INSTRUCTION MANUAL

MODEL MODEL 9000/*QUAD* FOUR CHANNEL CONTROLLER

Document No. 360-0114-01 • Revision C

Warning: Read & understand contents of this manual prior to operation. Failure to do so could result in serious injury or death.

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SECTION 1

IMPORTANT SAFETY ISSUES

The following terms and symbols are used in this manual to alert the operator of important instrument operating issues:

This symbol is intended to alert the user to the presence of important operating and maintenance (servicing) instructions.

This symbol is intended to alert the user to the presence of dangerous voltage within the instrument enclosure that may be sufficient magnitude to constitute a risk of electric shock.

This symbol signifies the system's ground terminal

DC refers to direct current voltages.
VAC refers to alternating current voltages.

WARNINGS:

- **Shock Hazard** - Disconnect or turn off power before servicing this instrument.
- NEMA 4X wall mount models should be fitted with a locking mechanism after installation to prevent access to high voltages by unauthorized personnel (see Figure 4.0).

- 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 REPLACE FUSE UNLESS POWER HAS BEEN SWITCHED OFF OR THE AREA IS KNOWN TO BE NON-HAZARDOUS.
- **WARNING- EXPLOSION HAZARD**- DO NOT DISCONNECT EQUIPMENT UNLESS POWER HAS BEEN SWITCHED OFF OR THE AREA IS KNOWN TO BE NON-HAZARDOUS.
- Use a properly rated CERTIFIED AC power (mains) cable installed as per local or national codes.
- For DC powered units, DC power must be from a SELV rated source.
- A certified AC power (mains) disconnect or circuit breaker should be mounted near the controller and installed following applicable local and national codes. If a switch is used instead of a circuit breaker, a properly rated CERTIFIED fuse or current limiter is required to be installed as per local or national codes. Markings for positions of the switch or breaker should state (I) for on and (O) for off.
- Clean using only a damp cloth with no solvents.

- Equipment not used as prescribed within this manual may impair overall safety.

1.0 GENERAL DESCRIPTION

The Model 9000/Quad Four Channel Controller is designed to display, and control alarm event switching for up to four inputs. Inputs are typically voltage or 4-20mA current from transmitters, monitors or other analog output devices. The MODEL 9000 is equipped with a Fault and three alarm levels per channel with features such as *ON* / *OFF* delays, latching relays and alarm *Acknowledge*. A dedicated horn driver circuit for a local audible annunciator is also standard. Two standard 5-amp alarm relays are configurable via the "alarm voting" menu to make relays trip based upon various alarm combinations. Real-Time Clock and Calendar are also standard. Options such as 4-20mA outputs, discrete relays for each alarm and audible annunciators are easily added. RS-485 (Modbus RTU) port is also available for sending data to PC's, PLC's, or DCS's.

A 128 x 64 pixel graphic LCD readout displays monitored data as bar graphs, 30-minute trends and engineering units. System configuration is via user friendly menus and all configuration data is retained in non-volatile memory during power interruptions. The MODEL 9000 front panel is shown below in Figure 1.0 displaying the bar graph data screen. The five button symbols below the display are magnetically activated using the supplied magnetic wand without opening the enclosure. Opening the enclosure door provides access to the "touch" keypad as shown in Figure 1.1.

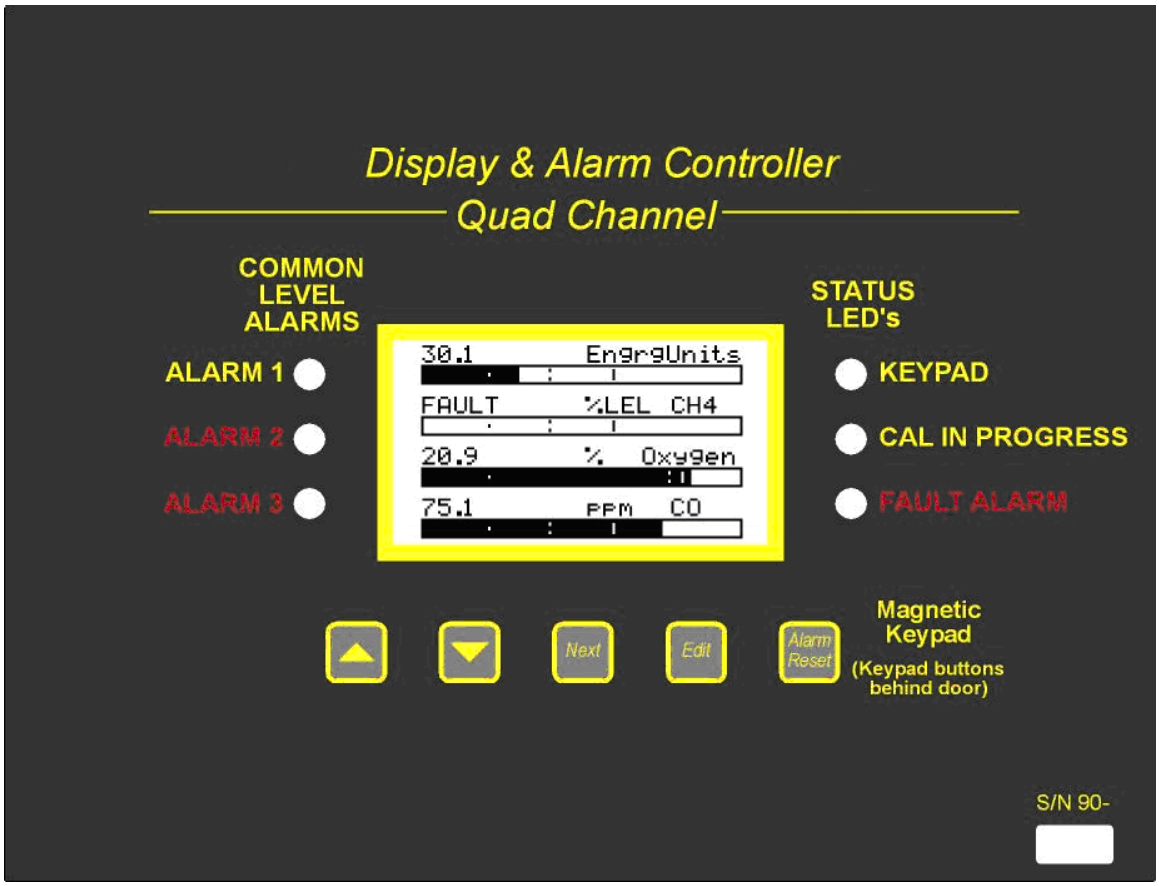

Figure1.0

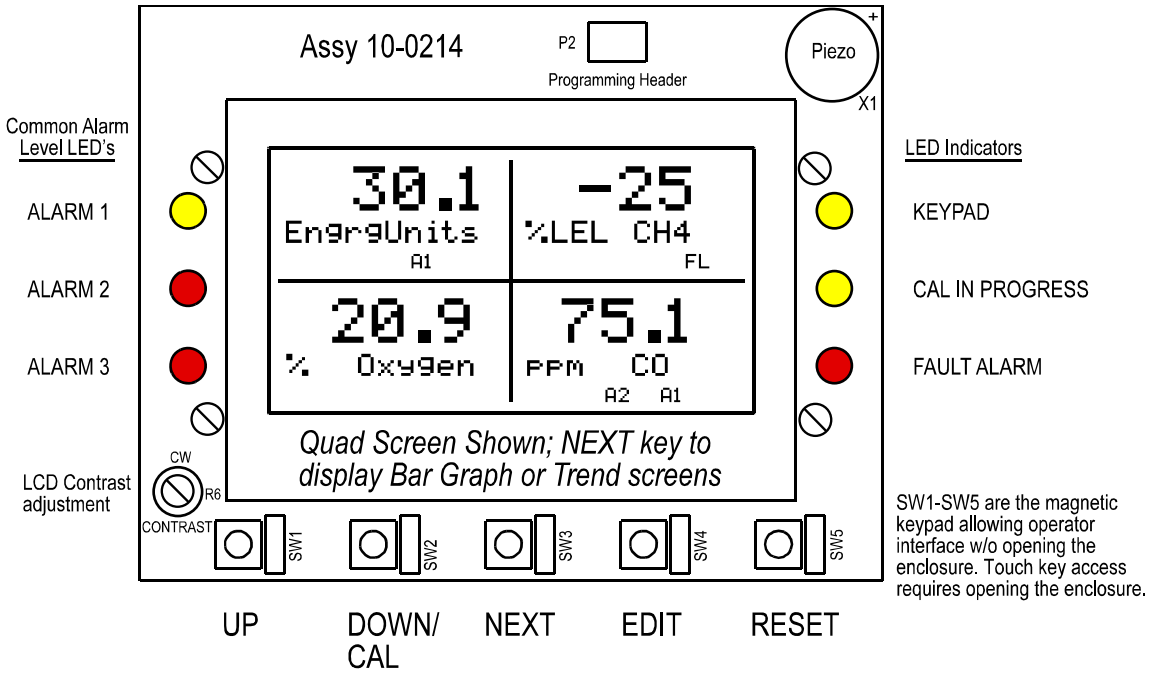

Figure1.1

1.1 DATA DISPLAY SCREENS

The MODEL 9000 Controller offers three modes for displaying monitored data. Each are shown below in Figure 1.2.

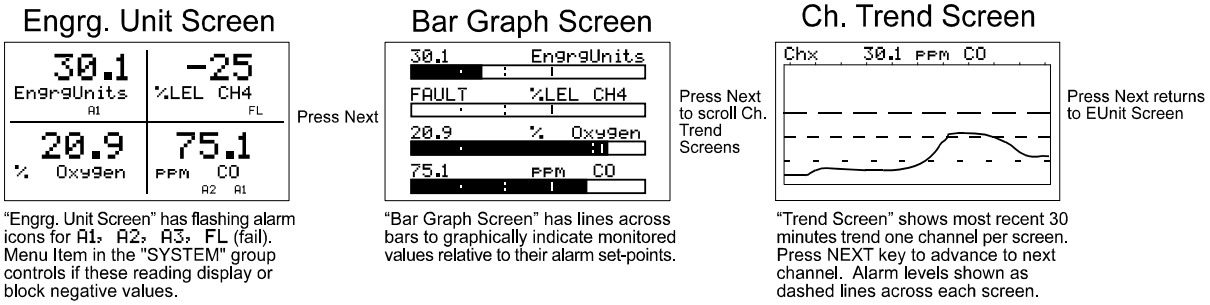

Figure 1.2

1.1.1 ENGINEERING UNIT SCREEN

The MODEL 9000 *Engineering Unit* screen shown at left in Figure 1.2 allows each channel's value and its 10-digit Eunits tag to be viewed simultaneously. A1, A2, A3, FL icons at lower right of each reading flash if ALARM 1, 2, 3 or FAULT alarms activate for this channel.

1.1.2 BAR GRAPH SCREEN

Values are displayed graphically as bar graphs with alarm levels indicated by vertical dashed lines across each bar. The bar graph screen is very useful for emphasizing current reading relative to the channel's alarm set-point. Live readings and their Eunits tag appear above each bar graph.

1.1.3 TREND SCREEN

The MODEL 9000 also provides 30-minute trend screens for each channel as shown in Figure 1.2. Live readings and their Eunits tag are displayed across the top of each trend screen. Channel numbers are shown in the upper right and are selected by the NEXT key. A1. A2 and A3 alarm levels appear as horizontal dashed lines across the screen.

1.2 SPECIFICATIONS:

1.2.1 POWER SUPPLY REQUIREMENTS

MODEL 9000 primary power may be either 10-30 VDC or 100-240VAC. AC power requirements are 100-240 VAC 50/60 Hz @ .80 amp max (including inrush) and 40 watts max steady state, applied to TB5 on the motherboard. If AC power is not available the primary power may be 10-30 VDC applied to TB1 on the motherboard. A back-up DC power source may also be connected to TB1 for automatic switchover if the AC power source fails. See Figures 3.0 & 3.1 for wiring information.

The basic MODEL 9000 consumes only 1.5 watts of 10-30 VDC power. Optional features such as relays and analog outputs increase power consumption as described below:

- 299-0019-01, **Analog Input PCB** option; add wattage for each monitor connected to this board's 24 VDC terminals.
- 299-0003-01, **Discrete Relay PCB** option; add 1.5 watt.
- 299-0020-01, **4-20mA Output PCB** option; add 1 watt.

With an AC primary power source connected to TB1 on the motherboard, TB3 terminals 1 & 2 on the motherboard provide a maximum of 10 watts output power for powering of auxiliary external devices such as relays, lights and monitors (see Figure 3.0). Power consumed from TB3 must be included when calculating system power consumption.
IMPORTANT! TB3 only provides 24VDC power when AC is primary power.

24 VDC terminals on the 299-0019-01 Analog input option (see Figure 3.3) is typically used to power external transmitters up to 10 watts per channel and these loads must also be calculated into the overall power budget. These terminals receive power from both the integral AC / DC power supply and the external TB1 supply as shown in Figure 3.0.

"EXTENDED" series enclosures described in Section 5 of this manual may include the 299-0025-01 DIN rail mounted 50 watt Power Supply module built into these larger enclosures.

1.2.2 RELAYS

Two mechanical (dry contact) Common Form C relays are standard and may be mapped to various alarm events as described in section 2.3.1. MODEL 9000's may also be equipped with optional solid-state common Form A relays (see order guide for details) in applications requiring non-arcing switching. Solid-state relays are recommended for switching of highly inductive loads.

A six mechanical (dry contact) Discrete Relay option board (see section 3.1.6) provides dedicated Form C relays for ALARM 1, ALARM 2 and FAULT for both channels.

All mechanical (dry contact) relays are rated at 5 Amp for 28 VDC and 250 ~VAC **RESISTIVE** loads. IMPORTANT: Appropriate diode (DC loads) or MOV (AC loads) snubber devices must be installed with inductive loads to prevent RFI noise spikes.

Optional solid state relays are rated at 2 Amp 12-280 ~VAC (600Vpk).

Relay wiring should be kept separate from low level signal wiring.

1.2.3 AMBIENT TEMPERATURE RANGE

-25 to 60 degrees C

1.2.4 HUMIDITY RANGE

0 TO 90% R. H. Non-Condensing.

1.2.5 ALTITUDE

Recommended up to 2000 meters

1.2.6 HOUSINGS / INSTALLATION CATEGORIES

- *NEMA 4X wall mount. DIV 2 Groups A,B,C,D; Category II and pollution degree 3; NEMA 4X; IP66
- *NEMA 7 wall mount for DIV 1 & 2 Groups B,C,D; includes 'O' Ring in door to satisfy NEMA 4 rating.

*Includes standard non-intrusive magnetic keypad.

1.2.7 APPROVALS

CSA C22.2 No 1010.1 and ISA S82.02; UL 1604 / C22.2 No 213 (Div 2 Groups A,B,C,D); EN55011 & EN61000 (CE Mark). CSA File # = 219995 and may be seen at: CSA-International.org.

SECTION 2

2.0 BASIC OPERATION

The MODEL 9000's graphic LCD displays monitored data and with the 5-button keypad also serves as the system's operator interface. All MODEL 9000 configuration variables are entered with this operator interface using SETUP menus accessed by pressing **EDIT** from either data screen. This *Setup* mode may be exited manually by pressing **NEXT,** or automatically when no keys are pressed for 5 minutes. Alarm relays and front panel alarm LED indicators remain active during the *Setup* mode. Alarm LED's flash upon new alarms and become steady after *Acknowledged* by pressing the **ALARM RESET** key. A **SECURITY** menu offers a password feature to prevent tampering with MODEL 9000 parameters.

A "sign-on" screen appears briefly after power is applied that indicates what type input / output options the unit is configured with.

2.1 SETUP MENU CONFIGURATION

Variables inside the **CHANNEL** (see section 2.2) and **SYSTEM** (see section 2.3) menu trees allow MODEL 9000 configuration for a wide range of monitoring applications. Select the

desired menu by scrolling with **UP/DOWN** and then **EDIT** to enter each menu. Figure 2.0 illustrates the menus tree for configuring *Channel* and *System* specific variables. *Channel* variables affect only the specific channel selected while *System* variables are related to features not specific to any channel.

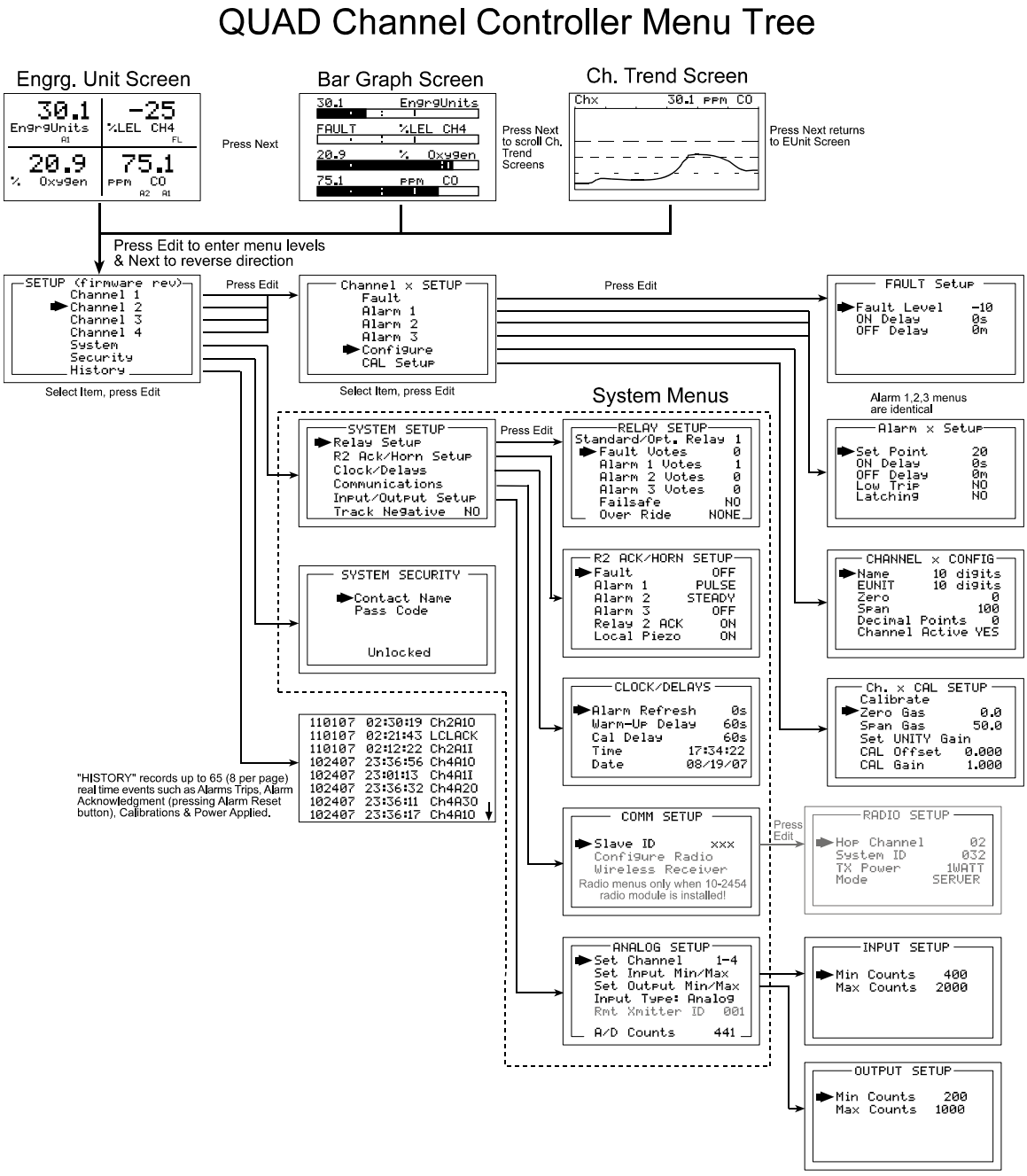

Figure 2.0

2.2 CHANGING MENU VARIABLES USING THE KEYPAD

Upon entering a menu, a pointer controlled by the **UP/DOWN** keys indicates the selected variable. Some are simple ***YES/NO*** or ***ON/OFF*** entries toggled by pressing the **EDIT** key. Others, such as *Channel ID* and *Eunits* fields may have many ASCII character possibilities.

Allowed ASCII characters are as follows:
ABCDEFGHIJKLMNOPQRSTUVWXYZ[\]^_`abcdefghijklmnopqrstuvwxyz blank space !"#$%&`()*+,-./0123456789:;<=>?@. Notice the often used *blank* character is located after lower case **z** and before the exclamation point **!. EDIT** places a cursor under the item and **UP/DOWN** scrolls through each allowed entry. The **NEXT** key moves the cursor to the next position within a field. When the field is complete, **EDIT** clears the cursor and loads the field into non-volatile memory where it is retained indefinitely. Without a cursor present, the **NEXT** key closes open menus in reverse order and returns the LCD to the data display.

2.2.1 MODEL 9000 SETUP CONFIGURATION MENUS

The SETUP menu shown in the middle of Figure 2.0 and in Figure 2.1 below is reached by pressing **EDIT** with any data display present. This is the entry-level screen to ALL *Channel*, *System* and *Security* menus. It also shows the revision of firmware operating in the MODEL 9000. Use the **UP/DOWN** keys to move the pointer to the desired menu and press the **EDIT** key.

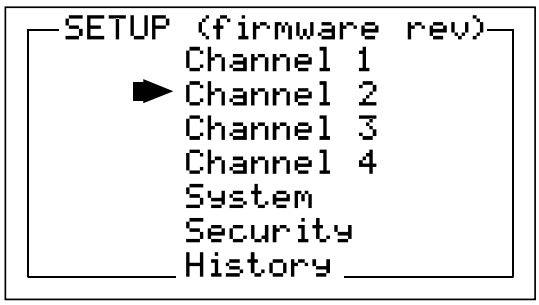

Figure 2.1

2.2.2 CHANNEL SETUP ENTRY MENU

The CHANNEL menu shown below in Figure 2.2 allows configuration of all variables for the selected channel. These are **Fault, Alarm 1**, **Alarm 2**, **Alarm 3**, **Configure** and **CAL Setup**.

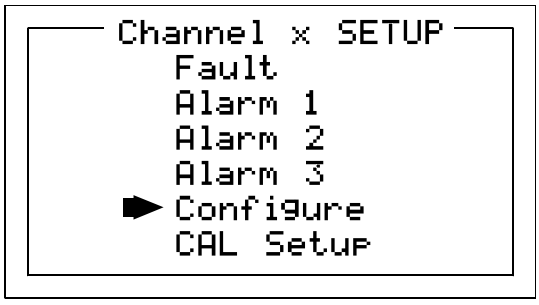

Figure 2.2

2.2.3 FAULT / ALARM 1 / ALARM 2 / ALARM 3 SET-UP MENUs

Alarms 1, 2 and 3 have identical menus. The only difference between each is A1 front panel LED indicators are yellow while A2 and A3 are red. Typical applications often have A1 set at a WARN level, A2 at a HIGH level and A3 at a higher SHUT DOWN level. However, it is important to understand there is no functional difference between A1, A2 and A3 and since their configuration menus are identical, only one is shown in Figure 2.3. The Fault menus is

identical to A1, A2, A3 except Fault alarms are always low trips (alarm activates as input goes below the set point) and Fault alarms may not be set for latching operation.

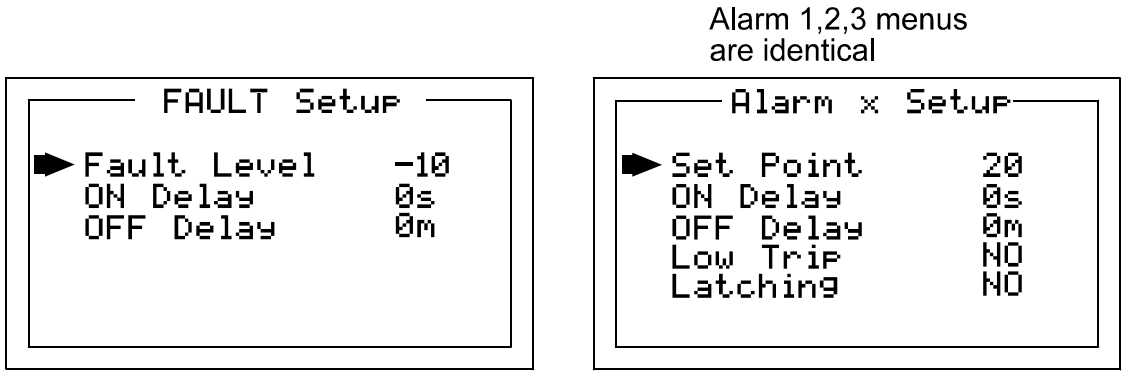

Figure 2.3

- **Set Point** is entered in engineering units and determines the value where the alarm trips. For example, if a channel monitors 0-50 ppmH2S and the desired alarm level is 10 ppm, the correct entry is 10.00. A one percent dead band prevents alarm chatter. This means after tripping an alarm the input must move at least 1% of full scale back through the setpoint for the alarm to auto reset.
- The **ON Delay / OFF Delay** entries allow **ON** and **OFF** time delays affecting how long the trip-point must be surpassed before an alarm event transition occurs. **ON** delays are limited to 10 seconds while **OFF** delays may be as long as 120 minutes. Delays are useful in many applications to prevent nuisance alarms and unwanted cycling into and out of alarm conditions.
- **Low Trip** is set for **NO** for increasing alarms or **YES** for decreasing alarms to determine if the alarm activates upon exceeding or falling below the set-point.
- **Latching** determines either manual or automatic alarm reset operation. **YES** requires a manual **Alarm Reset** to unlatch the alarm even though an alarm condition no longer exists. **YES** also causes this alarm's common relay, front panel LED, and optional discrete relay to latch. **NO** allows all outputs for this alarm to automatically reset after the alarm condition clears.

Common alarm LED indicators on the left side of the front panel indicate the status of A1, A2 A3 alarms. The common Fault LED is on the lower right side of the front panel. Any *new* alarm event causes the associated LED to flash until an **Alarm Reset** occurs causing an *acknowledged* steady on condition. Operators should recognize *new* alarms by a flashing LED. **Alarm Reset** also *acknowledges,* or deactivates, audible devices driven by the AUDIBLE ALARM option connector J2 (see Figure 3.1)

2.2.4 CONFIGURE MENU TO DEFINE CHANNEL

The channel setup menu after the alarm menus is **CONFIGURE.** It allows setting **Name** and **EUNIT** 10 digit ASCII fields, defines the measurement range with **ZERO** & **SPAN** entries, number of **Decimal Points** of resolution the reading will have, and if the channel is **Active**.

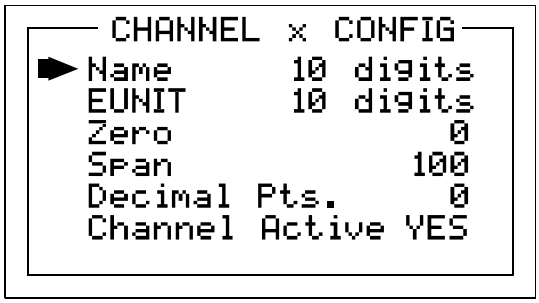

Figure 2.4

2.2.4a NAME / EUNITS ASCII DATA FIELDS

The first two items in this menu are for entering the 10 character channel *Name* and *engineering unit* ASCII fields. *Name* should describe the channel's data in user terminology such as tag # or other description. *Eunits* should define the units of measure for what this channel is to display. Section 2.2 describes how to modify these fields using the keypad.

2.2.4b INPUT MEASUREMENT RANGE

The **Zero / Span** menu entries allow configuration of the measurement range displayed by this channel. Measurement Range defines the range of the input signal's engineering units. For example, if a channel's input is 4-20mA from a transmitter monitoring 0 to 10ppm chlorine, then the **Zero** value should equal 0.000 and the **Span** value equal 10.00. Four digits must be entered so trailing 0's may appear here that are not displayed on other data screens. These menus work hand in hand with Min/Max Raw Counts menus described in section 2.3.4.

2.2.4c DECIMAL POINT RESOLUTION

Resolution of the displayed channel value is configured in this menu by setting the number digits trailing the decimal point. Displayed readings are limited to a maximum of four digits with a polarity sign. Auto-ranging displays the highest resolution allowed by this menu's decimal point entry. For example, a range of 0 to 100ppm and two decimal points reads **0.00** at 0ppm and **100.0** at 100ppm. This may be undesirable due to the high resolution at zero unless the sensor's output is extremely stable. If decimal points are limited to one, the 0ppm reading becomes **0.0** and the 100ppm reading remains **100.0**. Resolution may be limited further by setting decimal points to 0 where in the above example, 0ppm reads **0** and 100ppm reads **100**.

2.2.4d TURNING OFF UNUSED CHANNELS

The **Channel Active?** menu entry asks if this channel is to be utilized. **OFF** causes the controller to never process inputs applied to this channel and no alarms are tripped or data displayed. Inactive channels have a line drawn through them on the Setup screen to indicate it is turned off.

2.2.5 CAL SETUP MENU

Calibration <u>MUST</u> be preformed at the Transmitter <u>NOT</u> at the MODEL 9000. Therefore, the MODEL 9000 CAL MODE feature should not be used.

2.3 SYSTEM CONFIGURATION MENUS

Several items needing configuration are not specific to any channel but affect the entire MODEL 9000 *system*. These are located in the *SYSTEM* menus group shown in the dotted line box in Figure 2.0. System menus are accessed through the System SETUP menu shown in Figure 2.7 by pointing to the desired item and pressing **EDIT**.

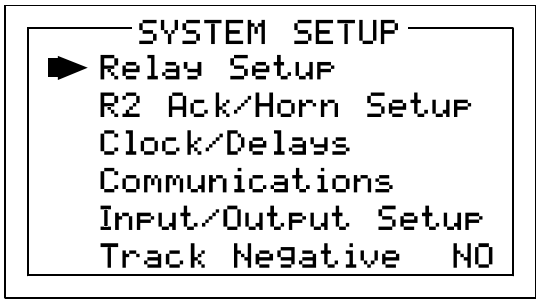

Figure 2.7

2.3.1 STANDARD / OPTIONAL RELAY SETUP MENUS

The menu shown in Figure 2.8 allows configuring of both the standard **Relay 1** & **Relay 2** motherboard relays and the six optional relays on the 299-0003-01 discrete relay option PCB. Both standard and optional relays are programmed in this menu. Select the relay to be configured by pointing the arrow at the top menu item and pressing EDIT. The field will scroll through all eight possible relays (2 standard and 6 optional).

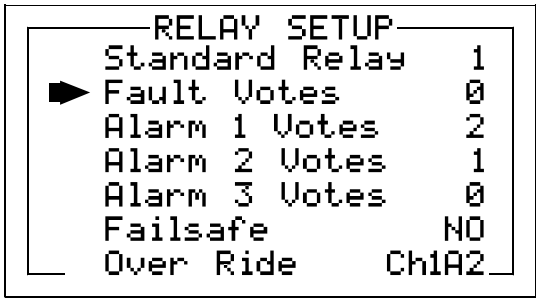

Figure 2.8

- **Fault, Alarm 1, Alarm 2, Alarm 3** menus in Figure 2.8 offers additional "voting" flexibility by controlling the channel alarm combinations that will trip the selected relay. Each ***Votes*** entry requires this quantity of channels, for of each type alarm be active before this relay activates. As illustrated in Figure 2.8 above, Standard Relay 1 activates when any 2 channels have Alarm 1 conditions, PLUS, any one channel has an Alarm 2 condition. And since the **Over Ride** menu (see description below) contains the **Ch1A2** entry Standard Relay 1 also activates if alarm 2 on channel 1 trips. Fault Votes and Alarm 3 Votes values are 0 therefore Fault and Alarm 3 conditions will not affect this relay. Votes follow the logical "AND" function.
- **Failsafe** set for YES causes this relay to be energized when its voting requirements are false (no alarm condition) and de-energized when the alarm vote requirements are true. The primary benefit of **Failsafe** is loss of power places the relay contacts into the alarm condition.

- **"Over Ride"** menu allows entering one of the 16 different alarms that will trip this relay regardless of the ***Votes*** entries. There are four alarms per channel and four channels and any one of these alarms may be used as the Over Ride. This feature is useful when one channel's alarm has more significance than the others.

2.3.2 RELAY 2 ACK (Acknowledge) / HORN SETUP MENU

- The **Horn SETUP** menu controls how each alarm type (Fault, and Alarms 1 through 3) will affect the horn driver circuit connected to J2 on the motherboard. Choices are **OFF, STEADY** or **PULSE**. Warning level alarms might be set to pulse the horn with high alarms set for steady. Personnel then know which alarm level is present by hearing the pulsing or steady horn.
- **Relay 2 Acknowledge** set to **ON** allows Relay 2 to be deactivated during alarm conditions by an **Alarm Reset**. This is useful if another audible device is being driven by the relay. The acknowledge feature is not available for Relay 1 since it is often used for driving a warning light and Relay 2 for driving a horn. It could be dangerous if an operator acknowledged the horn AND the light since no indication of the high alarm condition remains.
- **Local Piezo** set to **ON** causes the tiny local piezo adjacent to the LCD to mimic the J2 horn output.

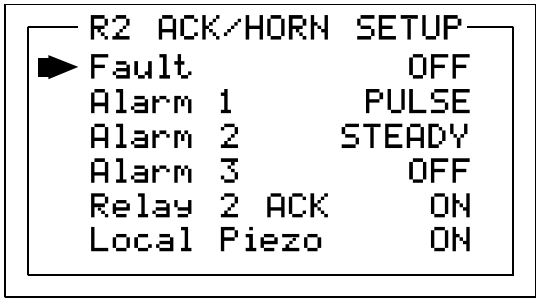

Figure 2.9

2.3.3 CLOCK / DELAYS MENU

These MODEL 9000 timers accommodate inputs that may require varying times to stabilize after power is applied and after calibrations are complete.

- **Alarm Refresh** menu allows reactivation of *Acknowledged* alarms after the time period expires. This feature is used primarily to restart audible alarm devices after having been silenced by an acknowledge function (via serial port or pressing the Alarm Reset button). An entry of 0 seconds effectively disables the **Alarm Refresh** function.
- **Warm Up Delay** menu allows setting how long alarm relays remain disabled after power is applied.
- **Cal Delay** determines how long alarm relays are inhibited after completing a calibration.
- **Time** and **Date** menu items are for setting the correct time and date. The MODEL 9000 is equipped with a 24-hour clock and calendar. Time of day must be entered in 24 hour mode. For example, 6:00:00 PM = is indicated as18:00:00.

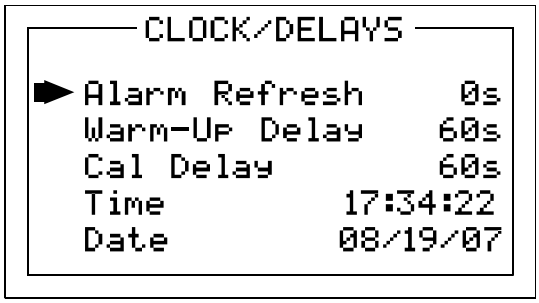

Figure 2.10

2.3.4 COMMUNICATIONS MENU

The **COMM SETUP** menu allows setting of the system's modbus **Slave Id** or RTU address (requires 299-0021-01 Modbus option PCB – see Section 3.2). This *slave* port may be used to transfer MODEL 9000 data to a modbus *master* device such as a PC, PLC, or DCS. The slave port is addressable, allowing many MODEL 9000 controllers to be connected to a single RS-485 cable.

The entire modbus database, including registers and supported Function Codes, is documented in section 3.2.1.

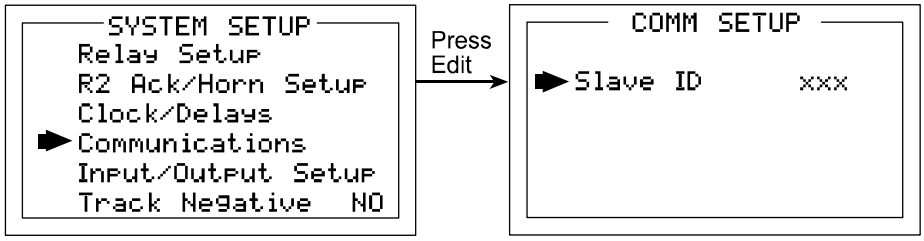

Figure 2.11

2.3.5 ANALOG SETUP MENU

The system **ANALOG SETUP** menus in Figure 2.12 allow setting the 11-bit A/D (analog to digital) counts and the 10-bit D/A (digital to analog) counts for each of the four channels. Use the **Set Channel** entry to scroll to the desired channel using the EDIT key. The live A/D counts value for the channel selected is also shown on the bottom of this screen.

The default setting for A/D counts is 400 for Min and 2000 for Max. This is based upon a 0-20mA input providing 0-2000 counts, or, 100 counts per mA input.

- **Min Counts / Max Counts** entries in the **INPUT SETUP** menus define the input A/D counts range for **Zero** and **Span** readings as described in section 2.2.4b. The default settings for each analog channel are 400 to 2000 counts. Standard inputs yield 400 counts at 4mA and 2000 counts at 20mA but, for example, if a special application requires the **Zero** reading at 6mA input and the **Span** reading at 18mA input the correct **A/D Min / Max Raw** counts would be 600 to 1800.00.
- **Min Counts / Max Counts** entries in the **OUTPUT SETUP** menus define the output D/A counts range for **Zero** and **Span** readings as described in section 2.2.4b. **OUTPUT SETUP** menus are only used when the MODEL 9000/QUAD is equipped with the 299-0020-01 4-20mA output option (Section 3.1.5). Ideally, 200 to 1000

yields a 4-20mA output but very slight modifications may be needed to provide precise 4mA and 20mA values for each channel.

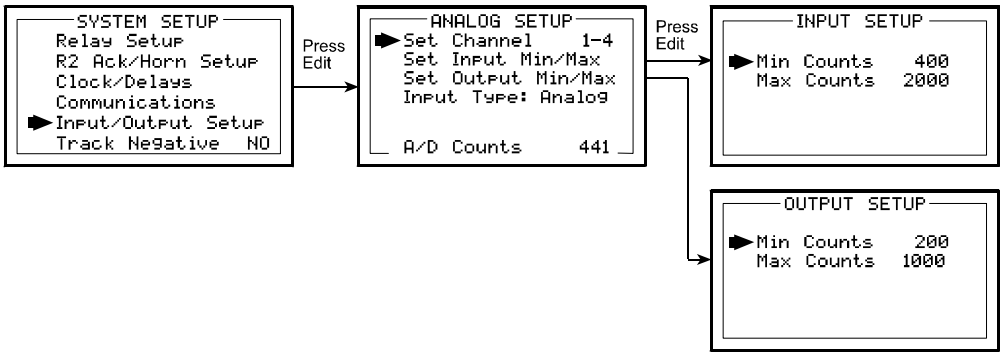

Figure 2.12

2.4 SYSTEM SECURITY MENU

A 4-digit **Pass Code** entered and confirmed in this menu item locks all menus. *Viewing* menus is not denied but attempts to *edit* variables flashes the ***Locked*** message on the LCD.

Authorized individuals locking the system should first enter a name, phone #, or other contact information into the 12 character field on the top line of the Security screen. To lock or unlock the system the correct 4 digit authorization number must be entered into the **Pass Code** field. It is very important to remember the 4 digit code since the factory must be consulted if it is lost.

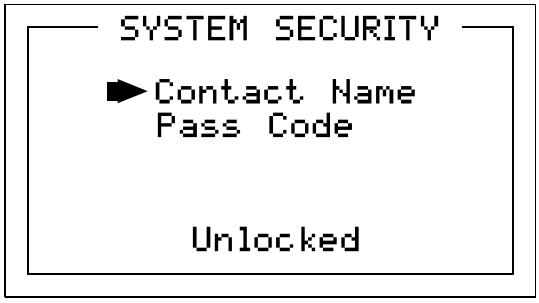

Figure 2.13

SECTION 3

3.0 MOTHERBOARD INTERFACE PCB # 10-0215

The MODEL 9000 Motherboard shown below in Figure 3.1 is the interface between the Display / CPU assembly and all other system I/O devices. The Display / CPU assembly attaches to the motherboard with 4-standoffs and connects via ribbon cable to S1. Input options described in sections 3.1.1 and 3.1.2 are available that may be installed into the *Input Option* P1 connector located on the lower left side of the motherboard. The middle position P2 connector is for the 299-0020-01 4-20mA Output option and the right position P3 connector is for the 299-0003-01 Discrete Relay option. Other option devices such as Modbus RTU RS-485 logger may also be installed to connectors located on the Motherboard.

The Motherboard PCB contains a 24 VDC universal input (100-240 VAC) switching power supply with up to 350mA available at the TB3 Auxiliary Power Output terminals. If AC power is unavailable, or if a DC battery back-up supply is needed, TB1 provides terminals for DC power input. Blocking diodes isolate internal and external DC supplies as shown in Figure 3.0. See section 1.2.1 for additional power source information.

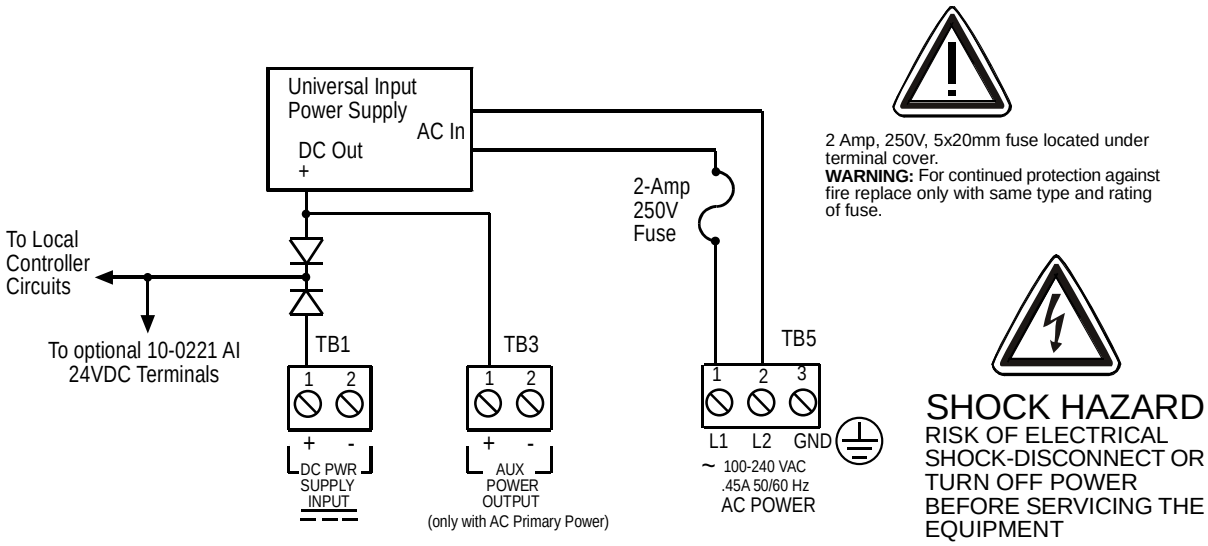

Figure 3.0

TB2 offers field terminals for a remote alarm reset switch. The motherboard also includes standard alarm relays 1 & 2 (K1 & K2) and their indicating LED's. TB4 provides field wiring terminals for these relays. TB5 is for connection to the 100-240 VAC power source. J2 is a 2-pin connector for powering the optional part # 1000-1892 audible annunciator.

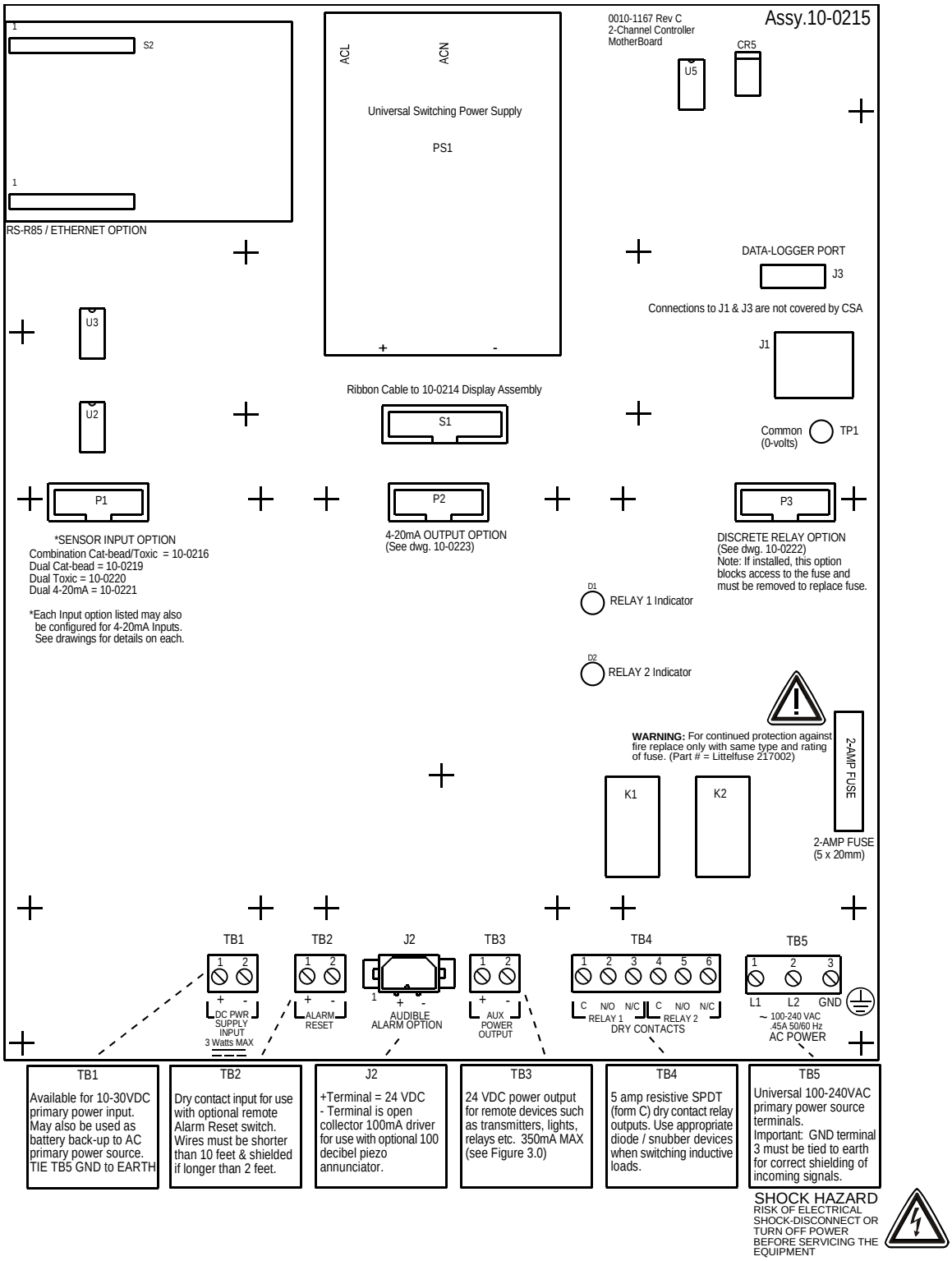

Figure 3.1

3.1 INPUT / OUTPUT OPTIONAL PCB's

P1, P2 and P3 connectors on the motherboard offer unique positions for I/O options described in this section. A screen appears briefly after power-up indicating what I/O options

are connected. The P1 position accepts the 299-0019-01 Analog Input option. It has default **Input Min / Max** menu (see section 2.3.4) settings of 400 – 2000 counts.

P2 is reserved only for the 299-0020-01 4-20mA Output option and P3 is reserved only for the 299-003-01 Discrete Relay option. Connector locations, relative to each option's mounting screws, prevent incorrect installation.

3.1.1 OPTIONAL ANALOG INPUT PCB # 299-0019-01

Important! 299-0019-01 PCB's may only be installed into motherboard position P1.

Analog input PCB option # 299-0019-01, shown in Figure 3.2 allows interfacing MODEL 9000's to field transmitters having 4-20mA or voltage outputs. Remove socketed 100 ohm (R1 – R4) terminators for 0-4 VDC max voltage inputs. The 299-0019-01 utilizes a 12-bit A/D converter such that 4mA provides 400 counts and 20mA 2000 counts. Min/Max raw counts menus default to 400/2000 but may be adjusted between 0/4095 as described in the **A/D Min / Max Raw** discussion in section 2.3.4. TB1 & TB2 provide each channel's terminals for receiving analog inputs. TB1 & 2 also provides 4 terminals connected to the MODEL 9000 internal 24 VDC power supply for powering external transmitters. Figure 3.3 shows correct wiring for both 2-wire and 3-wire transmitters.

*R1 = Ch1 100 ohm 4-20mA terminator
*R2 = Ch2 100 ohm 4-20mA terminator
*R3 = Ch3 100 ohm 4-20mA terminator
*R4 = Ch4 100 ohm 4-20mA terminator
*Spare = Spare 100 ohm 4-20mA terminator

* These 5 resistors are socketed for easy replacement.

Terminators are connected between each channel's HI & LO terminals.

LO = 24VDC Power Supply Common
24VDC = 24VDC Power Supply + output

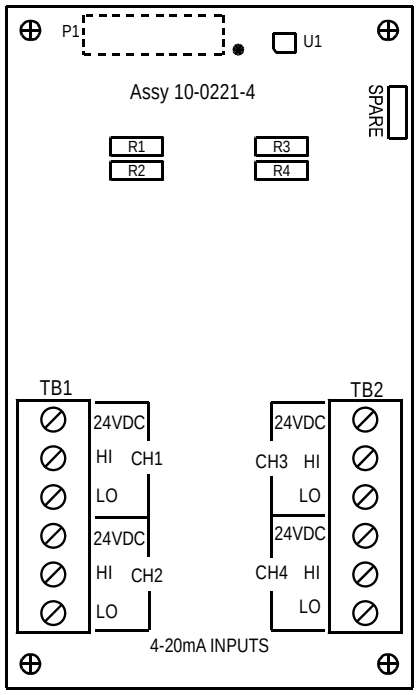

Figure 3.2

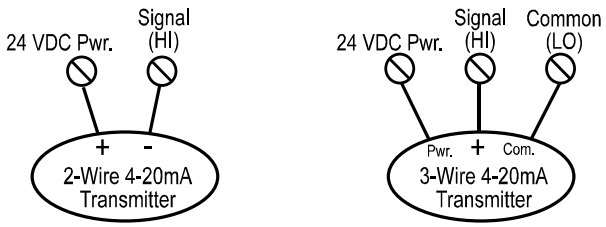

Figure 3.3

3.1.4 OPTIONAL DISCRETE RELAY PCB's #'s 299-003-01

Important! 299-003-01 PCB's may only be installed into motherboard position P3.

The optional *Discrete Relay PCB,* shown in Figure 3.5, adds six 5 amp form C relays. Each relay is fully programmable as described in section 2.3.1. Many MODEL 9000 applications utilize the standard equipped Relay 1 / Relay 2 (see section 2.3.1) and do not require optional discrete relays

All mechanical (dry contact) relays are rated at 5 Amp for 28 VDC and 250 ~VAC **RESISTIVE** loads. IMPORTANT: Appropriate diode (DC loads) or MOV (AC loads) snubber devices must be installed with inductive loads to prevent RFI noise spikes.

AC or DC power supplies to relays on the 299-003-01 Discrete Relay PCB option must be the same for each relay. Example: 24VDC should not be the power switched by one relay and 115VAC by others.

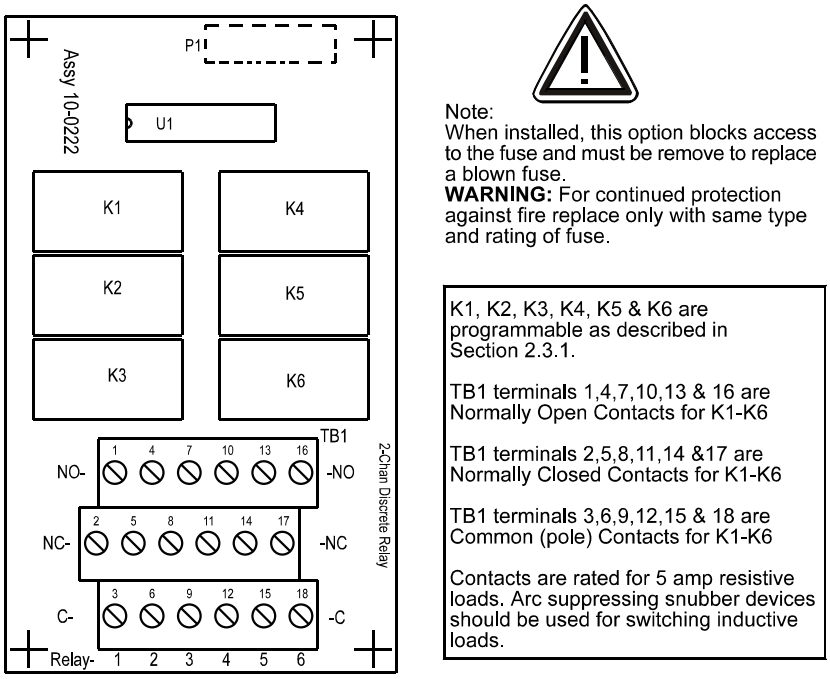

Figure 3.5

3.1.5 OPTIONAL 4-20mA ANALOG OUTPUT BOARD #299-0020-01

Important! 299-0020-01 PCB's may only be installed into motherboard position P2.

An optional 10-bit 4-20mA analog output board, shown in Figure 3.6, may be added. Each channel's output will transmit 4mA for 0% readings and 20mA for 100% readings. If the MODEL 9000 primary power is 100 – 240 VAC or at least 24 VDC, 4-20mA outputs are capable of driving 20mA through a 750 ohm load. Outputs are self powered and DC power should not be provided by the receiving device. Precision calibration of the 4-20mA output DAC (digital to analog converter) is accomplished via the **Analog Setup** menu as described in section 2.3.4.

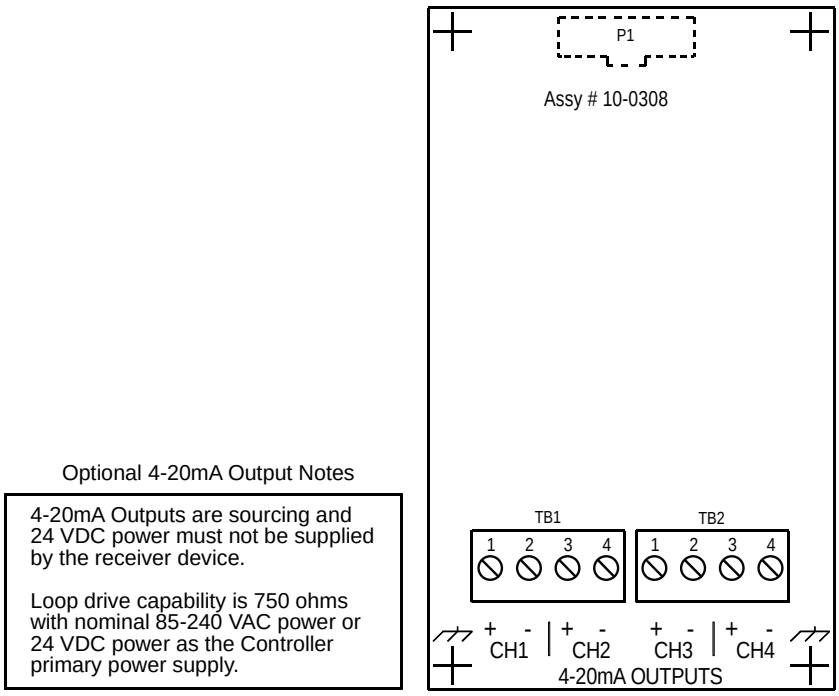

Figure 3.6

3.2 MODBUS RS-232 / RS-485 INTERFACE OPTION 299-0016-01

The 299-0016-01 Modbus option PCB add both RS-232 and RS-485 Modbus RTU slave ports. Figure 3.7 shows this optional PCB which mounts to connectors on the upper left corner of the MODEL 9000 motherboard. TB1 provides two pairs of T/Rx terminals and a floating terminal for shield continuation. This makes it easy to multi-drop MODEL 9000's onto an RS-485 cable without doubling wires into the same screw terminals. RS-232 interface may be made by connecting to DB9 connector S1. Section 3.2.1 lists all modbus registers and their function codes.

Follow correct IEEE RS-232 and RS-485 installation guidelines when using the 299-0016-01 option.

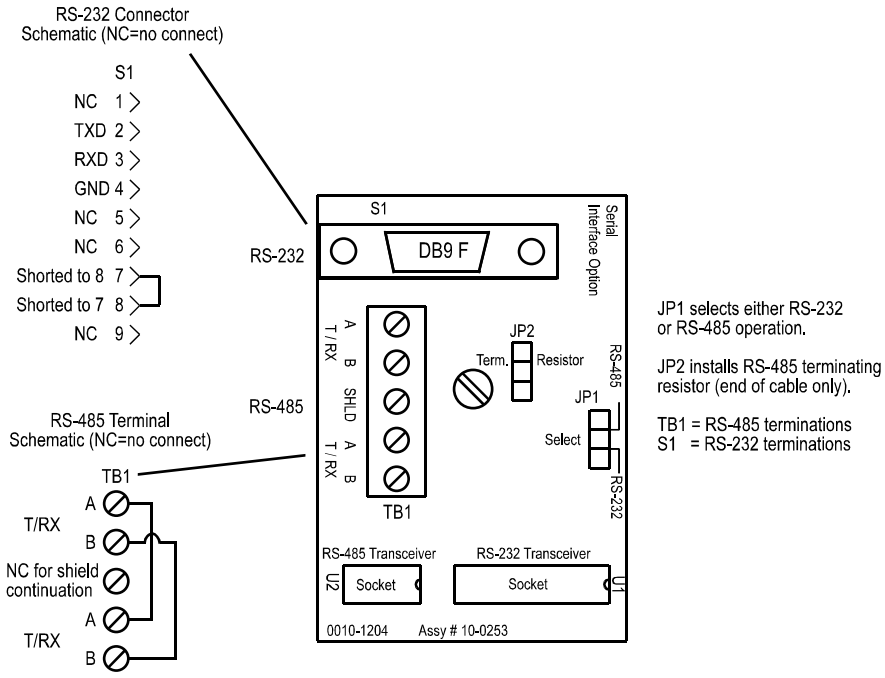
RS-232 Connector
Schematic (NC=no connect)
S1
NC 1
TXD 2
RXD 3
GND 4
NC 5
NC 6
Shorted to 8 7
Shorted to 7 8
NC 9
RS-232
RS-485
RS-485 Terminal
Schematic (NC=no connect)
TB1
A
T/RX
B
NC for shield
continuation
A
T/RX
B
S1
DB9 F
Serial
Interface Option
A
T / RX
B
SHLD
A
T / RX
B
TB1
JP2
Term.
Resistor
RS-485
JP1
Select
RS-232
RS-485 Transceiver
Socket
U2
RS-232 Transceiver
Socket
U1
0010-1204
Assy # 10-0253
JP1 selects either RS-232
or RS-485 operation.
JP2 installs RS-485 terminating
resistor (end of cable only).
TB1 = RS-485 terminations
S1 = RS-232 terminations

Figure 3.7

3.2.1 MODBUS REGISTER AND FUNCTION CODE SUMMARY

The following table identifies the available modbus RTU register locations and function codes.

VARIABLE		ALIAS	READ FUNCTION CODE	WRITE FUNCTION CODE
Read/Write Coils:				
Alarm Ack/Reset		2001	1	5
Note: After writing a TRUE to this register, the MODEL 9000 automatically returns it to FALSE.				
Read Only Discrete:				
Chan 1	Fault Alarm	12001	2	NA
Chan 1	Alarm 1	12002	2	NA
Chan 1	Alarm 2	12003	2	NA
Chan 1	Alarm 3	12004	2	NA
Chan 2	Fault Alarm	12005	2	NA
Chan 2	Alarm 1	12006	2	NA
Chan 2	Alarm 2	12007	2	NA
Chan 2	Alarm 3	12008	2	NA
Chan 3	Fault Alarm	12009	2	NA
Chan 3	Alarm 1	12010	2	NA
Chan 3	Alarm 2	12011	2	NA
Chan 3	Alarm 3	12012	2	NA
Chan 4	Fault Alarm	12013	2	NA
Chan 4	Alarm 1	12014	2	NA
Chan 4	Alarm 2	12015	2	NA
Chan 4	Alarm 3	12016	2	NA
Standard Relay 1		12017	2	NA
Standard Relay 2		12018	2	NA
Optional Relay 1		12019	2	NA
Optional Relay 2		12020	2	NA
Optional Relay 3		12021	2	NA
Optional Relay 4		12022	2	NA
Optional Relay 5		12023	2	NA
Optional Relay 6		12024	2	NA
Input Fault Relay		12025	2	NA
Read Only Registers:				
Product ID		30001	4	NA
Returns the numeric value “1000” for product ID.				
Firmware value		30002	4	NA
Return a numeric value for firmware value as (Version divided by 100).				
D2A Chan 1		31001	4	NA
D2A Chan 2		31002	4	NA
D2A Chan 3		31003	4	NA
D2A Chan 4		31004	4	NA
12 bit value representing the D2A value of 800 (0%) to 4000(100%) after all cal features are applied.				
Chan 1 Status		31005	4	NA
Chan 2 Status		31006	4	NA
Chan 3 Status		31007	4	NA
Chan 4 Status		31008	4	NA
16 bit status word bit assignment for each channel.				

ALARM1_BELOW_BIT	BIT1
ALARM2_BELOW_BIT	BIT2
ALARM3_BELOW_BIT	BIT3
ALARM1_LATCH_BIT	BIT5
ALARM2_LATCH_BIT	BIT6
ALARM3_LATCH_BIT	BIT7
WIRELESS INPUT	BIT4
CHANNEL_DISABLED_BIT	BIT9
CHANNEL_CAL_BIT	BIT10

System Status Word	31009	4	NA

16 bit status word bit assignment for system status.

TRACK NEGATIVE	BIT0
WIRELESS RECEIVER	BIT1
SECURITY LOCK	BIT15

Alarm Status Word	31010	4	NA

16 bit status word bit assignment for system status.

CHAN1 FAULT	BIT0
CHAN1 ALARM1	BIT1
CHAN1 ALARM2	BIT2
CHAN1 ALARM3	BIT3
CHAN2 FAULT	BIT4
CHAN2 ALARM1	BIT5
CHAN2 ALARM2	BIT6
CHAN2 ALARM3	BIT7
CHAN3 FAULT	BIT8
CHAN3 ALARM1	BIT9
CHAN3 ALARM2	BIT10
CHAN3 ALARM3	BIT11
CHAN4 FAULT	BIT12
CHAN4 ALARM1	BIT13
CHAN4 ALARM2	BIT14
CHAN4 ALARM3	BIT15

LED Blink Status	31011	4	NA

Bit set to 1 = LED Blinking, bit set to 0 = LED is steady ON.

CHAN1 FAULT	BIT0
CHAN1 ALARM1	BIT1
CHAN1 ALARM2	BIT2
CHAN1 ALARM3	BIT3
CHAN2 FAULT	BIT4
CHAN2 ALARM1	BIT5
CHAN2 ALARM2	BIT6
CHAN2 ALARM3	BIT7
CHAN3 FAULT	BIT8
CHAN3 ALARM1	BIT9
CHAN3 ALARM2	BIT10
CHAN3 ALARM3	BIT11
CHAN4 FAULT	BIT12
CHAN4 ALARM1	BIT13
CHAN4 ALARM2	BIT14
CHAN4 ALARM3	BIT15

Relay Status	31012	4	NA

Note: 1 = energized; 0 = deenergized

STANDARD RELAY 1	BIT0
STANDARD RELAY 2	BIT1
OPTION RELAY 1	BIT2
OPTION RELAY 2	BIT3
OPTION RELAY 3	BIT4
OPTION RELAY 4	BIT5
OPTION RELAY 5	BIT6
OPTION RELAY 6	BIT7
COMMON FAULT (no relay)	BIT8
Reserved	BIT9
Reserved	BIT10
Reserved	BIT11
Reserved	BIT12
Reserved	BIT13
Reserved	BIT14
Reserved	BIT15

VARIABLE	ALIAS	READ FUNCTION CODE	WRITE FUNCTION CODE

Memory Reals:

Notes: 41001 – 41040 "Real" represents float value without the decimal point such that 123.4 is returned as 1234. Decimal devisor is returned as 1, 10, 100, or 1000 for decimal position of 1, 2, 3, or 4, where 123.4 would return the devisor value 10.

Chan 1 Zero Real	41001	3	NA
Chan 1 Zero Divisor	41002	3	NA
Chan 1 Span Real	41003	3	NA
Chan 1 Span Divisor	41004	3	NA
Chan 1 Fault Alarm Real	41005	3	NA
Chan 1 Fault Alarm Divisor	41006	3	NA
Chan 1 Alarm 1 Real	41007	3	NA
Chan 1 Alarm 1 Divisor	41008	3	NA
Chan 1 Alarm 2 Real	41009	3	NA
Chan 1 Alarm 2 Divisor	41010	3	NA
Chan 1 Alarm 3 Real	41011	3	NA
Chan 1 Alarm 3 Divisor	41012	3	NA
Chan 2 Zero Real	41013	3	NA
Chan 2 Zero Divisor	41014	3	NA
Chan 2 Span Real	41015	3	NA
Chan 2 Span Divisor	41016	3	NA
Chan 2 Fault Alarm Real	41017	3	NA
Chan 2 Fault Alarm Divisor	41018	3	NA
Chan 2 Alarm 1 Real	41019	3	NA
Chan 2 Alarm 1 Divisor	41020	3	NA
Chan 2 Alarm 2 Real	41021	3	NA
Chan 2 Alarm 2 Divisor	41022	3	NA
Chan 2 Alarm 3 Real	41023	3	NA
Chan 2 Alarm 3 Divisor	41024	3	NA
Chan 3 Zero Real	410251	3	NA
Chan 3 Zero Divisor	41026	3	NA
Chan 3 Span Real	41027	3	NA
Chan 3 Span Divisor	41028	3	NA
Chan 3 Fault Alarm Real	41029	3	NA

Chan 3 Fault Alarm Divisor	41030	3	NA
Chan 3 Alarm 1 Real	41031	3	NA
Chan 3 Alarm 1 Divisor	41032	3	NA
Chan 3 Alarm 2 Real	41033	3	NA
Chan 3 Alarm 2 Divisor	41034	3	NA
Chan 3 Alarm 3 Real	41035	3	NA
Chan 3 Alarm 3 Divisor	41036	3	NA
Chan 4 Zero Real	41037	3	NA
Chan 4 Zero Divisor	41038	3	NA
Chan 4 Span Real	41039	3	NA
Chan 4 Span Divisor	41040	3	NA
Chan 4 Fault Alarm Real	41041	3	NA
Chan 4 Fault Alarm Divisor	41042	3	NA
Chan 4 Alarm 1 Real	41043	3	NA
Chan 4 Alarm 1 Divisor	41044	3	NA
Chan 4 Alarm 2 Real	41045	3	NA
Chan 4 Alarm 2 Divisor	41046	3	NA
Chan 4 Alarm 3 Real	41047	3	NA
Chan 4 Alarm 3 Divisor	41048	3	NA

Memory ASCII Strings:

User Info Chan 1	40401-40405	3	NA
User Info Chan 2	40406-40410	3	NA
User Info Chan 3	40411-40415	3	NA
User Info Chan 4	40416-40420	3	NA

10 ASCII characters (2 per register) assigned to the unit identifier read as bytes.

EUNITS Chan 1	40421-40425	3	NA
EUNITS Chan 2	40426-40430	3	NA
EUNITS Chan 3	40431-40435	3	NA
EUNITS Chan 4	40436-40440	3	NA

10 ASCII characters (2 per register) assigned to the engineering units read as bytes.

Chan 1 ASCII Reading	40441-40443	3	NA
Chan 2 ASCII Reading	40444-40446	3	NA
Chan 3 ASCII Reading	40447-40449	3	NA
Chan 4 ASCII Reading	40450-40452	3	NA

6 ASCII characters (2 per register) reflecting the display readout.

Firmware Version:

Version	40453-40455	3	NA

4 ASCII characters (2 per register) reflecting the firmware version.

SECTION 4

4.0 MODEL 9000PY NEMA 4X POLYCARBONATE WALL MOUNT (EXTENDED)

The MODEL 9000PY/QUAD wall mount NEMA 4X enclosure is shown in Figure 4.0. Non-metallic enclosures are not grounded by metal conduit. For internal ground points to be grounded to earth, the TB5 – GND terminal must have a proper earth ground connection (see Figure 3.1).

CAUTION: NONMETALLIC ENCLOSURE DOES NOT PROVIDE GROUNDING BETWEEN CONDUIT CONNECTIONS. USE GROUNDING TYPE BUSHINGS

AND JUMPER WIRES. ALL FIELD WIRING MUST HAVE INSULATION SUITABLE FOR AT LEAST 250V.

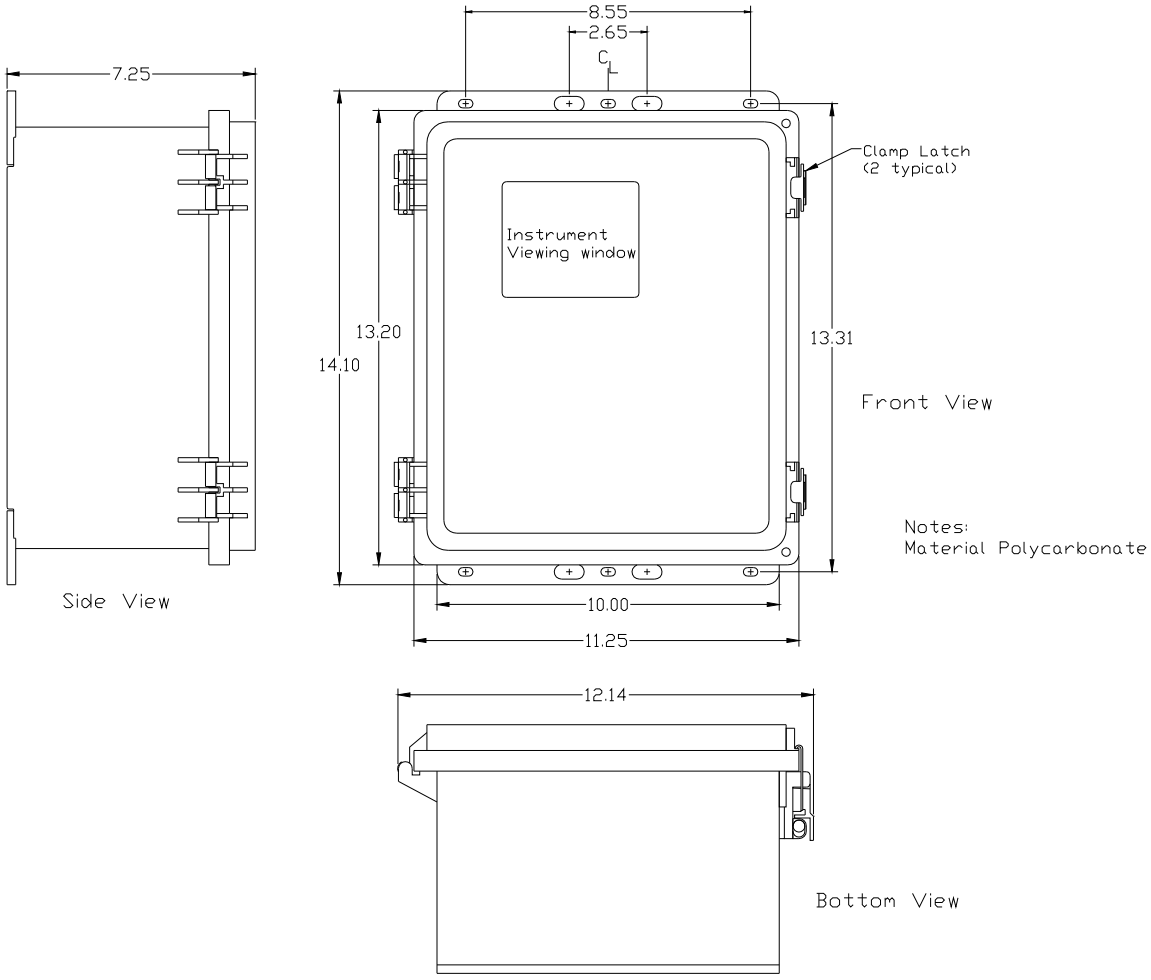

Figure 4.0

4.1 MODEL 9000PCS NEMA 4 PAINTED STEEL WALL MOUNT (EXTENDED) (SPECIAL ORDER)

The MODEL 9000PCS/QUAD shown in Figure 4.1 is a Painted Carbon Steel NEMA 4 wall mount enclosure designed for non-corrosive installations.

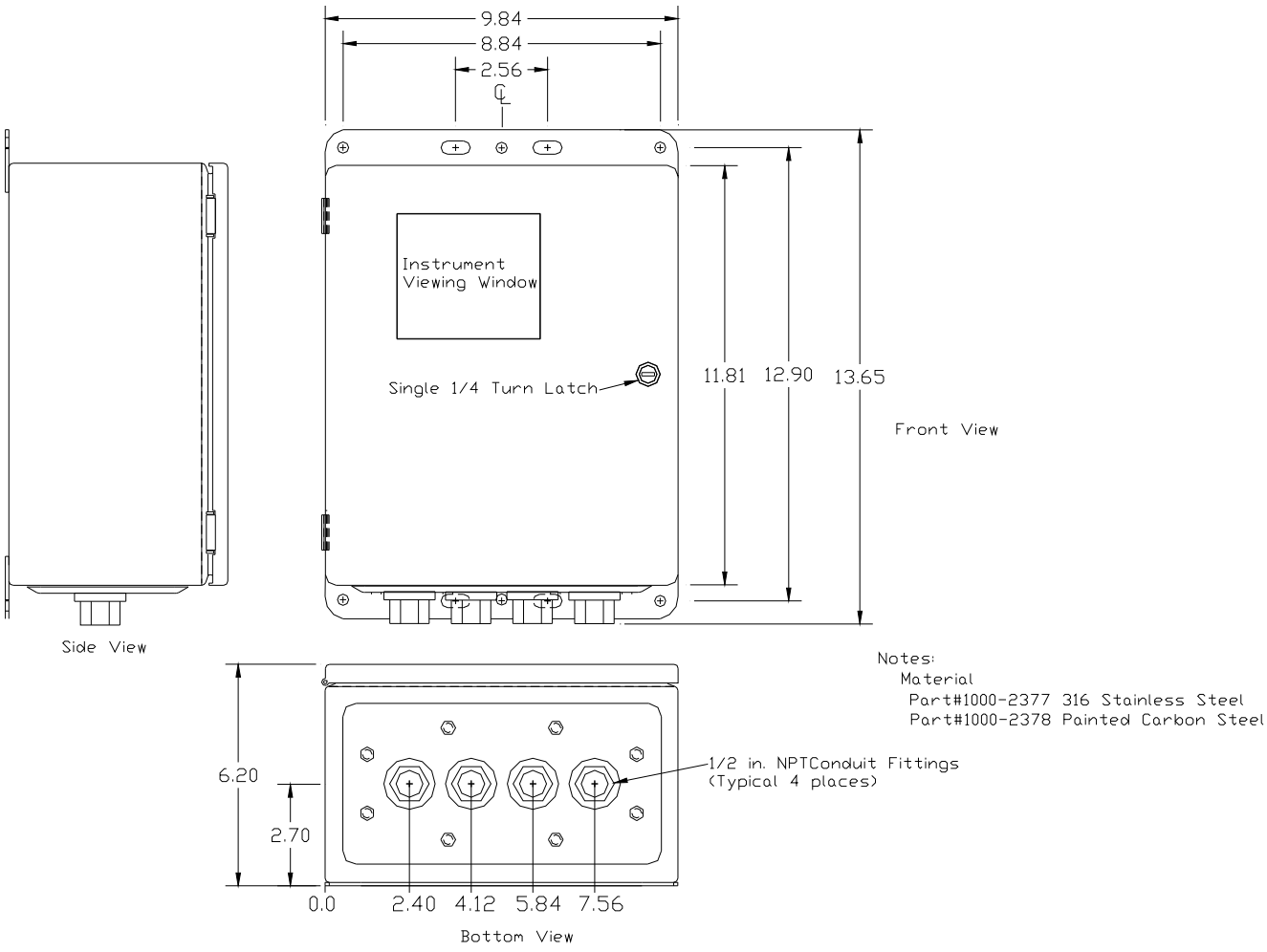

Figure 4.1

4.2 MODEL 9000SS NEMA 4X STAINLESS STEEL WALL MOUNT (EXTENDED)

The MODEL 9000SS/QUAD shown in Figure 4.2 is a 316 Stainless Steel NEMA 4X wall mount enclosure designed for corrosive installations.

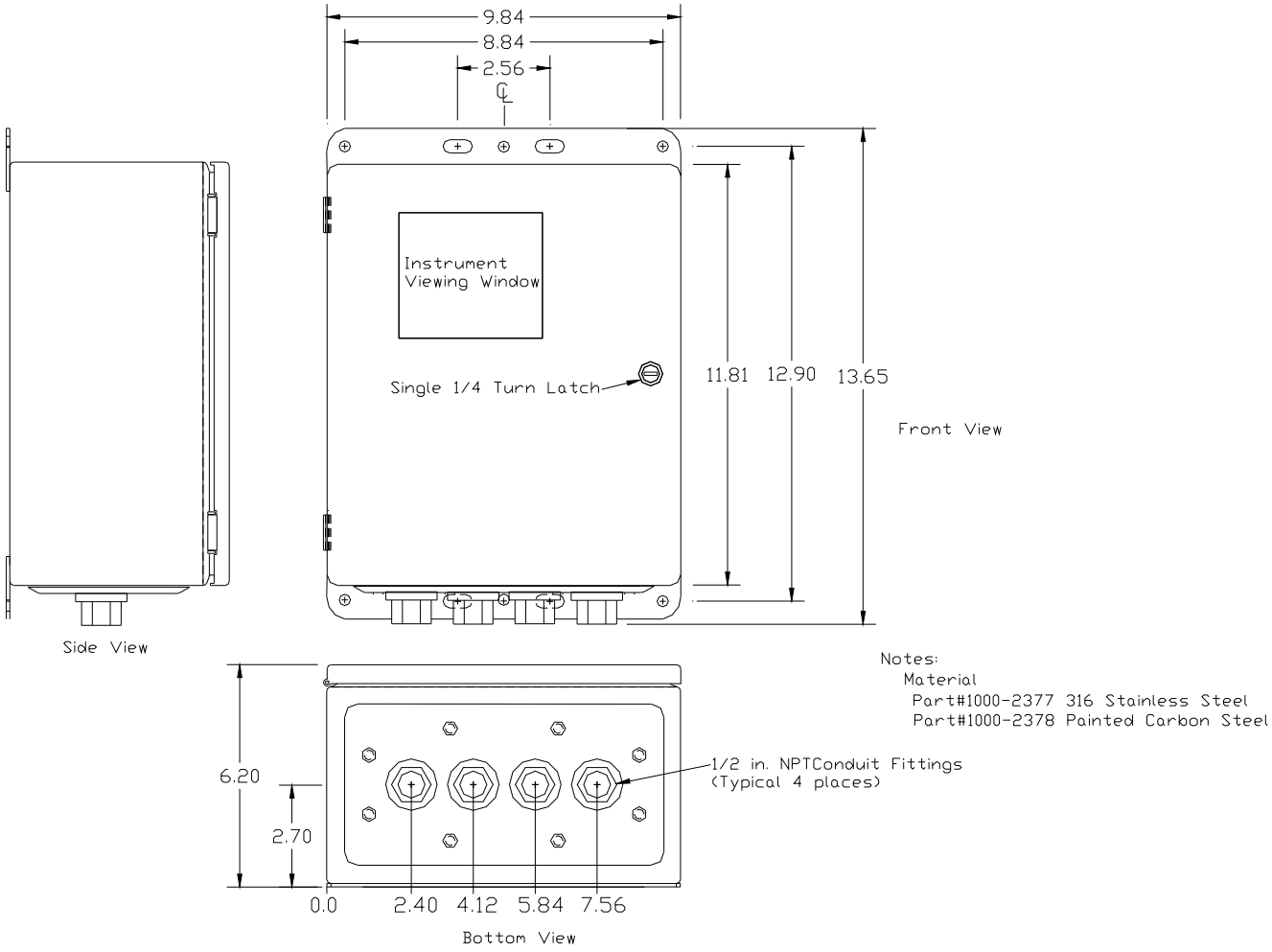

Figure 4.2

4.3 MODEL 9000XP NEMA 7 EXPLOSION-PROOF WALL MOUNT (EXTENDED) (SPECIAL ORDER)

The MODEL 9000XP/QUAD shown in Figure 4.3 is an aluminum NEMA 7 wall mount enclosure designed for mounting into potentially hazardous.

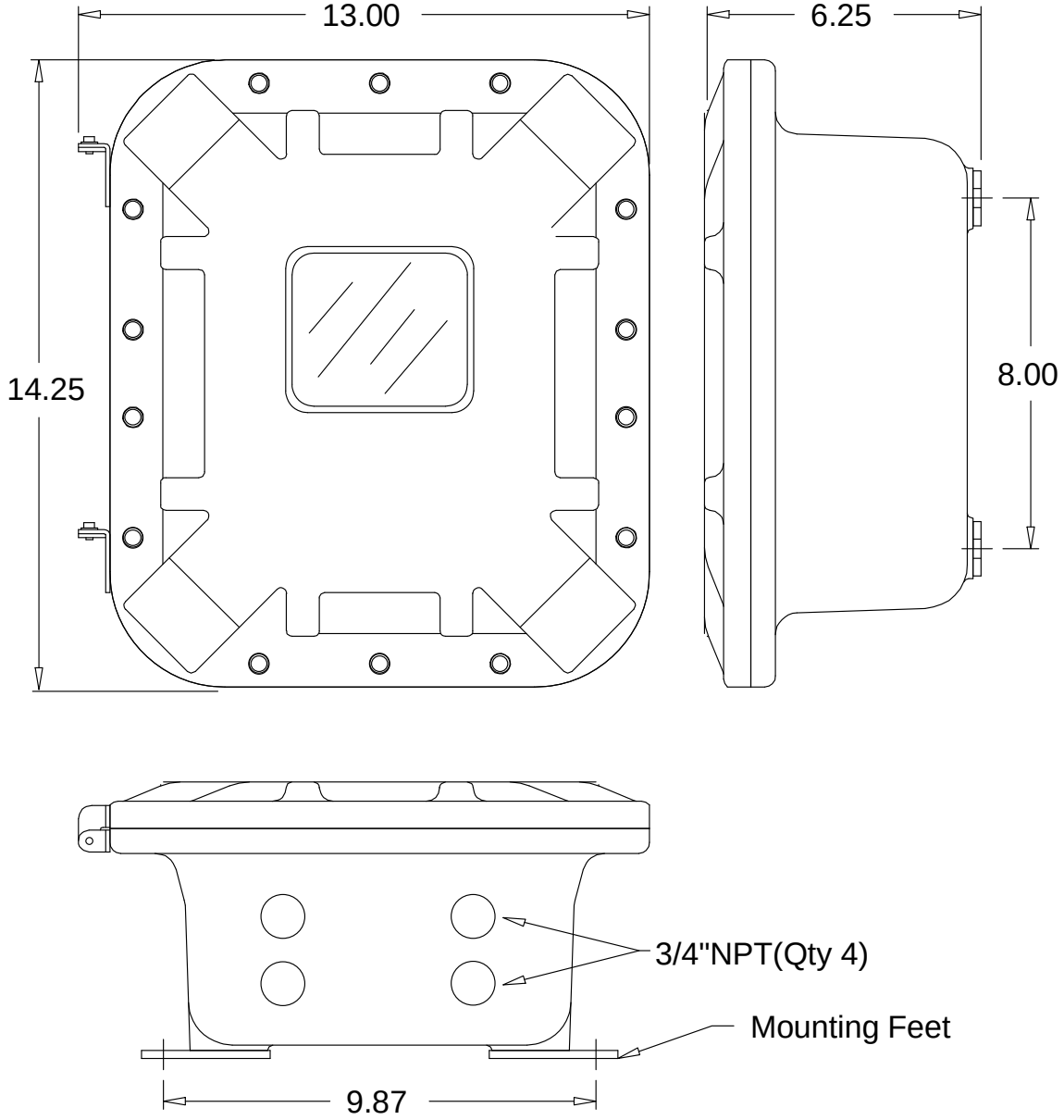

Figure 4.3

5.0 RETURN MATERIAL AUTHORIZATION

Sensidyne maintains an instrument service facility at the factory to provide its customers with both warranty and non-warranty repair. Sensidyne assumes no liability for service performed by personnel other than authorized Sensidyne authorized personnel. To facilitate the repair process, please contact the Sensidyne Service Department in advance for assistance with a problem which cannot be remedied and/or requires the return of the product to the factory. All returned products require a Returned Material Authorization (RMA) number. Sensidyne Service Department personnel may be reached at:

Sensidyne, LP
1000 112th Circle N, Suite 100
St. Petersburg, FL 33716 USA
800-451-9444 • +1 727-530-3602
+1 727-538-0671 [Service Fax] email: info@sensidyne.com

All non-warranty repair orders will have a minimum fee assessed whether the repair is authorized or not. This fee includes handling, administration and technical expenses for inspecting the instrument and providing an estimate. However, the estimate fee is waived if the repair is authorized.

If you wish to set a limit to the authorized repair cost, state a “not to exceed” figure on your purchase order. Please indicate if a price quotation is required before authorization of the repair cost, understanding that this invokes extra cost and handling delay. Sensidyne’s repair policy is to perform all needed repairs to restore the instrument to its full operating condition.

Repairs are handled on a “first in - first out” basis. Your order may be expedited if you authorize an expediting fee. This will place your order next in line behind orders currently in process.

Pack the instrument and its accessories (preferably in their original packing) and enclose your return address, purchase order, shipping and billing information, RMA number, a description of the problem encountered with your instrument and any special instructions. All prices are subject to change without notice.

If this is the first time you are dealing directly with the factory, you will be asked to prepay or to authorize a COD shipment.

Send the instrument, prepaid, to:

SENSIDYNE
1000 112TH CIRCLE N, SUITE 100
ST. PETERSBURG, FL 33716 USA
ATTENTION: Service Department
RMA #:_____

SERVICE OPTIONS

The Sensidyne Service Department offers a variety of service options which will minimize costly interruptions and maintenance costs. These options include initial training, on-site technical assistance, and full factory repairs. Sensidyne has developed several programs which offer options best suited to your applications and needs. For further information, contact the Sensidyne Service Department at the following numbers: 800-451-9444 • +1 727-530-3602 • +1 727-538-0671 [Service Fax].

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