TracXP™ TXP-C40
Quad Channel Controller Assembly
Instruction Manual

IMPORTANT: Read and understand contents of this manual prior to operation. Keep these user instructions for reference.

www.tracxp.com   1-844-325-3050   support@tracxp.com   3601 N St. Paul Ave
Sioux Falls, SD 57104

1   Safety Information

1.1   Read Before Installation and Operation
IMPORTANT

AVERTISSEMENT: Lire attentivement les instructions avant de metre en marche.

CAUTION: FOR SAFETY REASONS THIS EQUIPMENT MUST BE OPERATED AND SERVICED BY QUALIFIED PERSONNEL ONLY. READ AND UNDERSTAND INSTRUCTION MANUAL COMPLETELY BEFORE OPERATING OR SERVICING.

ATTENTION: POUR DES RAISONS DE SÉCURITÉ, CET ÉQUIPEMENT DOIT ÊTRE UTILISÉ, ENTRETENU ET RÉPARÉ UNIQUEMENT PAR UN PERSONNEL QUALIFIÉ. ÉTUDIER LE MANUE D'INSTRUCTIONS EN ENTIER AVANT D'UTILISER, D'ENTRETENIR OU DE RÉPARER L'ÉQUIPEMENT.

CAUTION: KEEP EXPLOSION PROOF COVER TIGHT WHILE CIRCUITS ARE ALIVE.

ATTENTION: GARDEZ LE COUVERCLE ANTI-EXPLOSION SERRÉ PENDANT QUE LES CIRCUITS SONT VIVANTS.

CAUTION: USE SUPPLY WIRES SUITABLE FOR 40°C ABOVE SURROUNDING AMBIENT.

ATTENTION: UTILISER DES FILS D'ALIMENTATION QUI CONVIENNENT A UNE TEMPERATURE DE 40°C AU-DESSUS DE LA TEMPERATURE AMBIANTE.

WARNING - EXPLOSION HAZARD
SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR CLASS I, DIVISION 2.

AVERTISSEMENT - RISQUE D'EXPLOSION
LA SUBSTITUTION DES COMPOSANTS PEUT PROVOQUER UNE ADAPTATION À LA CLASSE I, DIVISION 2.

WARNING- EXPLOSION HAZARD
DO NOT CONNECT OR DISCONNECT WHEN ENERGIZED UNLESS THE AREA IS KNOWN TO BE NON-HAZARDOUS.

AVERTISSEMENT - RISQUE D'EXPLOSION
NE PAS BRANCHER OU DÉBRANCHER LORSQU'IL EST SOUS TENSION, SAUF SI LA ZONE EST CONNUE POUR ÊTRE NON HASARDEUX.

CAUTION: A CONDUIT SEAL MUST BE INSTALLED WITHIN 18 INCHES OF THE ENCLOSURE.

ATTENTION: LE CONDUIT DOIT ÊTRE INSTALLÉ À MOINS DE 18 POUCES DU BOÎTIER.

1.2 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 5-0).
- Only the combustible monitor portions of this instrument have been assessed by CSA for 122.2 No. 152 performance requirements.
- 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.

2   Introduction

The TracXP TXP-C40 universal controller provides simultaneous alarm and display functions for one to four inputs. Easy to use and configure the TXP-C40 interface and programming are accomplished via non-intrusive magnetic interface or internal push buttons. Controller configuration is stored in nonvolatile memory. The system security menu locks all menus for ultimate security. Poly, stainless and NEMA 7 enclosures provide suitable materials and approvals for the most challenging applications. A direct sensor input option provides a very simple and economical gas detection solution. A wireless option provides both wired and wireless I/O capabilities. The easily configurable TXP-C40 can also be utilized to monitor non-gas detection parameters via 4-20 mA and Modbus® inputs in addition to standard gas detection requirements.

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 TXP-C40 front panel is shown below in Figure 2-1 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 2-2.
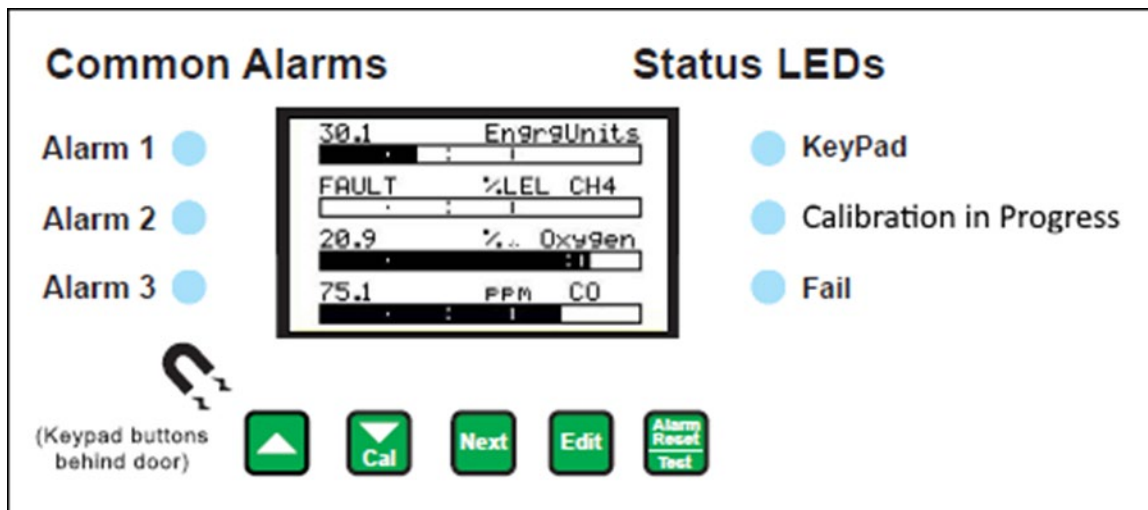
Figure 2-1 – Display Overview
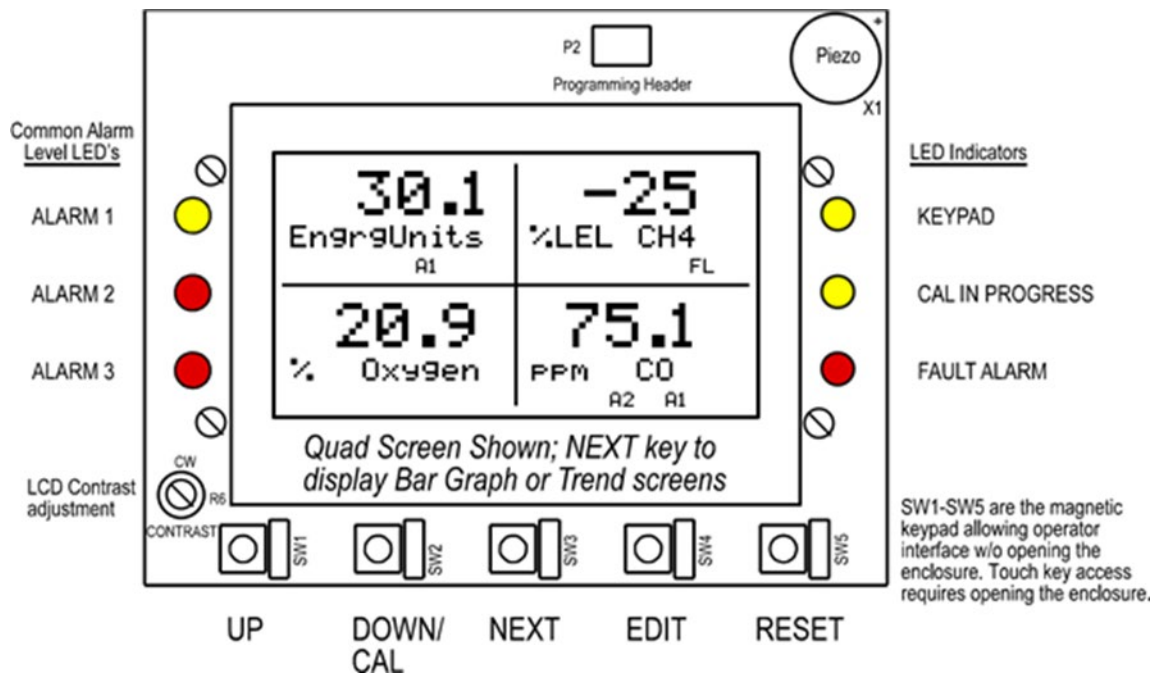
Figure 2-2 – Display PCBA Overview

2.1 Key Features

- Accepts inputs from up to four 4-20mA sensors transmitters
- 50 Watt, 24 VDC Power Supply standard (120 Watt optional)
- Provides 24 VDC external device power for transmitters and other devices
- Three adjustable independent alarm levels per channel
- Two programmable, 5-amp 30 VDC or 250 VAC resistive Form C
- Graphic LCD readout displays monitored data as bar graphs, engineering units, and 30-minute trends. Alarm LED's flash when new and become steady after acknowledged
- Modbus® master/slave RS-485 serial port interfaces to Modbus® devices
- Magnetic keypad allows non-intrusive operation
- Wireless Modbus interface option
- Cal mode allows zero/span calibration for direct sensor input applications
- Security functions to lock out unauthorized users
- All configuration data is stored in non-volatile memory
- NEMA 4X versions Certified for Class 1, Div. 2
- NEMA 7 explosion proof enclosure option
- Certified to CSA C22.2 NO. 152 for combustible detection and Class I, Division 2, Groups A, B, C, D

2.2 Optional Features

- Installed Audible and Visual alarm options (NEMA 4X enclosure only)
- Four (4) channel 4-20 mA input option board
- Four (4) channel 4-20 mA output option board
- Four (4) channel Bridge Input option board
- Alarm Relay option board – six (6) 5-amp, Form C relays

- 900 MHz Wireless radio option kit (NEMA 4X enclosures only)
- 2.4 GHz Wireless radio option kit (NEMA 4X enclosures only)

2.3 Ratings and Certifications

- CSA C22.2 No 1010.1 and ISA S82.02; CSA C22.2 No 152 for combustibles
- UL 1604 / C22.2 No 213 (Div. 2 Groups A, B, C, D)
- EN55011 & EN61000 (CE Mark)

2.4 Specifications

2.4.1 Power Supply Requirements

TXP-C40 primary power may be either 10-30 VDC or 100-240 VAC. All TXP-C40 Controllers ship with a 100-240 VAC 50/60 Hz @ .80-amp max (including inrush), 50-Watt power supply. 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 5-1 & 5-2 for wiring information.

The basic TXP-C40 consumes only 1.5 Watts of 10-30 VDC power. Optional features such as relays and analog outputs increase power consumption as described below:

- Analog Input PCB option: add maximum Wattage for each monitor connected to this board's 24 VDC terminals.
- Discrete Relay PCB option; add 1.5 Watt.
- 4-20mA Output PCB option; add 1 Watt.
- Bridge Sensor Input PCB option: add Wattage of each sensor attached.

With an AC primary power source connected to TB5 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 6-1). Power consumed from TB3 must be included when calculating system power consumption. IMPORTANT! TB3 only provides 24 VDC power when AC is primary power.

24 VDC terminals on the Analog input option (see Figure 6-4) 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 6-1.

Some applications may require 24 VDC power in excess of that available from the TXP-C40/QUAD's AC power supply on the motherboard and thereby require another 50 Watts

AC/DC supply. NEC Class 2 50-WATT external supplies are available for Division

1 and Division 2 potentially hazardous area installations and both also include a NEMA 4X weather rating.

"EXTENDED" series enclosures described in Section 4 of this manual may include the DIN rail mounted 50-Watt Power Supply module built into these larger enclosures.

2.4.2 Standard Output

Two mechanical (dry contact) Common Form C relays are standard and may be mapped to various alarm events as described in section 3.7.1. TXP-C40'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 3.2.4) 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.

2.4.3   Display
- 128 x 64-pixel graphic LCD with backlight, displays bar graphs, and engineering units.

2.4.4   Ambient temperature
- -25 to 60 degrees C

2.4.5   Humidity Range
- 0 TO 90% R. H. Non-Condensing.

2.4.6   Altitude
- Recommended up to 2000 meters

2.4.7   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.

3   General Operating Instructions

The TXP-C40's graphic LCD displays monitored data and with the 5-button keypad also serves as the system's operator interface. All TXP-C40 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 TXP-C40 parameters.

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

3.1   Data Display Screens

The TXP-C40 Controller offers three modes for displaying monitored data. Each are shown below in Figure 2-2.
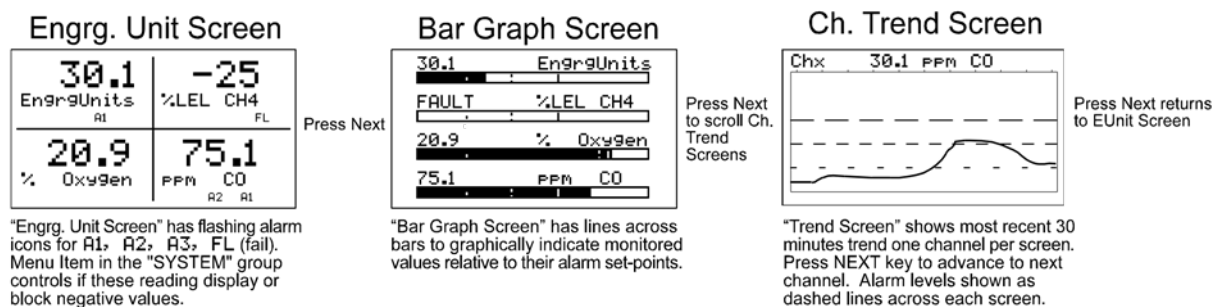
Figure 3-1 – Display Screens

3.1.1   Engineering Unit Screen

The TXP-C40 Engineering Unit screen shown at left in Figure 2-2 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.

3.1.2   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.

3.1.3   Trend Screen

The TXP-C40 also provides 30-minute trend screens for each channel as shown in Figure 3-1. 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.

3.2   Setup Menu Configuration

Variables inside the CHANNEL (see section 2.5) and SYSTEM (see section 2.6) menu trees allow TXP-C40 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.
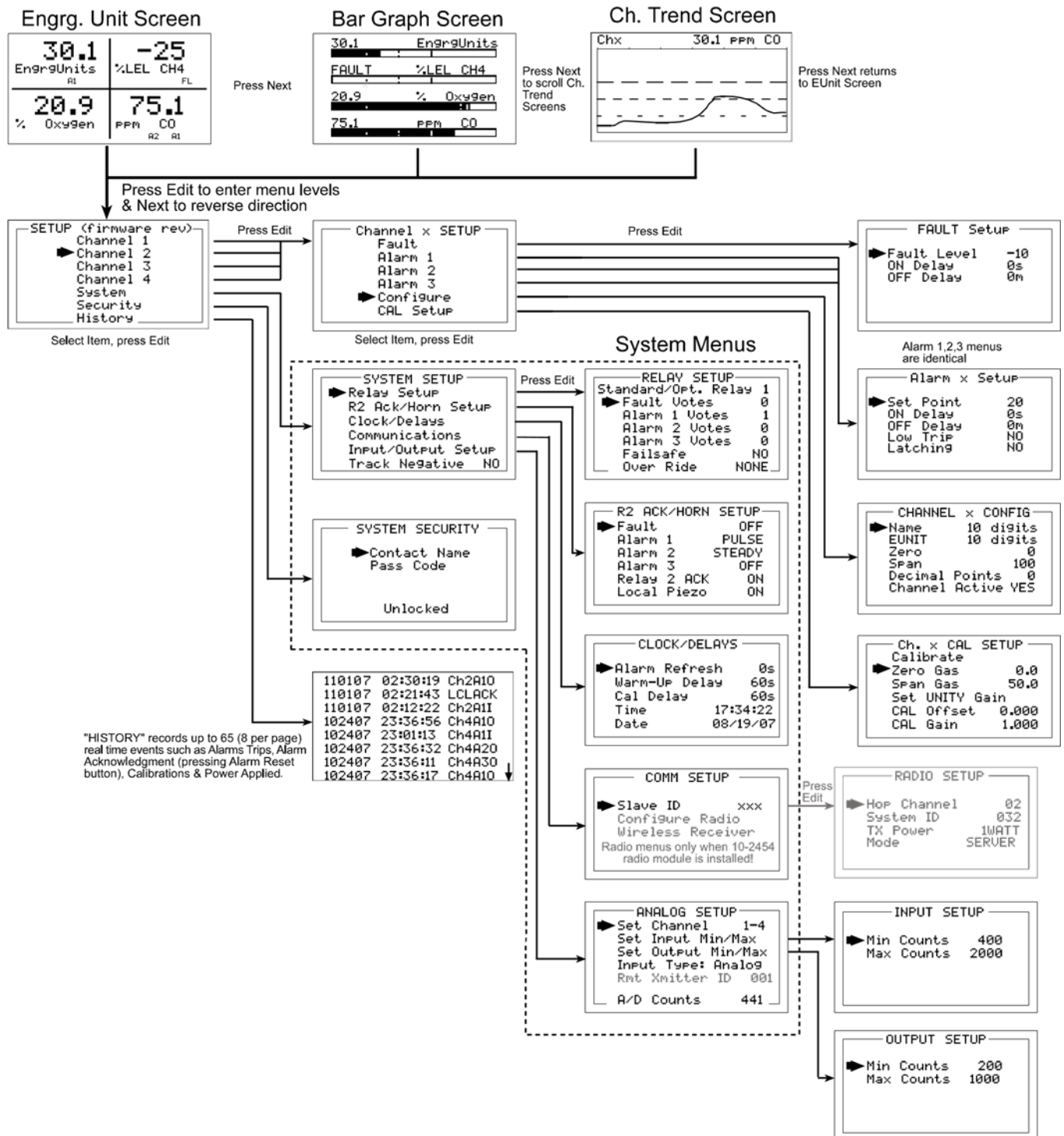
Figure 3-2 – QUAD Channel Menu Tree

3.3   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.

3.4   TXP-C40 Setup Configuration Menus

The SETUP menu shown in the middle of Figure 3-3 and in Figure 3-4 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 TXP-C40. Use the UP/DOWN keys to move the pointer to the desired menu and press the EDIT key.
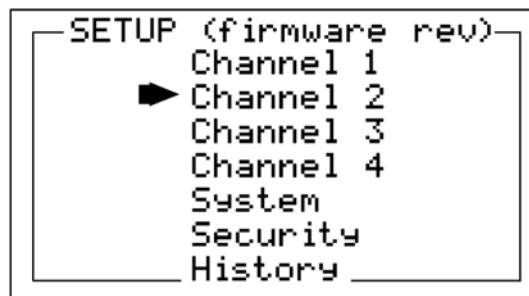
Figure 3-3 – Setup Configuration Menus

3.5   Channel Setup Entry Menu

The CHANNEL menu shown below in Figure 3-4 allows configuration of all variables for the selected channel. These are Fault, Alarm 1, Alarm 2, Alarm 3, Configure and CAL Setup.
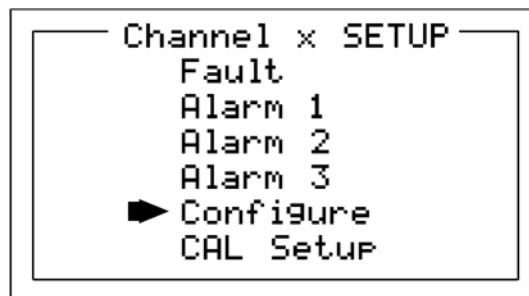
Figure 3-4 – Channel Setup Entry Menu

3.5.1   Fault / Alarm 1 / Alarm 2 / Alarm 3 Set Menu

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 3-5. 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.

```
         ┌─── FAULT Setup ───┐        ┌──Alarm × Setup──┐
         │                   │        │                 │
         │►Fault Level   -10 │        │►Set Point    20 │
         │ ON Delay      0s  │        │ ON Delay     0s │
         │ OFF Delay     0m  │        │ OFF Delay    0m │
         │                   │        │ Low Trip     NO │
         │                   │        │ Latching     NO │
         └───────────────────┘        └─────────────────┘
```

Alarm 1,2,3 menus are identical

Figure 3-5 – Alarm Set Menu

- **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 lo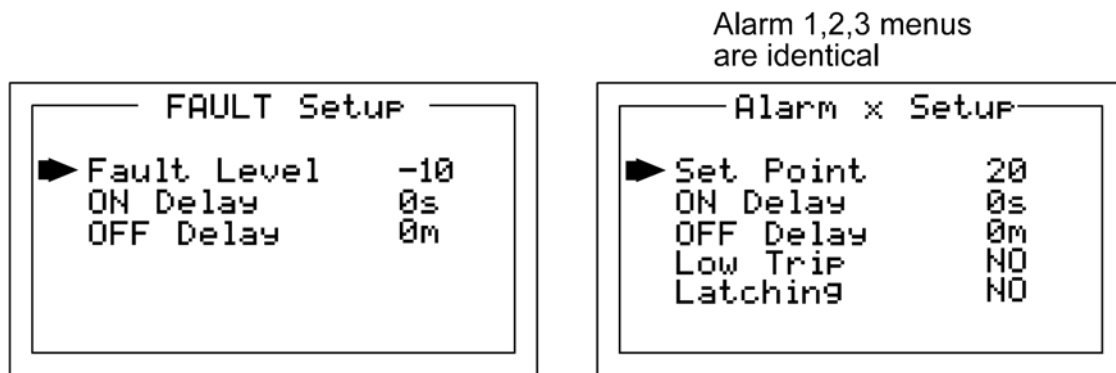ng as 120 minutes. Delays are useful in many applications to prevent nuisance alarms and unwanted cycling into and out of alarm conditions.
- **Low Trip** is set for NO for increasing alarms or YES for decreasing alarms to determine if the alarm activates upon exceeding or falling below the set-point.
- **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)

3.5.2   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.
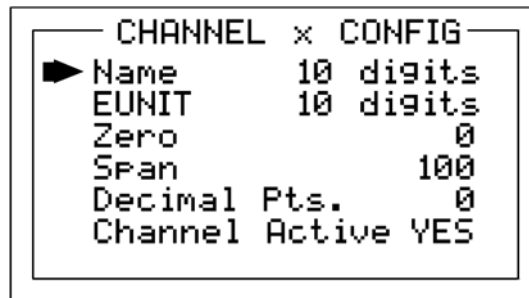
```
┌─── CHANNEL x CONFIG───┐
│ ► Name        10 digits│
│   EUNIT       10 digits│
│   Zero              0 │
│   Span            100 │
│   Decimal Pts.      0 │
│   Channel Active YES  │
└───────────────────────┘
```

Figure 3-6 – Configure Menu to Define Channel

3.5.3   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 2.5 describes how to modify these fields using the keypad.

3.5.4   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 2.6.5.

3.5.5   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.

3.5.6   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.

3.5.7   CAL Setup Menu

The TXP-C40 CAL MODE feature supports pushbutton calibration of zero and span values. This feature should be utilized only when there are no other zero/span controls within the monitoring system since it is inappropriate to calibrate a signal at more than one point. Therefore, if calibration will be performed at another transmitter or monitoring device, the TXP-C40 CAL MODE feature should not be used.

The CAL SETUP menu allows entering the correct Zero & Span Gas set-point values needed to calibrate the channel. These are entered in the same engineering units as input range.
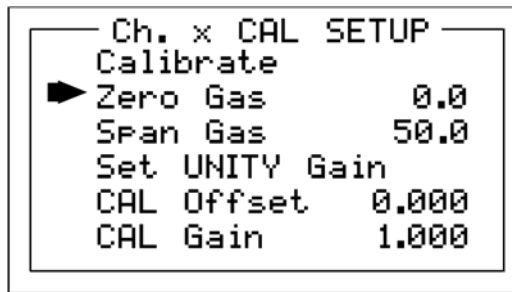
```
┌──── Ch. x CAL SETUP ────┐
│ Calibrate               │
│► Zero Gas          0.0  │
│ Span Gas          50.0  │
│ Set UNITY Gain          │
│ CAL Offset       0.000  │
│ CAL Gain         1.000  │
└─────────────────────────┘
```

Figure 3-7 – CAL Setup Menu

3.5.8   Calibrate Input Menu

The CAL MODE (flow chart shown in Figure 3-6) is designed to make calibration quick, easy and error free. A successful ZERO and SPAN calibration requires only a few keystrokes. Optional 4-20mA outputs (if equipped) transmit 1.5 mA during CAL MODE and 4 mA during the subsequent CAL DELAY to prevent external alarms during calibration. Local TXP-C40 alarm relays are inhibited during CAL MODE. Unintentional calibrations may be reset by the Set UNITY menu item. Set UNITY resets Cal OFFSET to 0 & Cal GAIN to 1 which is useful for returning the calibration to a known starting place. Sensor aging may be monitored by recording zero and span readings at Unity Gain when the sensor is new, and again later when degradation may have occurred. CAL MODE automatically exits if no keystroke is detected after 5 minutes.

Use the following step-by-step procedure to perform ZERO and SPAN calibrations.

1. To enter the CAL MODE from any data display, press the dual-purpose DOWN / CAL key then use the UP/DOWN keys to select the channel to calibrate.
2. Stimulate the monitor to be calibrated with an appropriate ZERO calibration standard. Observe the screen's live reading and when it is stable press the EDIT key to perform the ZERO calibration.
3. If the ZERO calibration is successful, CAL MODE automatically proceeds to the SPAN check.
4. Apply the correct SPAN calibration standard. After the reading is stable, press the EDIT key to perform a SPAN calibration.
    WARNING: The SPAN calibration standard used must match the value specified since this is the reading the TXP-C40 will indicate after a successful SPAN calibration. The SPAN calibration value may be edited if it becomes necessary to apply a different calibration standard to set SPAN (see Span Calibration in section 2.5.8).
5. If the SPAN calibration is successful, the display flashes "REMOVE CAL GAS" and starts the CAL DELAY.
6. CAL MODE will be complete after the end of the CAL DELAY.

The flow chart in Figure 3-6 illustrates the above procedure. UP, CAL, NEXT & EDIT labels indicate keystrokes (CAL/DOWN is a dual-purpose key). The CAL MODE information screen (top of the chart) is available for advanced users to see Offset / Gain calibration constants and live analog to digital converter (A/D) counts. Span set point calibration values may also be edited from this screen.   Holding the UP key, for 5 seconds during CAL MODE, displays this screen.

Unity Gain may be used at any time to cancel incorrect calibrations and start again. Unity means Offset = 0.00 and Gain = 1.00.
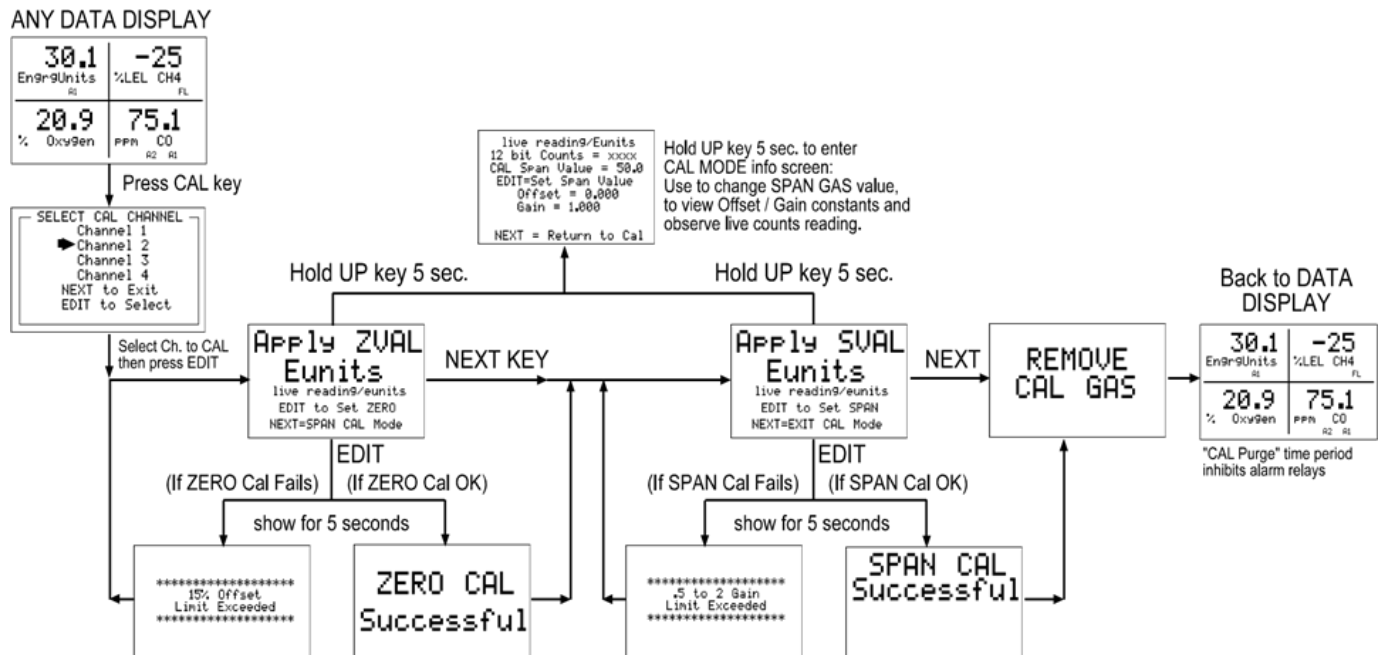
Figure 3-8 – Calibration Input Menu Tree

3.6 System Configuration Menu

Several items needing configuration are not specific to either channel but affect the entire TXP-C40 system. These are located in the SYSTEM menus group shown in the dotted line box in Figure 2-1. System menus are accessed through the System SETUP menu shown in Figure 3-7 by pointing to the desired item and pressing EDIT.
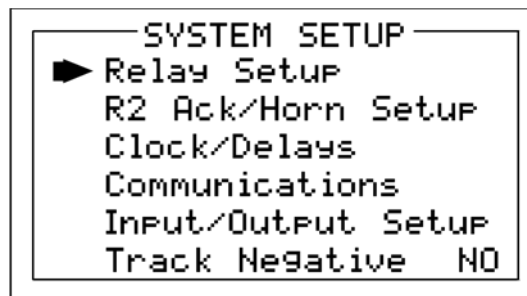
Figure 3-9 – System Configuration Menu

3.6.1 Standard / Optional Relay Setup Menus

The menu shown in Figure 3-8 allows configuring of both the standard Relay 1 & Relay 2 motherboard relays and the six optional relays on the 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).

```
┌─────RELAY SETUP─────┐
│   Standard Relay   1 │
│ ▶ Fault Votes      0 │
│   Alarm 1 Votes    2 │
│   Alarm 2 Votes    1 │
│   Alarm 3 Votes    0 │
│   Failsafe        NO │
│   Over Ride     Ch1A2│
└──────────────────────┘
```

Figure 3-10 – Relay Setup Menu

- Fault, Alarm 1, Alarm 2, Alarm 3 menus in Figure 3-8 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 3-8 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 Override 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.
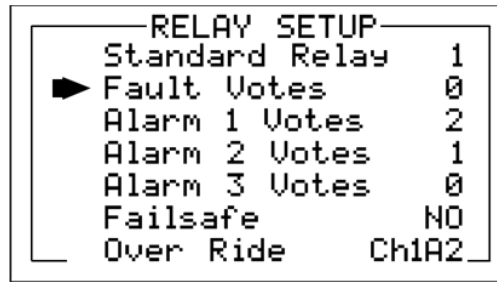- Failsafe set for YES causes this relay to be energized when its voting requirements are false (no alarm condition) and de-energized when the alarm vote requirements are true. The primary benefit of Failsafe is loss of power places the relay contacts into the alarm condition.
- Override menu allows 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. Any one of these 16 alarms may be used as the Override. This feature is useful when one channel's alarm has more significance than the others.
- "Sympathy" alarms are also configured in the Override menu. When TXP-C40/QUAD controllers are sending their Modbus data to an TXP-C64 controller, it is possible to configure the TXP-C64 to return a trip command to the relay of all TXP-C40s configured with a sympathy alarm that are on the same Modbus network. This feature is especially useful when several TXP-C40/QAUD controllers are combined to monitor a perimeter. It makes it possible for an alarm detected at one controller to trip an alarm at the others. An example is instead of only a strobe light at the unit with the alarm flashing its' strobe, the Sympathy feature allows all units to flash their strobe in "sympathy" to the unit with the actual alarm condition.

SympFlt, SympA1, SympA2, or SympA3 are the sympathy alarm options available. A Sympathy mode in our TXP-C64 controller broadcasts the Sympathy override when it detects an alarm condition from another network controller. When a sympathy alarm is entered into this field, and the correct Sympathy setup is configured into the TXP-C64 controller, the TXP-C40/QUAD relay will energize when the corresponding alarm level is reached at another TXP-C40/QUAD controller that is part of the network. The alarm level is assigned to the relay by entering one of the four possible sympathy overrides - SympFlt, SympA1, SympA2, or SympA3. When the relay has Sympathy override assigned, the TXP-C40/QUAD accepts a broadcasted alarm flag from the TXP-C64. The active Sympathy alarm condition causes the screen to flash Sympathy and energize the relay. With these settings, if four TXP-C40s are setup in a perimeter monitoring application and a Sympathy override is assigned to a relay at each powering a local strobe light, then all the strobes will be activated when any one of the sensor points at any TXP-C40 goes into alarm

3.6.2   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.

  IMPORTANT:
  If a Sympathy override is configured (see section 3.6.1) for relay 2, the local alarm reset does not acknowledge the relay. The relay may only be acknowledged from the network's TXP-C64 Modbus master controller.

  Note: For firmware revisions 3.02 and above, if relay 2 is used as a discrete alarm condition such as all votes = 0 and an override condition is set, the acknowledge feature is disabled.

- If Standard Relay 2 is used in the Acknowledge mode AND with votes and an Override configured, the override condition will dominate the Acknowledge. In this mode, Standard Relay 2 should not be used to drive an audible device.
- Local Piezo set to ON causes the tiny local piezo adjacent to the LCD to mimic the J2 horn output.

```
┌── R2 ACK/HORN SETUP──┐
│► Fault           OFF │
│  Alarm 1       PULSE │
│  Alarm 2      STEADY │
│  Alarm 3         OFF │
│  Relay 2 ACK      ON │
│  Local Piezo      ON │
└──────────────────────┘
```
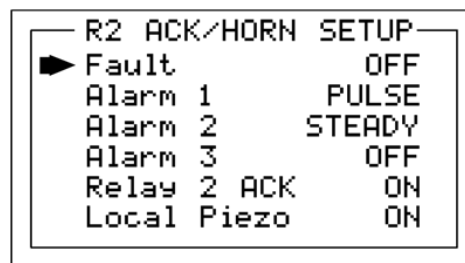
Figure 3-11 – Relay 2 Acknowledge/Horn Setup Menu

3.6.3   Clock / Delays Menu

These TXP-C40 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 TXP-C40 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.

```
┌──────── CLOCK/DELAYS ────────┐
│                              │
│ ➤ Alarm Refresh        0s    │
│   Warm-Up Delay        60s   │
│   Cal Delay            60s   │
│   Time           17:34:22    │
│   Date           08/19/07    │
│                              │
└──────────────────────────────┘
```
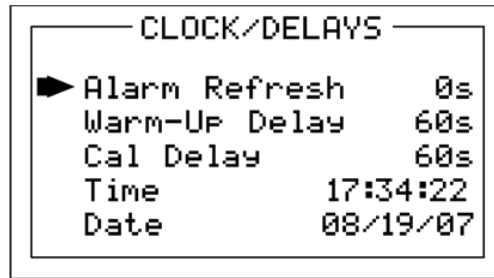
Figure 3-12 – Clock/Delays Menu

3.6.4   Modbus Communications Menu

The COMM SETUP menu allows setting of the system's Modbus port. It may function as a wired Modbus Master / Slave serial option in Section 5.1) or wireless Modbus Master / Slave (requires 900MHZ or 2.4GHZ radio kit option in section 5). A very common application is to connect two TXP-C40/QUAD controller's serial ports together with one set as master and one as slave. This allows the master to mimic readings from the slave.

Wireless Receiver mode configures the port to receive serial data from our wireless ST48RF battery powered sensor transmitters (requires 900MHZ or 2.4GHZ radio kit option in section 5)

- Modbus Master mode allows the communication port to poll any Modbus slave device using the Modbus RTU protocol. This setting is also utilized for Wireless Modbus Master.
- Modbus Slave mode allows the communication port to be polled by any Modbus master device using the Modbus RTU protocol. This setting is also utilized for Wireless Modbus Slave. This slave port may be used to transfer TXP-C40 data to a
  Modbus master device such as a PC, PLC, DCS or even other TracXP by Macurco Controllers such as the 16 Channel TXP-C16. The slave port is addressable, allowing many TXP-C40 controllers to be connected to a single RS-485 cable. A converter is available to make this port also compatible with Ethernet TCP/IP networks.
- Wireless Receiver mode is exclusively for wireless communication to our TXP-WTA wireless sensor transmitters see Section 5 (please visit TXP-WTA).

The entire Modbus database, including registers and supported Function Codes, is documented in section 3.3.1. See section 5 for COMM SETUP menu descriptions for WIRELESS TXP-C40/QUAD networks.

Figure 3-13 – Modbus Communications Menu
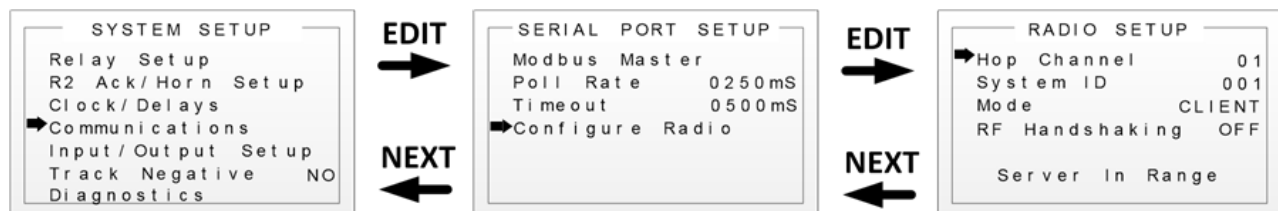
3.6.5   Analog Setup Menu

The system ANALOG SETUP menus in Figure 3-12 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 2.5.4. The default settings for each analog channel are 400 to 2000 counts. Standard inputs yield 400 counts at 4 mA and 2000 counts at 20 mA but, for example, if a special application requires the Zero reading at 6 mA input and the Span reading at 18 mA 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 2.5.4. OUTPUT SETUP menus are only used when the TXP-C40/QUAD is equipped with the 4-20mA output option (Section 3.2). Ideally, 200 to 1000 yields a 4-20mA output but very slight modifications may be needed to provide precise 4 mA and 20 mA values for each channel.
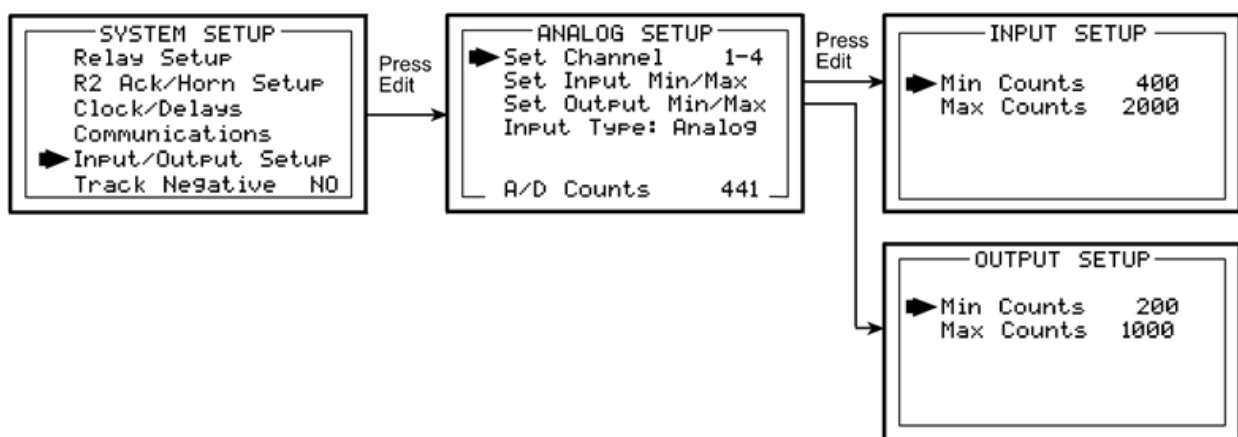
Figure 3-14 – Analog Setup Menu

3.7   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 3-15 – System Security Menu

4   Wiring

4.1   Motherboard Interface PCB

The TXP-C40 Motherboard shown below in Figure 4-1 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 3.2.1 and 3.2.2 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 4-20mA Output option and the right position P3 connector is for the Discrete Relay option. Other option devices such as Modbus RTU RS-485, Ethernet and a data 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 350 mA 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 4-0. See section 1.4.1 for additional power source information.
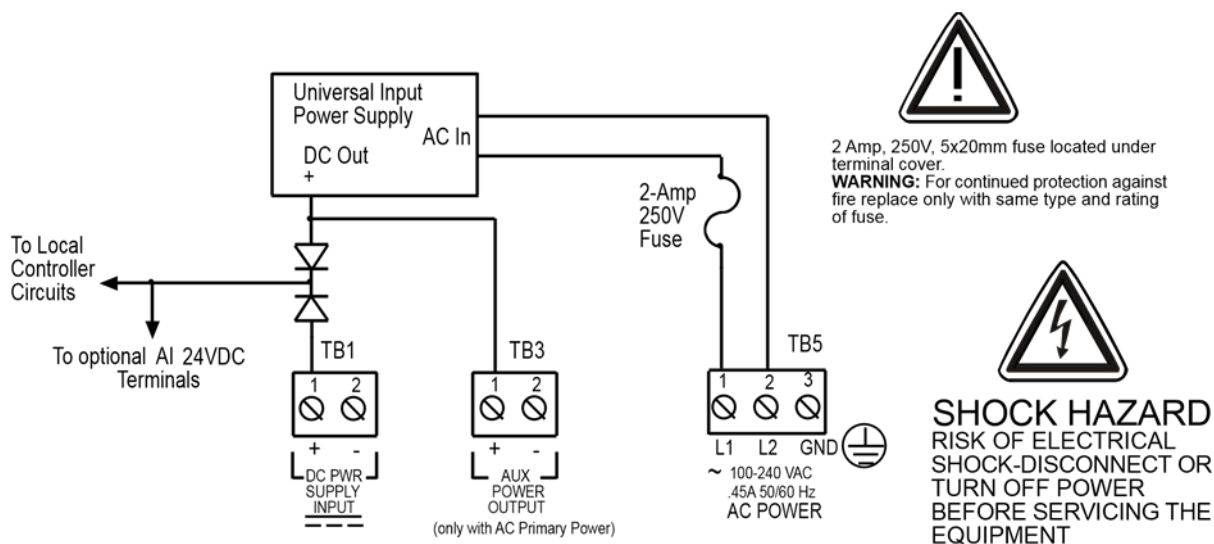
Figure 4-1 – Motherboard Input/output Power Connections

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 audible annunciator.
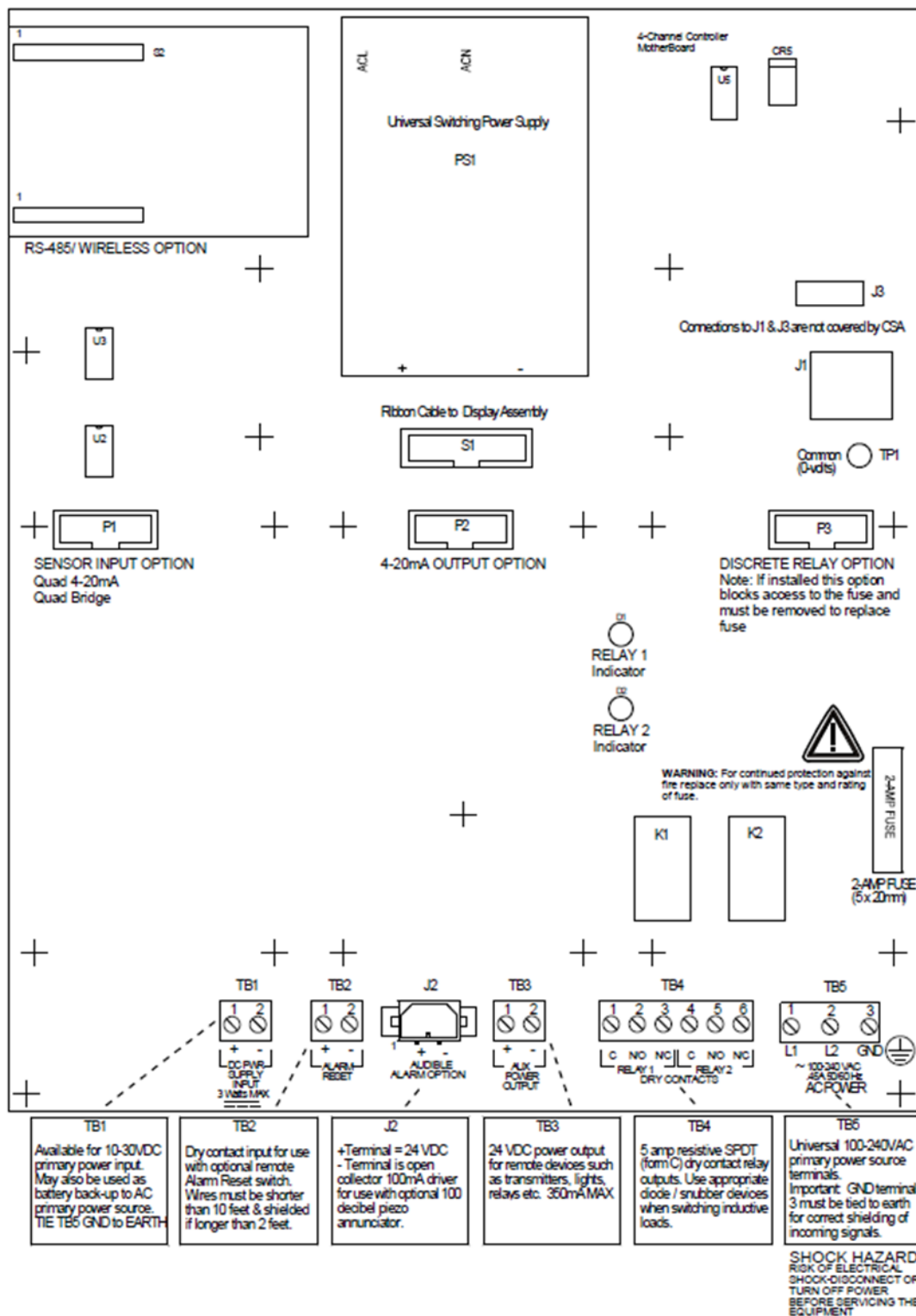
Figure 4-2 – Motherboard Connections Overview

4.2 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 either the

Analog Input option or the Bridge Sensor Input option. Both have default Input Min / Max menu settings of 400 – 2000 counts.

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

### 4.2.1 Optional Analog Input PCB

⚠️ **In compliance with CSA C22.2 No. 152 certification, the 4-20mA input does not include or imply approval of the LEL gas detection apparatus such as sensors, transmitters, or devices connected to the system. In order to maintain CSA Certification of the system, all 4-20mA gas detection instruments connected to the input must also be CSA Certified.**

Important! Analog Input PCB's may only be installed into motherboard position P1.

Analog input PCB option shown in Figure 4-3 allows interfacing TXP-C40'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 Analog Input Bd. utilizes a 12-bit A/D converter such that 4 mA provides 400 counts and 20 mA 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 2.6.5. TB1 & TB2 provide each channel's terminals for receiving analog inputs. TB1 & 2 also provides 4 terminals connected to the TXP-C40 internal 24 VDC power supply for powering external transmitters. Figure 4-3 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.
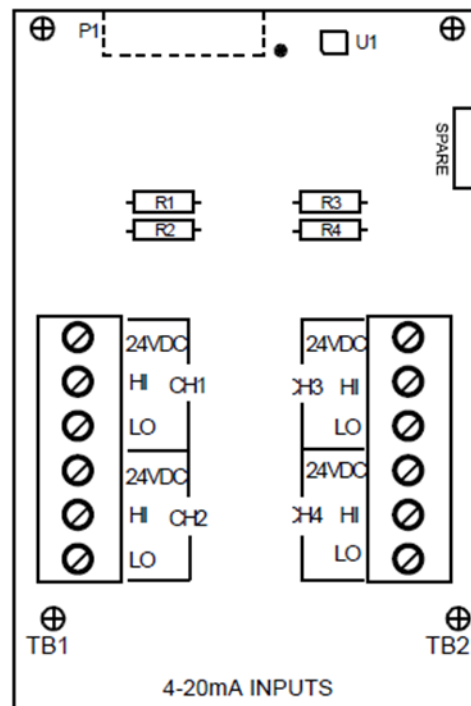LO = 24 VDC Power Supply Common
24 VDC = 24 VDC Power Supply + output

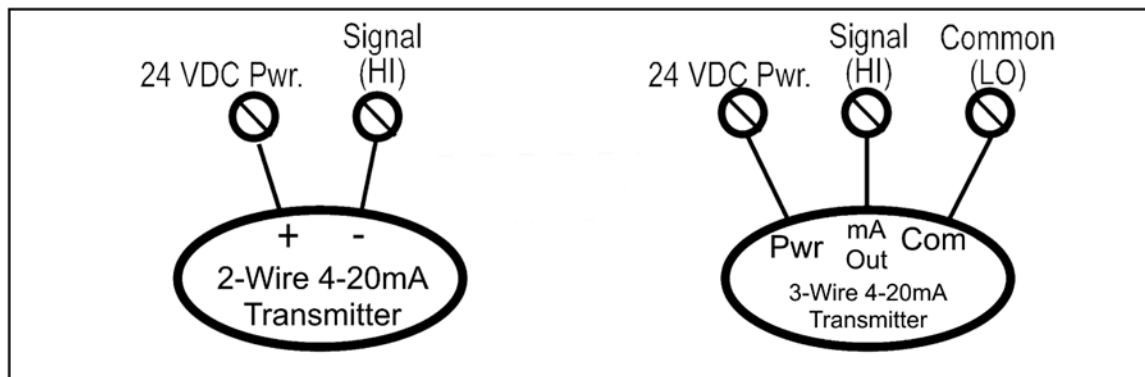Figure 4-3 – Optional Analog Input PCB

Figure 4-4 – 4-20mA Wiring

4.2.2 Optional Bridge Sensor Input Board

Important! PCB's may only be installed into motherboard position P1.

The Quad Channel Bridge Sensor Input option shown in Figure 4-4 allows these popular sensors to be connected directly to the TXP-C40 without additional signal conditioning or transmitters. Each channel is equipped with a bridge amplifier, balance potentiometer, and an adjustable switching regulator for setting the correct sensor excitation voltage. A 3-position coarse gain jumper allows setting the gain of the bridge amplifier. Fault supervision circuitry forces the TXP-C40 into a FAULT condition upon sensor failure or removal.

This option may also be configured to accept 4-20mA inputs into channels 3 & 4 to allow mixing sensors and current loops into the same board. Placing either channel's 2 position LEL/4-20mA jumper (JP5 or JP6) into the 4-20mA position, and installing the associated precision 100 ohm socketed resistor, allows 4-20mA signals to be applied to the mA+ / mA- terminals (see Optional 4-20mA notes in Figure 4-4). Precision 100 ohm resistors are taped to the inside of the TXP-C40 enclosure.

Bridge sensors require the Initial Setup calibration procedure described in section 4.2.3. After performing the one time only Initial Setup all subsequent calibrations are by the TXP-C40's electronic Cal Mode menus (see section 2.5.8). Sensors mounted locally to the TXP-C40 normally do not require Initial Setup since it is performed at the factory.

4.2.3 Bridge Sensor Initial Setup

Bridge sensors vary widely in power requirements and sensitivity. It is therefore important to configure each channel to match the sensor with which it will operate. Sensors attached to the TXP-C40 enclosure at the factory have already had Initial Setup.

1. Prior to connecting remote sensors, apply power to the system. Measure the voltage between each channel's A and R terminals and set the Voltage Adjust potentiometers for the correct sensor excitation voltage (remove TXP-C40 terminal cover). This may range from 1.5 volts to 7.5 volts depending upon sensor specifications. **Sensors may be damaged by accidental over voltage conditions. It is recommended the Voltage Adjust potentiometer screws be covered by a dollop of RTV or similar material after completion of this procedure.**
2. Remove system power and connect sensor wires to the A-C-R terminals. Reapply system power and confirm correct voltage across each sensor's A & R terminals. Note if sensor wires are long, it will be necessary to measure the excitation voltage at the sensor end to compensate for I * R voltage losses in the wiring.
3. With zero cal stimulus on that sensor, adjust its Balance potentiometer for a ZERO reading on the LCD.

4. Apply 50% span stimulus to the sensor and allow the reading to stabilize. Place the 3 position Coarse Gain jumper into the position which reads between approximately 45 and 65% with 50% on the sensor. Gain settings for each jumper position are as follows: no jumpers = 1, LO = 7, MED = 12, HI = 24. Multiple jumpers have an additive affect upon gain, so for example the LO and MED jumpers together provide a gain of 19.

Initial setup is now complete and normally only requires repeating if a sensor is replaced.

Final calibration of this channel may now be performed using the TXP-C40's electronic Cal Mode feature described in section 2.5.8.
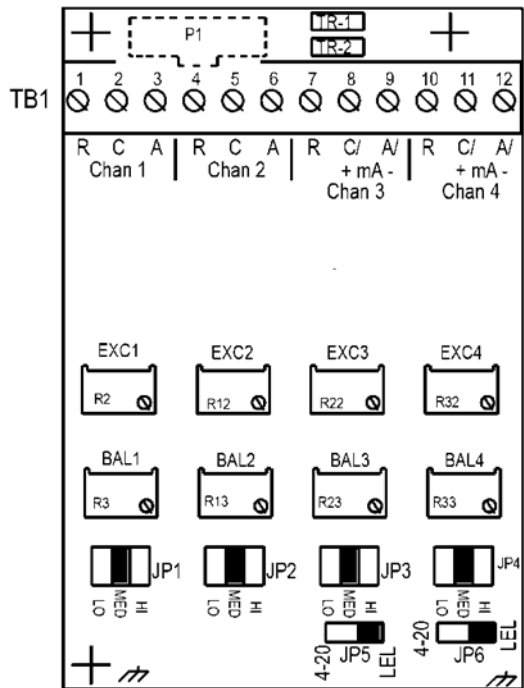
*TR1 = Ch3 100 ohm 4-20mA terminator
*TR2 = Ch4 100 ohm 4-20mA terminator
*Install TR1 or TR2 only for 4-20mA Inputs
MoveJP5 or JP6 to 4-20 left side

Ch3 mA Input + = TB1-8, -= TB1-9
Ch4 mA Input + = TB1-11, -= TB1-12
Shields may be tied to PCB mounting screw

Set EXC (Sensor Excitation) pots R2, R12, R22, R32 for correct Sensor volts between R & A terminals for channels 1, 2, 3 & 4

Set BAL (Sensor Balance) pots R3, R13, R23, R33 for correct XERO readings for channels 1, 2, 3 & 4

Set Coarse Gain jumpers JP1, JP2, JP3 JP4 for correct sensor millivolts for channels 1, 2, 3 & 4

Figure 4-5 – Optional 4-20mA Input Notes for Ch's 3 & 4

4.2.4   Optional Discrete Relay PCB's

Important! PCB's may only be installed into motherboard position P3.

The optional Discrete Relay PCB, shown in Figure 4-6, adds six 5-amp form C relays. Each relay is fully programmable as described in section 2.6.1. Many TXP-C40 applications utilize the standard equipped Relay 1 / Relay 2 (see section 2.6.1) 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 Discrete Relay PCB option must be the same for each relay. Example: 24 VDC should not be the power switched by one relay and 115 VAC by others.
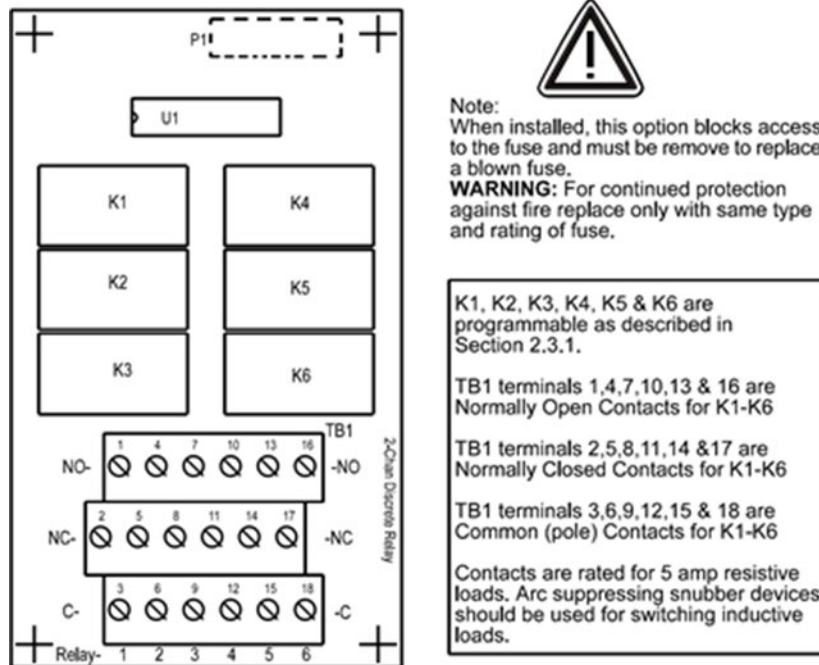
Figure 4-6 – Optional Discrete Relay PCB

4.2.5   Optional 4-20mA Analog Output PCB

Important! 4-20mA Analog Output PCB's may only be installed into motherboard position P2.

An optional 10-bit 4-20mA analog output board, shown in Figure 4-6, may be added. Each channel's output will transmit 4 mA for 0% readings and 20 mA for 100% readings. If the TXP-C40 primary power is 100 – 240 VAC or at least 24 VDC, 4-20mA outputs are capable of driving 20 mA through a 750-ohm load. Outputs are self-powered and DC power should not be provided by the receiving device. Precision calibration of the 420-mA output DAC (digital to analog converter) is accomplished via the Analog Setup menu as described in section 2.6.5.

4-20mA Outputs are sourcing and 24 VDC power must not be supplied by the receiver device.

Loop drive capability is 750 ohms with nominal 85-240 VAC power or 24 VDC power as the Controller primary power supply.

P1

TB1   TB2

1 2 3 4   1 2 3 4

+ - + -   + - + -
CH1   CH2   CH3   CH4
4-20mA OUTPUTS
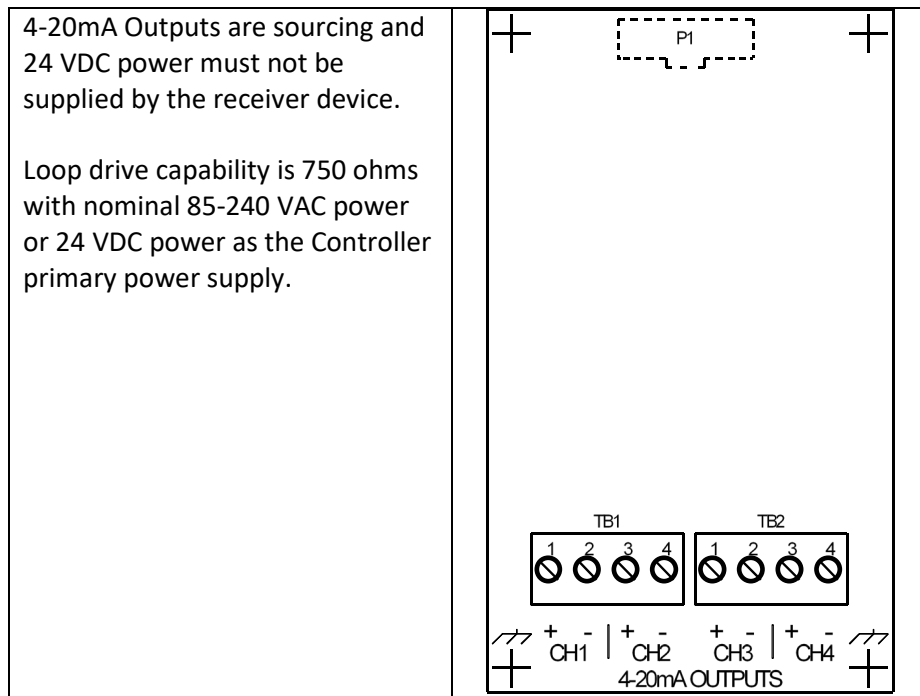
Figure 4-7 – Optional 4-20mA Analog Output PCB

4.3   Modbus RS-232 / RS-485 Interface Option

⚠️ **In compliance with CSA C22.2 No. 152 certification, the Wireless / MODBUS interface to a LEL gas detector may only be used for data collection or record keeping with regard to combustible gas detection and not for performance verification.**

The Modbus option PCB add both RS-232 and RS-485 Modbus RTU slave ports. Figure 4-7 shows this optional PCB which mounts to connectors on the upper left corner of the TXP-C40 motherboard. TB1 provides two pairs of T/Rx terminals and a floating terminal for shield continuation. This makes it easy to multi-drop TXP-C40'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 3.3.1 lists all Modbus registers and their function codes.

Follow correct IEEE RS-232 and RS-485 installation guidelines when using the Serial Interface Option board.
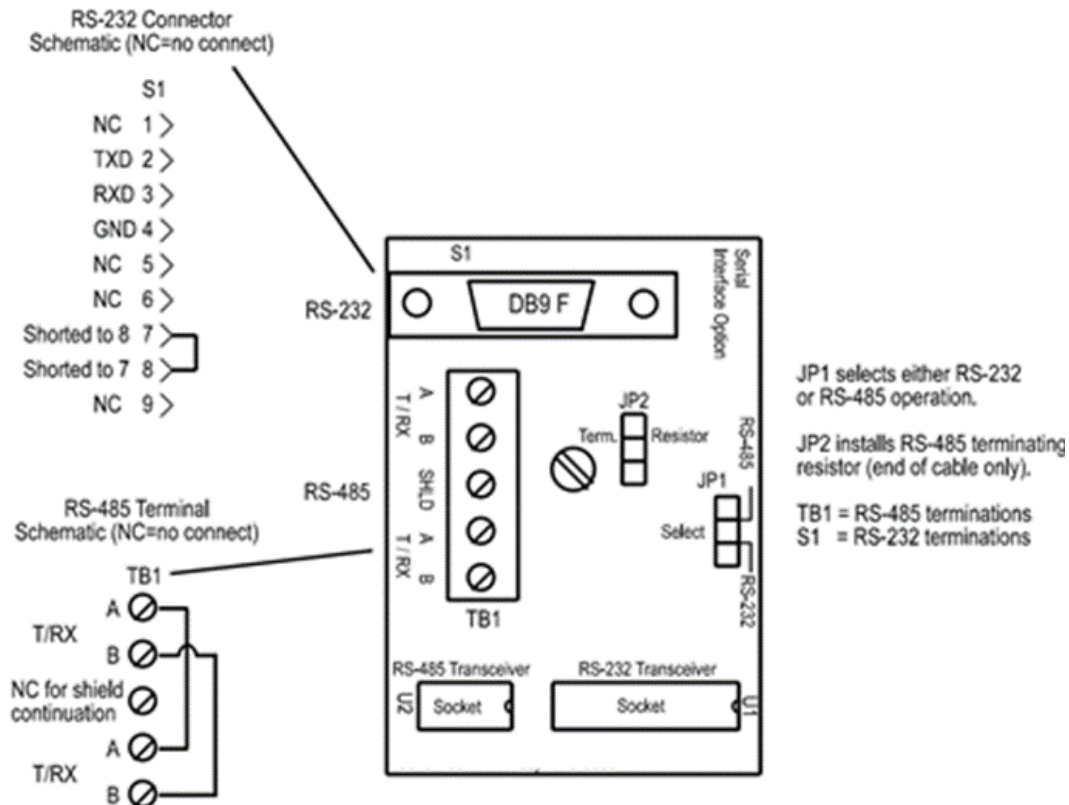
Figure 4-8 – Modbus RS-232/RS-485 Interface Option PCB

4.3.1 Modbus Register and Function Code Summary
The following table identifies the available Modbus RTU register locations and function codes.

Read/Write Coils:

VARIABLE	ALIAS	READ FUNCTION CODE	WRITE FUNCTION CODE
Alarm Ack/Reset	2001	1	5

Note: After writing a TRUE to this register, the TXP-C40 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:

VARIABLE	ALIAS	READ FUNCTION CODE	WRITE FUNCTION CODE
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

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

VARIABLE	ALIAS	READ FUNCTION CODE	WRITE FUNCTION CODE
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.

VARIABLE	ALIAS	READ FUNCTION CODE	WRITE FUNCTION CODE
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

VARIABLE	ALIAS	READ FUNCTION CODE	WRITE FUNCTION CODE
Memory Reals: Cont.			
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.

Sympathy:

 Notes: 40004 registers are utilized by our TXP-C64 controller when a Modbus network is configured for sympathy (see section 2.6.1). This feature must be configured in both the TXP-C64 Modbus master controller and the TXP-C40 Modbus slave controllers to function.

Sympathy Status	40004	NA	6

0=FALSE, 1=TRUE

FAULT	BIT0
ALARM 1	BIT1
ALARM 2	BIT2
ALARM 3	BIT3
Acknowledge	BIT15

4.4   Optional Power Supplies

Many applications require 24 VDC power in excess of the 10 Watts supplied by the PS1 power supply located on the motherboard (see Figure 4-1). "Extended" enclosure models (see Section 5) come equipped with an integral NEC Class 2, 50 Watt power supply, or an optional 120 Watt power supply, for Division 1 and Division 2 potentially hazardous area installations and both also include a NEMA 4X weather rating.

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

5   Enclosure Options

5.1   TXP-C40PY NEMA 4X Polycarbonate Wall Mount (Standard)

The TXP-C40PY/QUAD wall mount NEMA 4X enclosure is shown in Figure 5-0. Nonmetallic 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 5-1).

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.
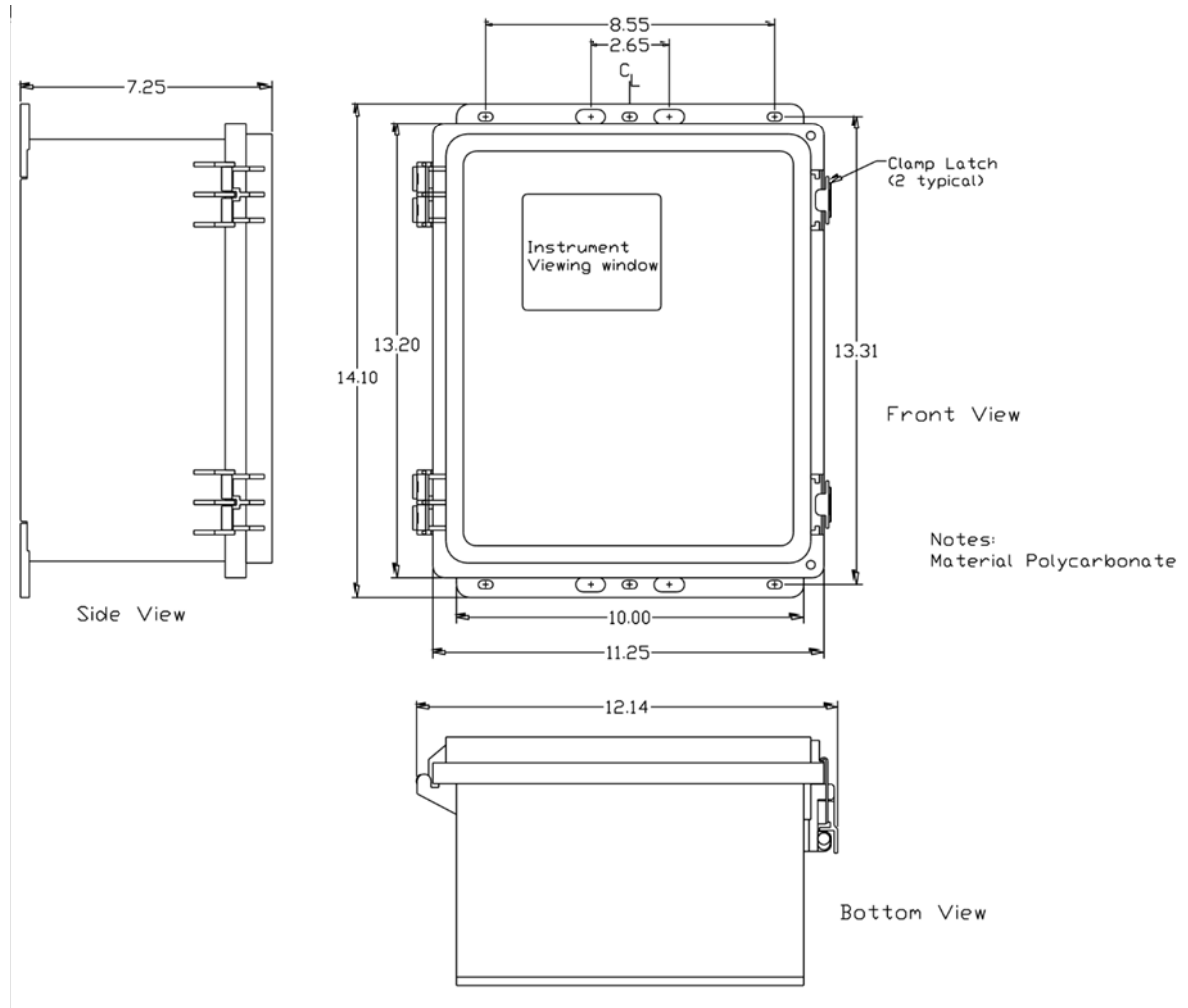
Figure 5-9 – NEMA 4X Polycarbonate Wall Mount Enclosure

5.2   TXP-C40SS NEMA 4X Stainless Steel Wall Mount (Extended)

The TXP-C40SS/QUAD shown in Figure 5-2 is a 316 Stainless Steel NEMA 4X wall mount enclosure designed for corrosive installations.
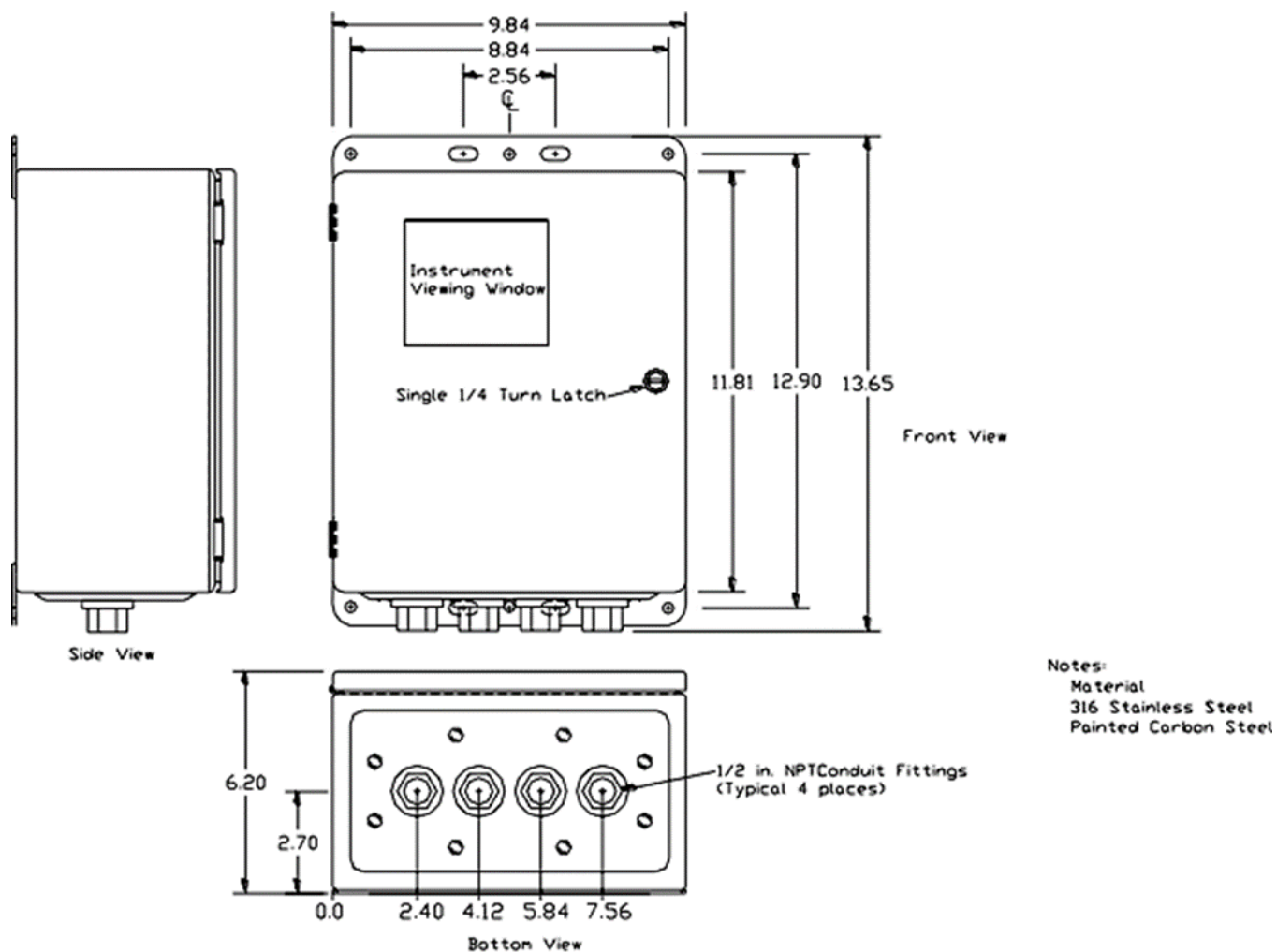
Figure 5-10 – NEMA 4X Stainless Steel Wall Mount Enclosure

5.3 TXP-C40XP NEMA 7 Explosion-Proof Wall Mount (Compact)

TXP-C40XP/QUAD shown in Figure 5-3 is an aluminum NEMA 7 wall mount enclosure designed for mounting into potentially hazardous areas.
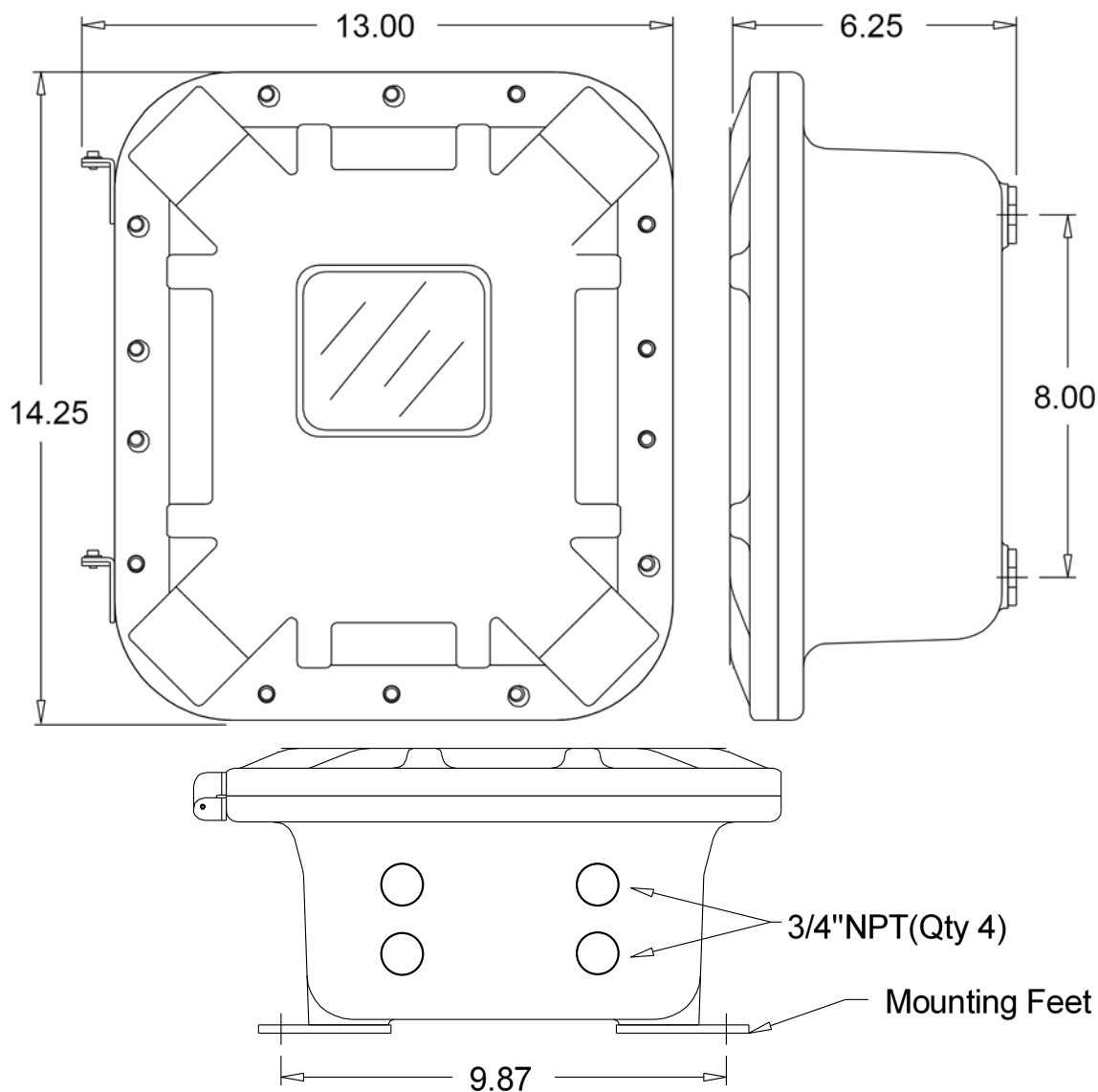

Figure 5-11 – NEMA 7 Explosion-Proof Wall Mount Enclosure

6   Wireless Option

6.1   Adding the Wireless Radio Kit Option

TXP-C40 serial port may be connected to a FHSS (Frequency Hopping Spread Spectrum) wireless radio modem shown in Figure 6-1. There are two different frequency options offered, 900 MHz and 2.4 GHz. The radio kit options allow wireless Modbus master / slave (see section 5.4) and "Wireless Receiver" (see section 5.3) modes of operation. "Wireless Modbus" interfaces allow TXP-C40's to either send (slave) or retrieve (master) from other Modbus capable devices.

Each transceiver on a wireless network must have their RADIO SETUP menus configured to share the same hopping channel (0-32) and System ID (0-255) to communicate. All TracXP by Macurco wireless transceivers utilize a Server-Client network where Clients synchronize their hopping to the Server. The Server transmits a beacon at the beginning of every hop (50 times per second). Client transceivers listen for this beacon and upon hearing it will indicate InRange with the LED on the radio modem board and synchronize their hopping with the Server. Each network should consist of only one Server. There should never be two servers on the same RF Channel number in the same coverage area as the interference between the two servers will severely hinder RF communications. The Server must be in a powered location (as opposed to a battery powered TXP-WTA utilizing a "sleep" mode) and Servers typically should be centrally located since all Clients must receive the beacon in order to communicate.
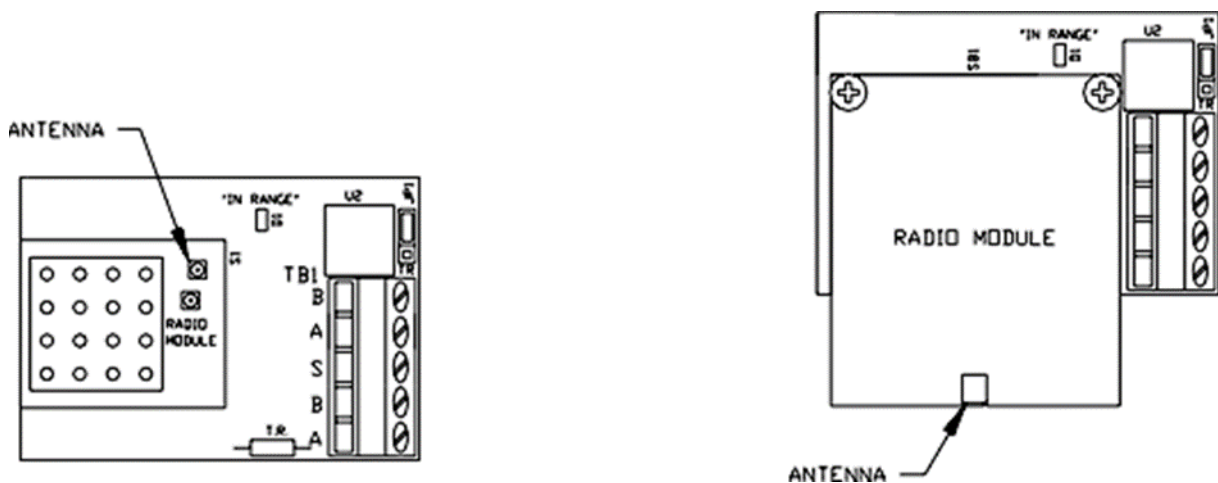

Figure 6-1 – Wireless Kit

6.2   Radio Setup Menu

Radio modules must be connected to the TXP-C40's radio option board for RADIO SETUP. Pressing the EDIT key with the arrow pointing to the Communications menu brings the COMM SETUP menu to the screen. With the arrow pointing at Configure Radio press enter again to enter the RADIO SETUP menu (Figure 6-2).

- Hop Channel may be set from 1-32 using the TXP-C40 keypad and assigns the pseudo-random radio frequency hopping pattern. A transceiver will not go InRange of or communicate with a transceiver operating on a different Hop Channel.
- System ID may be set from 1-255 using the TXP-C40 keypad and is similar to a password character or network number and makes network eavesdropping more difficult. A transceiver will not go InRange of or communicate with a transceiver operating on a different System ID.

- Mode may be set for CLIENT or SERVER. For a single TXP-C40 communicating to up to four battery powered TXP-WTA transceivers, Mode must = Server. To prolong battery life, TXP-WTAs sleep most of the time and therefore may not be Servers. If an application calls for multiple TXP-C40 locations, only one may be set for Server and all others must be Clients. This single Server transmits a beacon which all of the network's Clients synchronize to. ONLY ONE SERVER PER NETWORK.
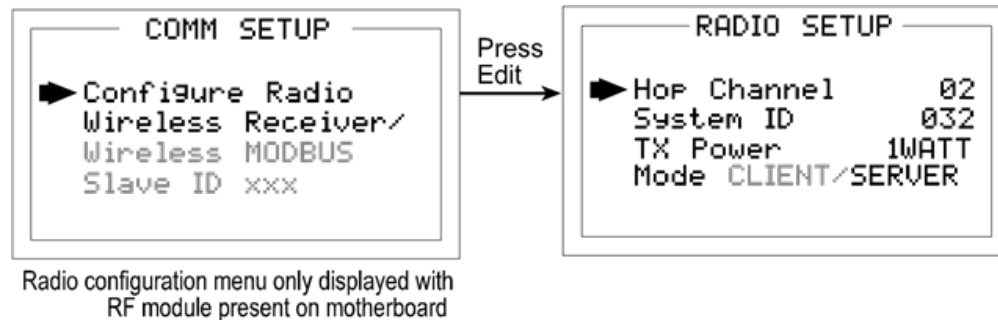

Radio configuration menu only displayed with RF module present on motherboard

Figure 6-2 – Radio Setup Menu

6.3   Wireless Receiver Mode

Wireless Receiver mode is exclusively for wireless communication to our TXP-WTA wireless sensor transmitters (please visit TXP-WTA). In Receiver mode the radio connects to the TXP-C40's Mother board and receives input data from up to four TXP-WTA sensor transmitters. Wired and wireless inputs may be mixed between the TXP-C40's four channels so it is possible to also accept wired signals from analog input option PCBs described in section 3.1.

Use the WIRELESS setting shown at right of Figure 6-3 ONLY FOR COMMUNICATION TO TXP-WTA WIRELESS TRANSCEIVERS.

TXP-WTA's transmit 200 counts for 0% and 1000 counts for 100% full scale readings so

Input Min/Max menu values should be 200 & 1000 (factory default). The Rmt Xmitter ID menu entry must match the Remote Id address setting in the TXP-WTA providing data to this TXP-C40 channel. Voltage level of the 3.6-volt lithium battery in this TXP-WTA is also displayed on the ANALOG SETUP screen, below the Rmt Xmitter Id.
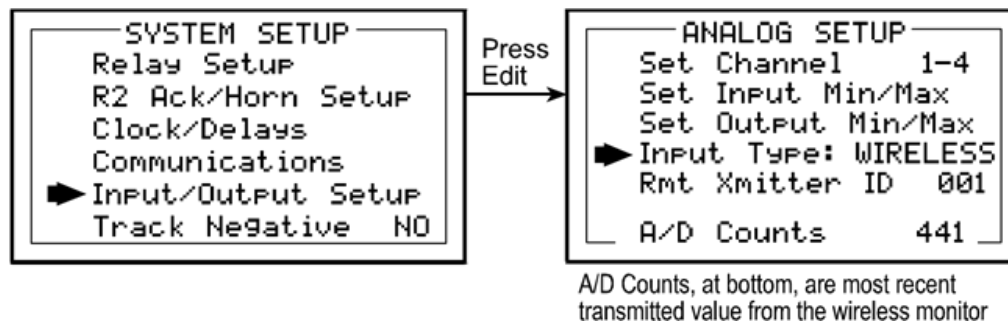

A/D Counts, at bottom, are most recent transmitted value from the wireless monitor

Figure 6-3 – Wireless Receiver Menu

6.3.1   Radio Status Alarms

When an TXP-C40 channel's Input Type is set for WIRELESS, in addition to processing the TXP-WTA's 10-bit "counts" value, it also receives status bits indicating Communications Error, Low Battery and Calibrations.

- Communications Error – Each channel's 30-minute trend screens (Figure 6-4) are very useful for diagnosing wireless problems since it indicates amount of time since the most recent transmission was received. The down arrow on top of the trend screen resets to far right each time a transmission is received by that channel. When not in alarm, TXP-WTAs transmit each 5-minutes so the arrow should never progress past the 5-minute interval. The TXP-C40 activates the channel's FAULT alarm and indicates ComErr if no transmission has been received in 18 consecutive minutes.
- Low Battery status indicates the TXP-WTA's integral 3.6V lithium D cell has dropped to below 3.3V and should be replaced very soon. LoBatt is indicated on the TXP-C40's LCD readout and the Alarm 3 LED flashes. Relays are not energized by low battery conditions. The actual battery voltage of the wireless transmitter may be seen in the ANALOG SETUP screen described above in section 5.2.
- Calibrations performed at the TXP-WTA force a transmission of the Calibration bit which is indicated on the TXP-C40's LCD readout by "Rmt Cal". Alarms are inhibited until the Calibration bit is cleared.
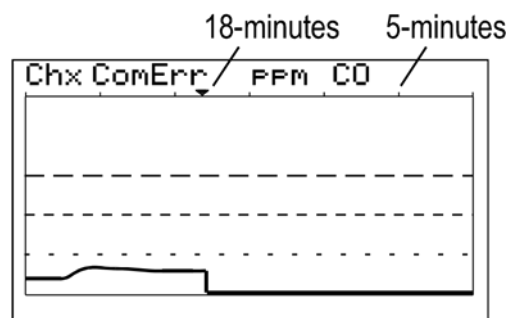

Figure 6-4 – Wireless Chx ComErr Screen

6.4 Wireless Modbus Master / Slave Modes

6.4.1 Wireless Modbus Slave Mode

Wireless MODBUS allows one or many TXP-C40s to function as wireless Modbus slaves by selecting wireless MODBUS in the COMM SETUP menu (Figure 6-3). These wireless networks require a Modbus master such as a DCS, HMI, or another TracXP by Macurco Controller equipped with our compatible radio modem. As in all TracXP by Macurco wireless networks, one transceiver must be designated as Server and all others as Clients. No special configuration is required by the master or slave since this is a standard Modbus network. However, radios must have the same Hop Channel and System ID settings to communicate.

The entire TXP-C40 Modbus database, including registers and supported Function Codes, is documented in section 3.3.1.

6.4.2 Wireless Modbus Master Mode

Wireless MODBUS allows TXP-C40s to function as wireless Modbus masters as another way to acquire input data. A very common Modbus master application is to retrieve readings from another TXP-C40 configured as a slave.

6.5 Antenna Selection

6.5.1 Dipole and Collinear Antennas

These antennas are connected to the Radio via a length of coax cable. If the cable is larger than 6mm diameter (1/4 inch), do not connect the cable directly to the radio connection on the TXP-C40 enclosure. Thick cables have large bending radii and sideways force on the connector can cause a poor connection. Use a short flexible pigtail between the thick cable and the radio connection.

The polarity of these antennas is the same as the main axis, and they are normally installed vertically. They can be mounted horizontally (horizontal polarity), however the antenna at the other end of the wireless link would need to be mounted perfectly parallel for optimum performance. This is very difficult to achieve over distance. If the antenna is mounted vertically, it is only necessary to mount the other antennas vertically for optimum "coupling" – this is easy to achieve.

Dipole and collinear antennas provide best performance when installed with at least 1 to 2 "wavelengths" clearance of walls or steelwork. The wavelength is based on the frequency:

- Wavelength in meters = 300 / frequency in MHz
- Wavelength in feet = 1000 / frequency in MHz

Therefore, 900 MHZ antennas require at least 2/3 meter (2 feet) and 2.4GHz 15 cm (6 inches). Antennas may be mounted with less clearance, but radiation will be reduced. If the radio path is short this won't matter. It is important the antenna mounting bracket is well connected to "earth" or "ground" for good lightning surge protection.

6.5.2   Yagi Antennas

Yagi antennas are directional along the central beam of the antenna. The folded element is towards the back and the antenna should be "pointed" in the direction of the transmission. Yagis should also be mounted with at least 1 to 2 wavelengths of clearance from other objects. The polarity of the antenna is the same as the direction of the orthogonal elements. For example, if the elements are vertical the Yagi transmits with vertical polarity.

In networks spread over wide areas, it is common for a central unit to have an omnidirectional antenna and the remote units to have Yagi antennas. In this case, as the omnidirectional antenna will be mounted with vertical polarity, then the Yagi's must also have vertical polarity. Care needs to be taken to ensure the Yagi is aligned correctly to achieve optimum performance.

Two Yagis can be used for a point-to-to link. In this case they can be mounted with the elements horizontally to give horizontal polarity. There is a large degree of RF isolation between horizontal and vertical polarity (approx –30dB) so this installation method is a good idea if there is a large amount of interference from another system close by transmitting vertical polarity.

An important mounting tip – if a Yagi has drainage holes in the dipole element, do not mount the antenna with the drainage.

6.5.3   Mounting Near Other Antennas

Avoid mounting your network's antenna near any other antenna even when the other antenna is transmitting on a different radio band. High RF energy of the transmission from a close antenna can "deafen" a receiver. This is a common cause of problems with wireless systems.

Because antennas are designed to transmit parallel to the ground rather than up or down, vertical separation between antennas is a lot more effective than horizontal separation. If mounting near another antenna cannot be avoided, mounting it beneath or above the other antenna is better than mounting beside it. Using different polarity to the other antenna (if possible) will also help to isolate the RF coupling.

6.5.4   Coax Cables

If a coax cable connects to the antenna via connectors, it is very important to weatherproof the connection using or equivalent sealing tape. Moisture ingress into a coax cable connection is the most common cause of problems with antenna installations. A three-layer sealing process is recommended – an initial layer of electrical PVC tape, followed by a second layer of self-vulcanizing weatherproofing tape with a final layer of electrical PVC tape.

Allowing a drip "U loop" of cable before the connection is also a good idea. The loop allows water to drip off the bottom of the U instead of into the connection, reduces installation strain and provides spare cable length in case later the original connectors need to be removed, the cable cut back and new connectors fitted.

Avoid installing coax cables together in long parallel paths. Leakage from one cable to another has a similar effect as mounting an antenna near another antenna.

6.6   Surge Protection & Grounding

Voltage surges can enter the TXP-C40 via the antenna connection, power supply connection, connections to other equipment and even the "earth" or "ground" connection. Surges are electrical energy following a path to earth and the best protection is achieved by "draining" the surge energy to earth via an alternate path. Wireless devices need to have a solid connection to earth via a ground stake or ground grid if the soil has poor conductivity. Solid connection means a large capacity conductor (not a small wire) with no coils or sharp bends. All other devices connected to the TXP-C40 need to be grounded to the same ground point. There can be significant resistance between different ground points leading to very large voltage differences during lightning activity. As many wireless units are damaged by earth potential surges due to incorrect grounding as direct surge voltage.

It is very difficult to protect against direct lightning strikes but the probability of a direct strike at any one location is very small. Unfortunately, power line surges and electromagnetic energy in the air can induce high voltage surges from lightning activity several miles away.

6.6.1   Antenna Grounding

Electromagnetic energy in the air will be drained to ground via any and every earth path. An earth path exists between the antenna and the TXP-C40 and to protect against damage this earth path current must be kept as small as possible. This is achieved by providing better alternate earth paths. It is important to ground the antenna to the same ground point as the TXP-C40. Antennas are normally mounted to a metal bracket which should be grounded to the TXP-C40 earth connection. Surge energy induced into the antenna will be drained first by the mount's ground connection, second by the outside shield of the coax cable to the ground connection on the radio and third by the internal conductor of the coax cable via the radio electronics. This third earth path causes damage unless the other two paths provide a better earth connection allowing surge energy to bypass the electronics.

When an antenna is located outside of a building and outside of an industrial plant environment, external coax surge diverters are recommended to further minimize the effect of surge current in the inner conductor of the coax cable.

Coax surge diverters have gas-discharge element which breaks down in the presence of high surge voltage and diverts any current directly to a ground connection. A surge diverter is not normally required when the antenna is within a plant or factory environment, as the plant steelwork provides multiple parallel ground paths and good earthing will provide adequate protection without a surge diverter.

6.6.2   Connections to Other Equipment

Surges can enter the wireless unit from connected devices, via I/O, Serial or Ethernet connections. Other data devices connected to the wireless unit should be well grounded to the same ground point as the wireless unit.

Special care needs to be taken where the connected data device is remote from the wireless unit requiring a long data cable. As the data device and the wireless unit cannot be connected to the same ground point, different earth potentials can exist during surge conditions.

There is also the possibility of surge voltages being induced on long lengths of wire from nearby power cables. Surge diverters can be fitted to the data cable to protect against surges entering the wireless unit.

The same principle applies to I/O device is not close to the wireless unit, the risk of surge increases. Surge diverters for I/O wiring are available to protect the wireless unit.

7   Appendix A – Table of Figures

8   Macurco Gas Detection Product limited warranty

Macurco warrants the TXP-C40 gas detector will be free from defective materials and workmanship for a period of two (2) years from the date of manufacture, provided it is maintained and used in accordance with Macurco instructions and/or recommendations. If any component becomes defective during the warranty period, it will be replaced or repaired free of charge, if the unit is returned in accordance with the instructions below. This warranty does not apply to units that have been altered or had repair attempted, or that have been subjected to abuse, accidental or otherwise. The above warranty is in lieu of all other express warranties, obligations or liabilities. THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR PARTICULAR PURPOSE ARE LIMITED TO A PERIOD OF TWO (2) YEARS FROM THE PURCHASE DATE. Macurco shall not be liable for any incidental or consequential damages for breach of this or any other warranty, express or implied, arising out of or related to the use of said gas detector. The manufacturer or its agent's liability shall be limited to replacement or repair as set forth above. Buyer's sole and exclusive remedies are the return of the goods and repayment of the price, or repair and replacement of non-conforming goods or parts.

Macurco Gas Detection

3601 N. St. Paul Avenue
Sioux Falls, SD 57104

Technical Support Contact Information

Phone: 1-844-325-3050
Fax: 1-605-951-9616
Email: support@tracxp.com
Website: www.tracxp.com/support/

General Contact Information

Phone : 1-877-367-7891
Fax : 1-605-951-9616
Email: info@tracxp.com
Website: www.tracxp.com

Rev - 1.1
Issue Date: 9-16-2020
Document No: 34-2900-0207-6
© Aerionics 2020. All rights reserved.
Macurco is a trademark of Aerionics, Inc.