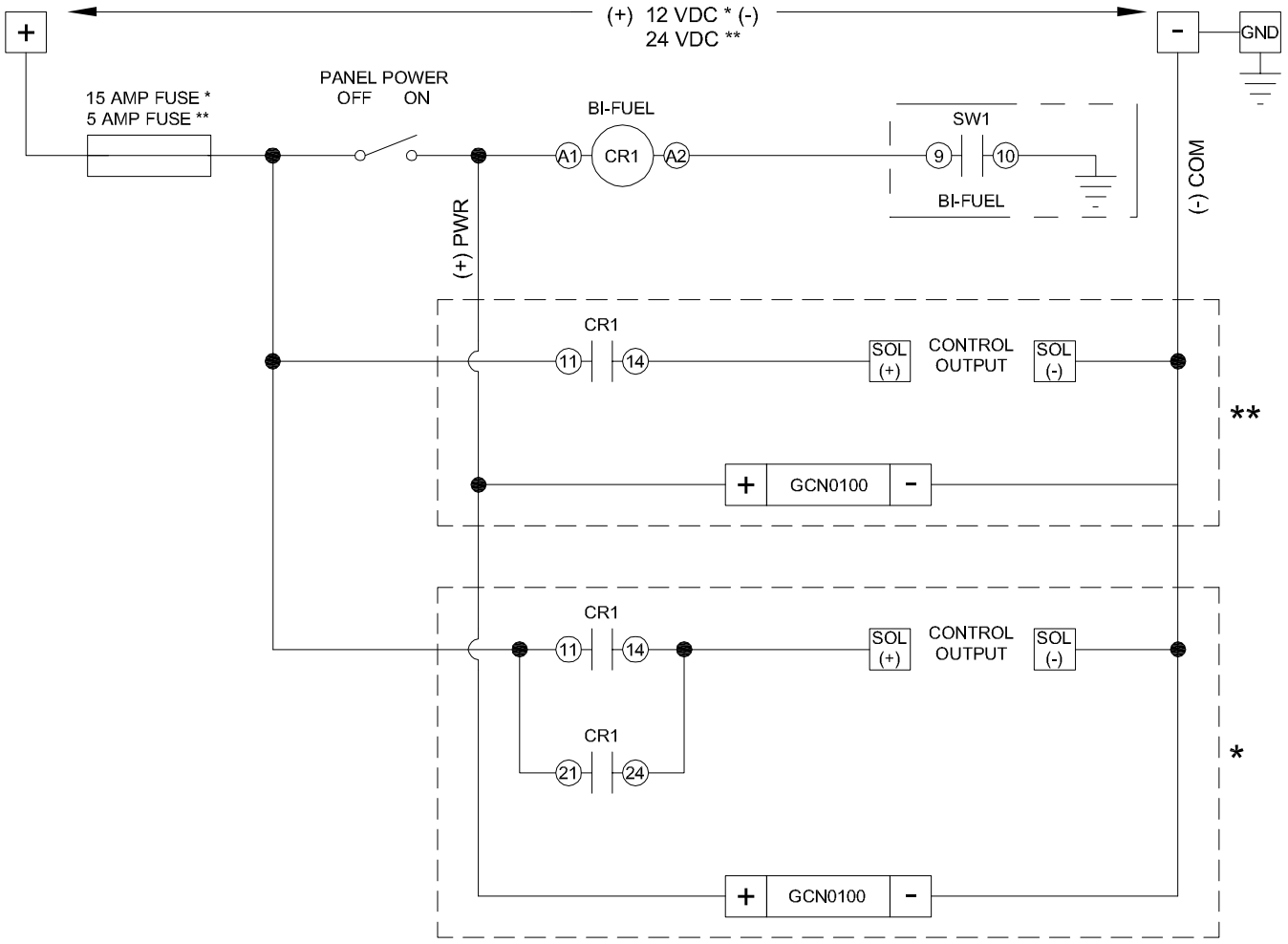


FIG. 4 FLOW CHART



NOTES:
1. TO MAKE A CHANGE, USE THE UP (↑) OR DOWN (↓) ARROW KEY TO POINT TO THE ITEM TO BE CHANGED. WHEN THE (+) ARROW POINTS TO THE ITEM, PRESS ENTER. THE ARROW WILL CHANGE TO THE SCROLL (⇕) SYMBOL. USE THE UP OR DOWN ARROW KEYS TO SCROLL, THEN PRESS ENTER. "SAVED" WILL BE DISPLAYED ON THE LINE FOR ONE SECOND, THEN THE LINE WILL RETURN WITH THE NEW VALUE.
2. USE THE MENU/ESC KEY TO EXIT ANY MENU AND RETURN TO THE HOME SCREEN.
3. CHANNEL 2 PATH IS THE SAME AS CHANNEL 1.

FIG. 5 LADDER LOGIC

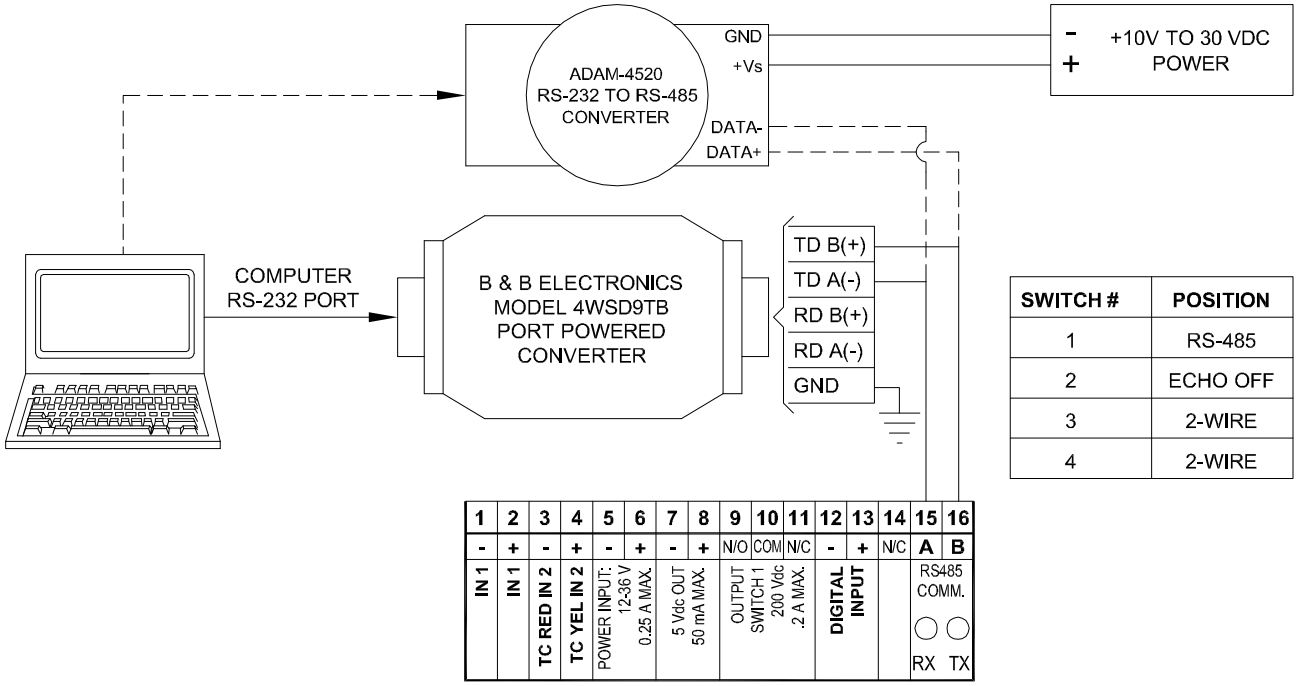


*GPN0100-12
**GPN0100

FIG. 6 GPN0100 CHANNEL DESCRIPTION CHART

Channel	Description	Displayed Units (Default: English)	Displayed Units (Metric)	Default Control Setpoints		Default Safety Setpoints	
				Low	High	Low	High
1	MAP	psig	Kpa	20	55	—	—
2	EGT	°F	°C	—	—	– 76	1476

FIG. 7 RS-485 COMMUNICATIONS: PC HOOK-UP



SWITCH #	POSITION
1	RS-485
2	ECHO OFF
3	2-WIRE
4	2-WIRE

RECOMMENDED RS-232 TO RS-485 CONVERTERS:

PORT POWERED B & B ELECTRONICS MODEL: 4WSD9TB
EXTERNAL DC POWERED OPTICALLY ISOLATED ADVANTECH AMERICA P/N: ADAM-4520

FIG. 8 RS-485 COMMUNICATIONS: MULTIPLE SLAVE UNITS