GDS Corp

Gas and Flame Detection

Operation and Maintenance Manual

C2 *Quad Protector* Display & Alarm Controller

GDS Corp.

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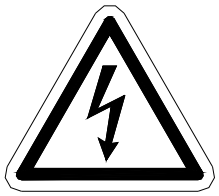

CAUTION: FOR SAFETY REASONS THIS EQUIPMENT MUST BE OPERATED AND SERVICED BY QUALIFIED PERSONNEL ONLY. READ AND UNDERSTAND INSTRUCTION MANUAL COMPLETELY BEFORE OPERATING OR SERVICING.

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.

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1 SAFETY INFORMATION

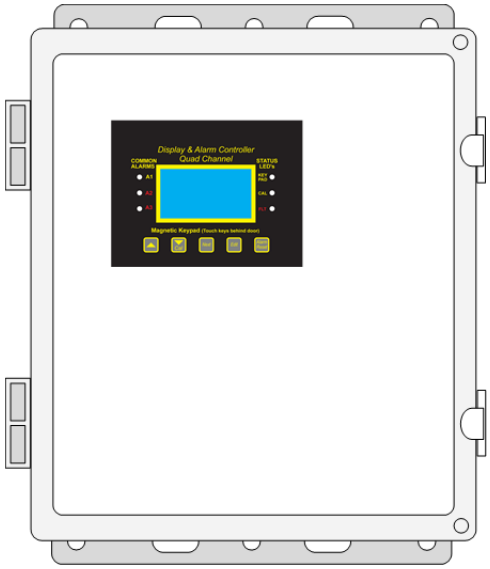
Important – Read Before Installation

Users should have a detailed understanding of C2 Quad Protector Controller operating and maintenance instructions. Use the C2 Quad Protector Controller only as specified in this manual or detection of gases and the resulting protection provided may be impaired. Read the following WARNINGS prior to use.

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.
- 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 GENERAL INFORMATION



The GDS Corp C2 Quad Protector Four Channel Controller is designed to display and control alarm event switching for up to four wired or wireless inputs, typically voltage or 4-20mA current from transmitters, monitors or other analog output devices. The C2 Quad Protector 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) or Ethernet (Modbus TCP) ports are also available for sending data to PC's, PLC's, DCS's, or other GDS Corp controllers. A 128 x 64 pixel graphic LCD readout displays monitored data as bar graphs, 30-minute trends and engineering units.

Key features include:

- Accepts four analog or four direct-bridge style sensors
- Large LCD shows values, bar-graph and trend data
- Built-in support for GASMAX TX wireless monitors
- Two 5A SPDT common relays with 6x optional
- Optional four-channel analog 4-20mA output
- Operates on either 110/220VAC or 12-24VDC
- Alarm RESET silences horn without clearing alarms
- Relay voting logic and override capability
- Magnetic and touch keys for easy access to menus
- NEMA 4X polycarbonate, painted steel and stainless enclosures
- CSA Certified for use in Class I Division 2 Hazardous Areas

3 SPECIFICATIONS

Power Input	Internal AC supply: 110/220VAC, 50/60 Hz input, 20 watts steady state (40W max inrush) to TB5; If AC power, a maximum of 10 watts is available on TB3 and analog board "24VDC" terminals to power external devices External DC supply: 10-30VDC applied to TB1 (can be supplied as backup) Optional internal 50 watt AC power supply available for driving GDS-IR sensors or other high-wattage loads (requires extended enclosure)
Power Requirements	Basic controller - 1.5 watts Analog input board – Determined by devices connected Bridge Input board – Determined by devices connected (Cat bead = 300 mW, SmartIR = 80 mW, PID = 120 mW) Four-channel 4-20mA output board – Add 1.0 watts Six channel discrete relay board – Add 1.5 watts MODBUS / RS-485 interface – Add 1.0 watts Wireless Radio – Add 1.0 watts
Display	64 x128 pixel LCD with alphanumeric display of alarm status and gas values
Input	Analog – 4 channel analog input board for 4-20mA Bridge – 4 channel direct sensor input for bridge-style sensors Wireless – 4 channel wireless 900 MHz or 2.4 GHz
Output	Standard – two programmable SPST dry contact relays, 5A resistive Optional – six programmable SPST dry contact relays, 5A resistive (8 total) Optional – 4 channel 4-20mA analog output
RF Section (900 MHz)	Frequency range from 902 to 928 MHZ. Receiver sensitivity -100 dBm. Radio certified to FCC Part 15.247.
RF Section (2.4 GHz)	Frequency range from 2.406 GHz to 2.472 GHz. Receiver sensitivity -100 dBm. Radio certified to FCC Part 15.247.
Temperature	-25°C to +60°C Operating; 0 to 90% relative humidity
Altitude	Maximum operating 6200 ft / 2000 m
Housing	Aluminum housing (2) with epoxy paint standard; #316 stainless steel optional
Dimensions	Compact enclosure Extended enclosure NEMA 7
Approvals	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).
Warranty	Two years on electronics

4 CONTROLLER OPERATION

The C2 Quad Protector Controller is a highly reliable and flexible solution for monitoring up to four wired or wireless inputs. Wired inputs can be either 4-20mA analog, 'millivolt output direct bridge' sensors for combustibles, carbon dioxide or volatile organic compounds or MODBUS data.

During normal operation, the microprocessor reads each channels input and converts the input value to scaled and calibrated engineering units. Channels can be programmed to accept data from either analog, wired MODBUS or wireless inputs on a channel-by-channel basis. The data is then displayed on the LCD and values are checked against pre-programmed alarm values. If the inputs exceed alarm thresholds, then the corresponding LED indicators and relay(s) are activated. Finally, the latest data is stored in the internal MODBUS database for query by remote wired or wireless MODBUS masters.

Input data is processed between 10 and twenty times per second to ensure prompt response to rapidly changing values. Built-in calibration and programmable timers and delay values enhance usability and allow the C2 Quad Protector to reliably manage sophisticated systems.

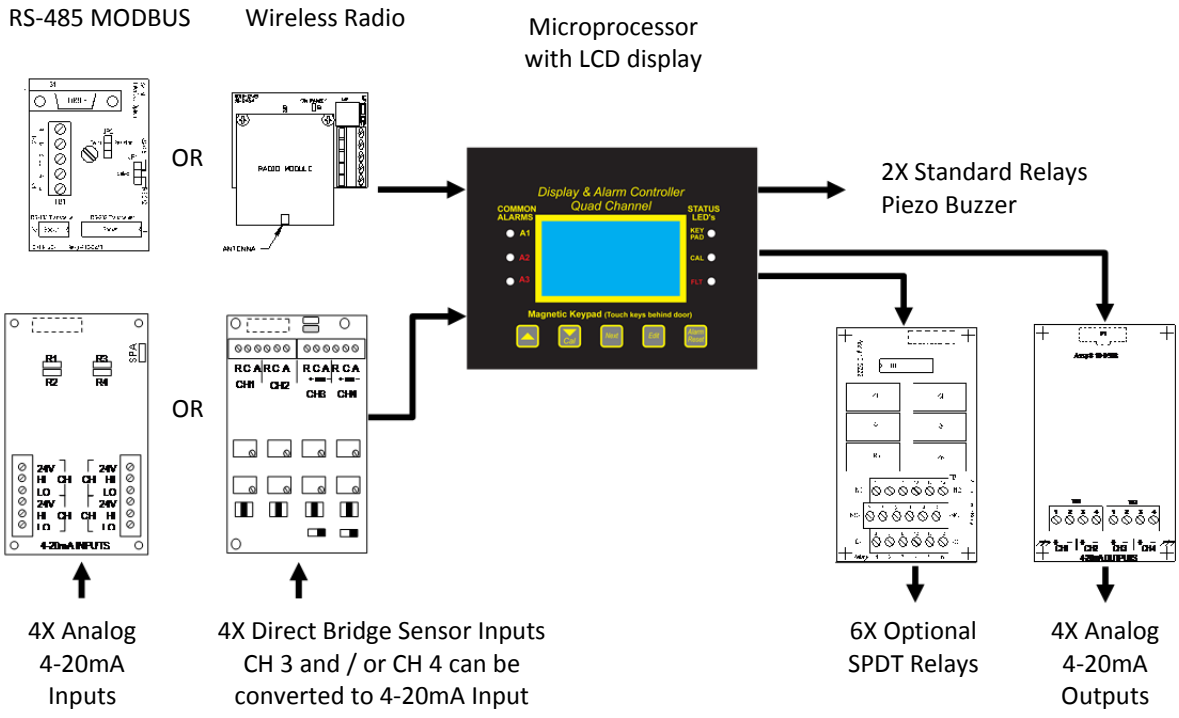


Figure 4-1: C2 Quad Protector Overview

5 INSTALLATION

SELECTING A LOCATION

The C2 Quad Protector Controller should be mounted in a location that combines sources of AC or DC power, line-of-sight access for wireless gas detectors and suitable visibility for any locally-mounted warning strobe or horn. Entry gates, central control rooms, outdoor instrument shelters and free-standing poles are ideal locations. Since the C2 Quad Protector Controller can operate on 12VDC power, it can be easily mounted to hardware supporting temporary or permanently installed solar panels. Hardware for wall mount, pole mount and magnetic mount is available. The controller should not be mounted in direct sunlight and should be kept away from sources of vibration or shock.

MOUNTING THE C2 QUAD PROTECTOR CONTROLLER

The C2 Quad Protector Controller offers three types of mounting: wall mount, magnetic mount and pole mount. See Chapter 15 for detailed dimensions.

POWER & RELAY WIRING

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 5-1.

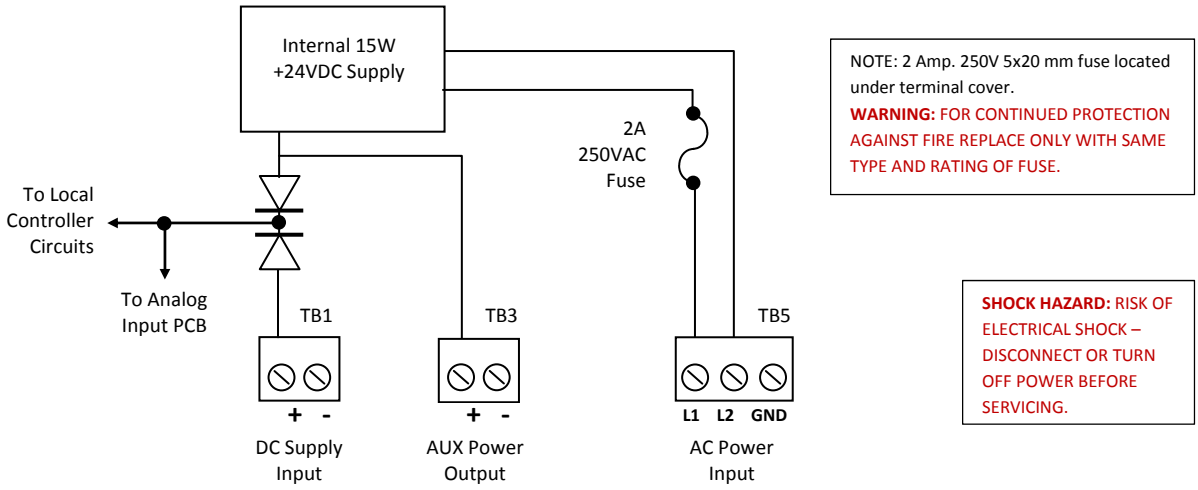


Figure 5-1: Power Supply Input Detail

NOTE: 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.

NOTE: WHEN USING +12VDC SOLAR POWER AND LOOP-POWERED DEVICES, MAKE SURE THAT SUFFICIENT VOLTAGE IS PRESENT ON THE LOOP TO MAINTAIN THE MINIMUM VOLTAGE ACROSS EACH DEVICE. FOR LONG CABLE RUNS, A 12V TO 24V DC/DC CONVERTER MAY BE REQUIRED. CONTACT GDS CORP FOR MORE INFORMATION.

USE IN HAZARDOUS AREAS

The C2 Quad Protector is certified for use in Class I Division 2 hazardous areas. Certified under 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).

6 HARDWARE OVERVIEW

SYSTEM MOTHERBOARD

The C2 Quad Protector motherboard provides the interface between the Display / CPU assembly and all system devices. The Display assembly attaches to the motherboard and connects via ribbon cable to S1.

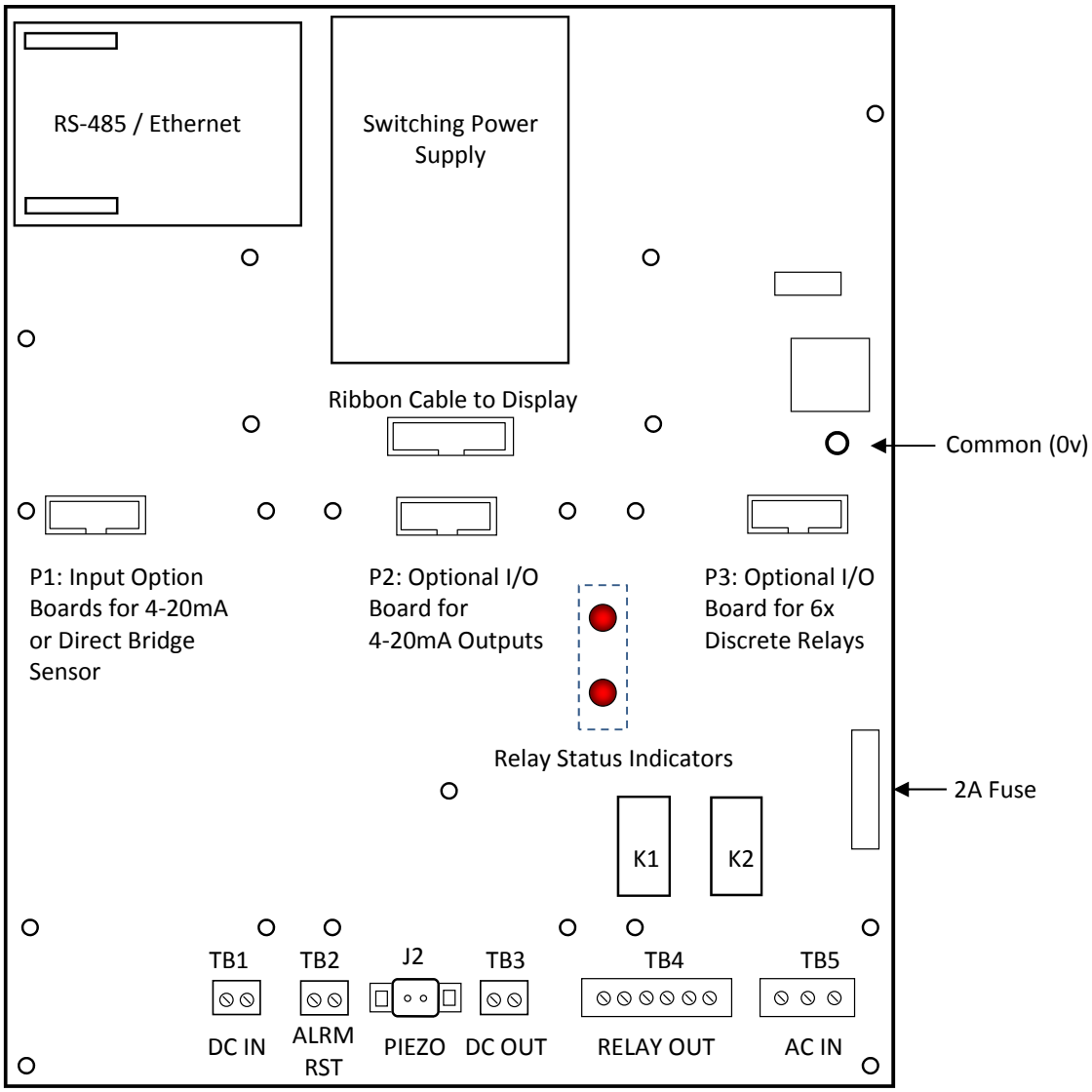


Figure 6-1: C2 Quad Protector Motherboard

Connector P1 is reserved for analog or bridge input, connector P2 is reserved for 4-20mA output and P3 supports the 6 channel optional relay board. 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 if 50W optional supply is not installed. J2 is a 2-pin polarized connector for powering the optional #1000-1892 audible piezo buzzer.

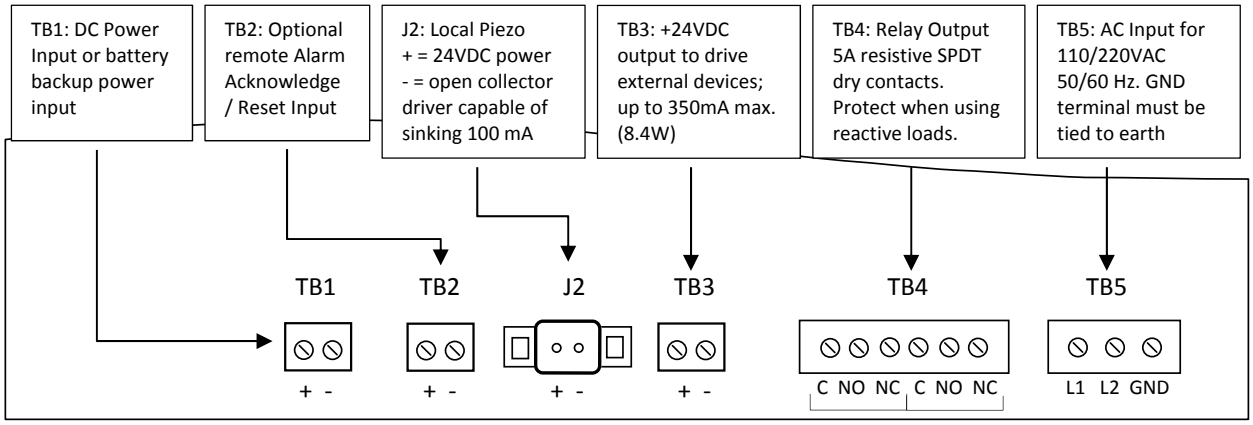


Figure 6-2: Motherboard User Connections Detail

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.

DISPLAY / CPU MODULE

The Display / CPU module mounts on the motherboard using standoffs and connects to the system via a short ribbon cable. The display includes a 128 x 64 pixel bit-mapped LCD, six LED indicators, five physical pushbuttons and a low volume piezo buzzer. Display contrast can be adjusted via the LCD Contrast potentiometer at the lower left corner of the display PCB.

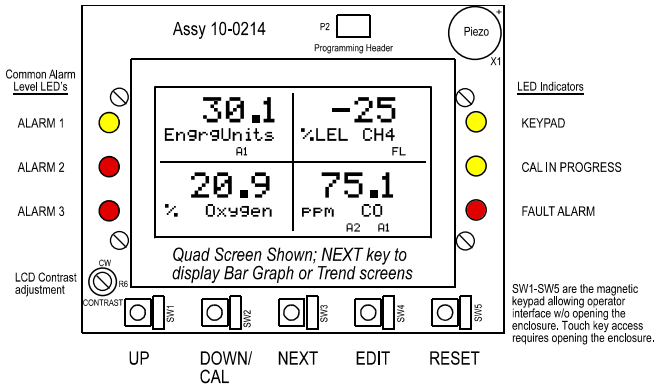


Figure 6-3: Display / CPU Module

I/O CONNECTOR P1

The P1 position accepts either the #10-0221-4 4-channel Analog Input option OR the #10-0309 4-channel Bridge Sensor Input option. Both have default Input Min / Max menu settings of 400 – 2000 counts.

Analog Input Board: Analog input PCB option # 10-0221-4 allows interfacing to field transmitters having 4-20mA or voltage outputs. Remove socketed 100 ohm (R1 – R4) terminators for 0-4 VDC max voltage inputs. The 10-0221-4 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 C2 Quad Protector internal 24 VDC power supply for powering external 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

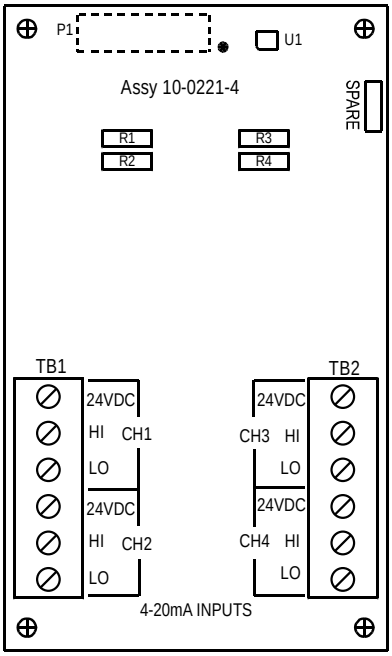


Figure 6-4: 10-022104 Analog Input Board

IMPORTANT: IN COMPLIANCE WITH CSA C22.2 NO. 152 CERTIFICATION, THE 4-20 MA 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 4-20 MA GAS DETECTION INSTRUMENTS CONNECTED TO THE INPUT MUST ALSO BE CSA CERTIFIED.

Bridge Input Board: The 10-0309 Quad Channel Bridge Sensor Input option board allows bridge-type sensors to be directly connected to the C2 Quad Protector Controller without additional signal conditioning. Each channel is equipped with a bridge amplifier, balance potentiometer, and adjustable switching regulator for setting the correct sensor excitation voltage. A 3 position coarse gain jumper allows adjustment for the bridge amplifier amplification. Fault supervision circuitry forces the C2 Quad Protector into a FAULT condition upon sensor failure or removal.

This board may also be configured to accept analog 4-20mA input on channels 3 & 4 to support a combination of bridge sensors and analog current input. Placing the Channel 3 or Channel 4 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.

NOTE: WHEN USING CHANNEL 3 AND CHANNEL 4 IN ANALOG INPUT MODE, +24V EXCITATION VOLTAGE **MUST BE PROVIDED FROM THE MOTHERBOARD**. THE "R" PIN DOES NOT PROVIDE +24VDC.

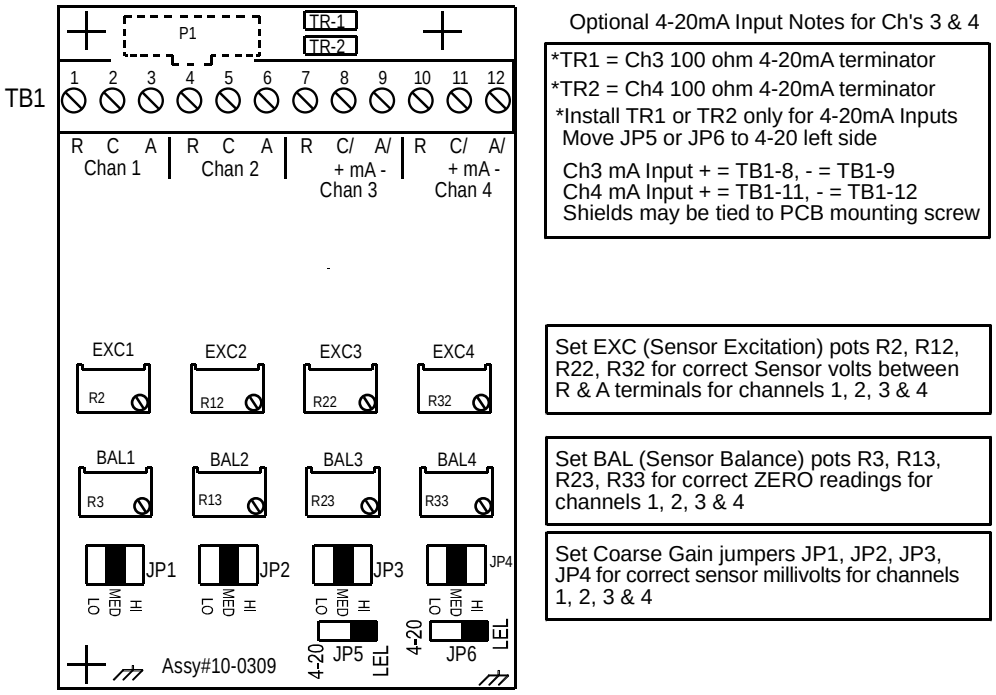


Figure 6-5: 10-0309 Bridge Input Board

I/O CONNECTOR P2

An optional 10-bit 4-20mA analog output board, shown in Figure 8-7, may be added at location P2. Each channel's output will transmit 4mA for 0% readings and 20mA for 100% readings. Negative input readings are clamped at 4mA until they drop below the FAULT settings, at which time the output goes to 0 mA.

If the C2 Quad Protector primary power is 100 – 240 VAC or at least 24 VDC, each 4-20mA output is capable of driving a full 20mA through a 750 ohm load. Outputs are self-powered (current source) and DC power should never 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.

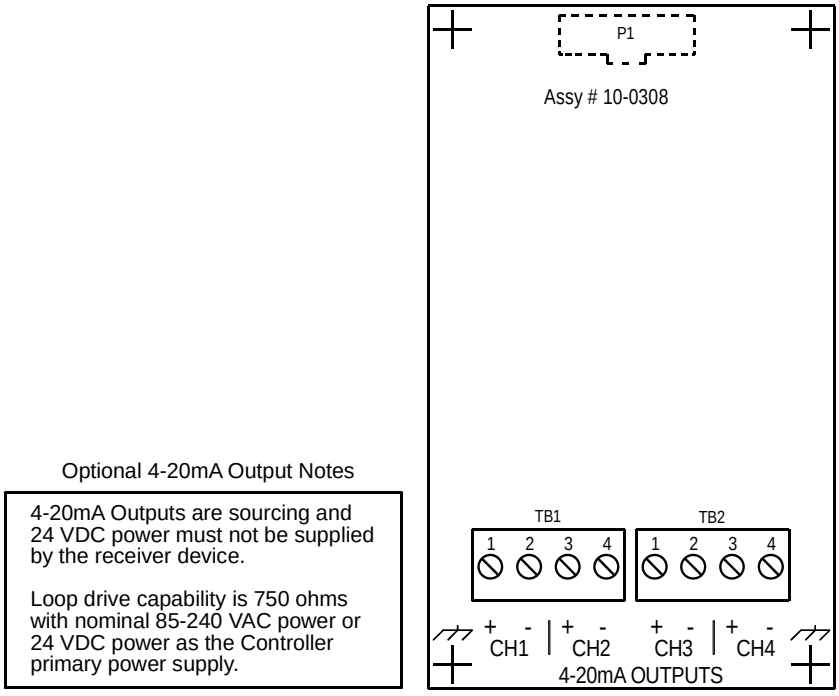


Figure 6-6: 10-0308 Analog Output Board

I/O CONNECTOR P3

The optional Discrete Relay PCB adds six 5 amp form C relays. Each relay is fully programmable.

IMPORTANT: AC OR DC POWER SUPPLIES TO RELAYS ON THE 10-0222 SIX-CHANNEL DISCRETE RELAY BOARD **MUST BE THE SAME FOR EACH RELAY**. EXAMPLE: 24VDC SHOULD NOT BE THE POWER SWITCHED BY ONE RELAY AND 115VAC BY OTHERS.

IMPORTANT: ALL MECHANICAL (DRY CONTACT) RELAYS ARE RATED AT 5 AMP FOR 28 VDC AND 250 ~VAC RESISTIVE LOADS. APPROPRIATE DIODE (DC LOADS) OR MOV (AC LOADS) SNUBBER DEVICES **MUST BE INSTALLED WITH INDUCTIVE LOADS** TO PREVENT RFI NOISE SPIKES.

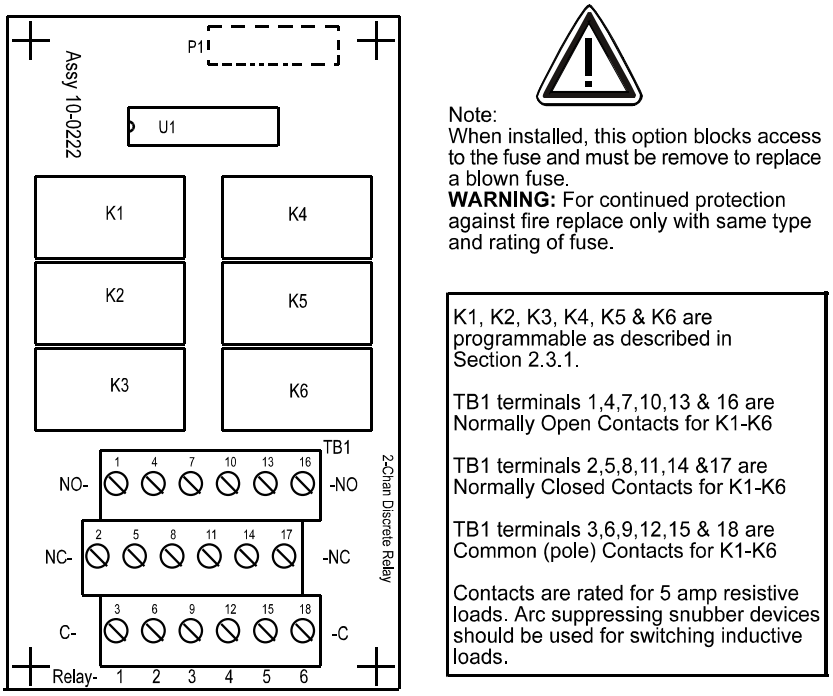


Figure 6-7: 10-0222 Discrete Relay Board

MODBUS / RS-232 & RS-485 INTERFACE

The #10-0253 Modbus option PCB adds both RS-232 and RS-485 Modbus RTU slave ports. Figure 9-9 shows this optional PCB which mounts to connectors on the upper left corner of the C2 Quad Protector motherboard. TB1 provides two pair of corresponding "A" and "B" MODBUS terminals and a floating terminal for shield continuation. This makes it easy to multi-drop controllers onto a single RS-485 cable without doubling wires in the same screw terminals. To access the RS-232 interface, connect a mating connector to the DB9 connector S1.

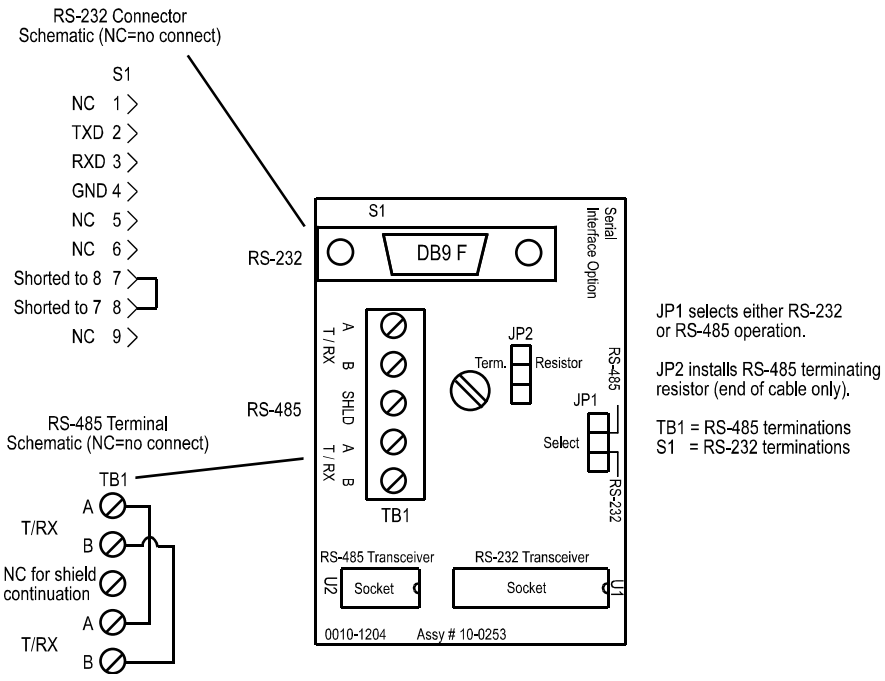


Figure 6-8: MODBUS Serial Interface

IMPORTANT: 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.

WIRELESS RADIO KIT OPTION

The C2 Quad Protector serial port may be connected to a FHSS (Frequency Hopping Spread Spectrum) wireless radio modem shown in Figure 6-9. There are two different frequency options offered, 900 MHz (10-0328) and 2.4 GHz (10-0355). The radio kit options allow wireless MODBUS *master / slave* and GDS Corp "Wireless Receiver" operation.

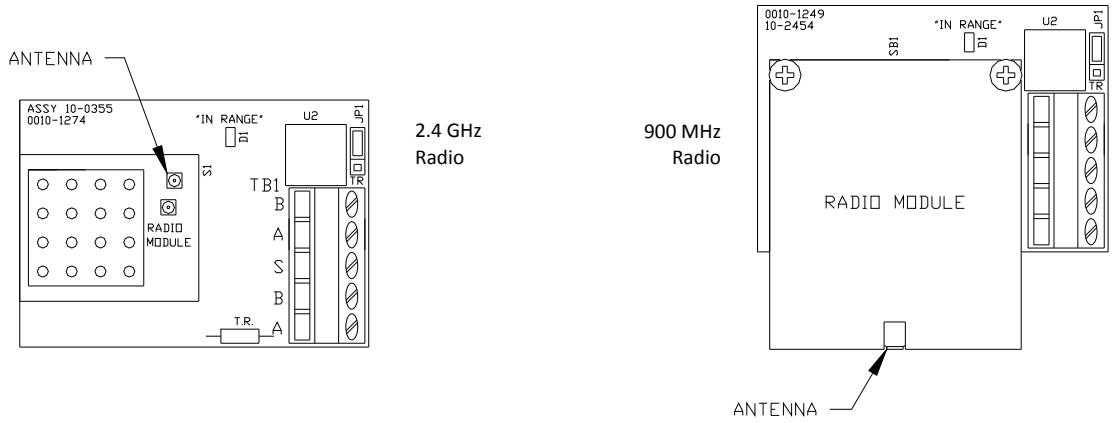


Figure 6-9: Wireless Radio Options

OPTIONAL 50W POWER SUPPLY

Many applications require DC power in excess of the 10 watts available from the universal power supply located on the motherboard. "Extended" enclosure models can be equipped with a DIN-rail mounted 50 watt DC supply rated for Class I Division 2 hazardous areas.

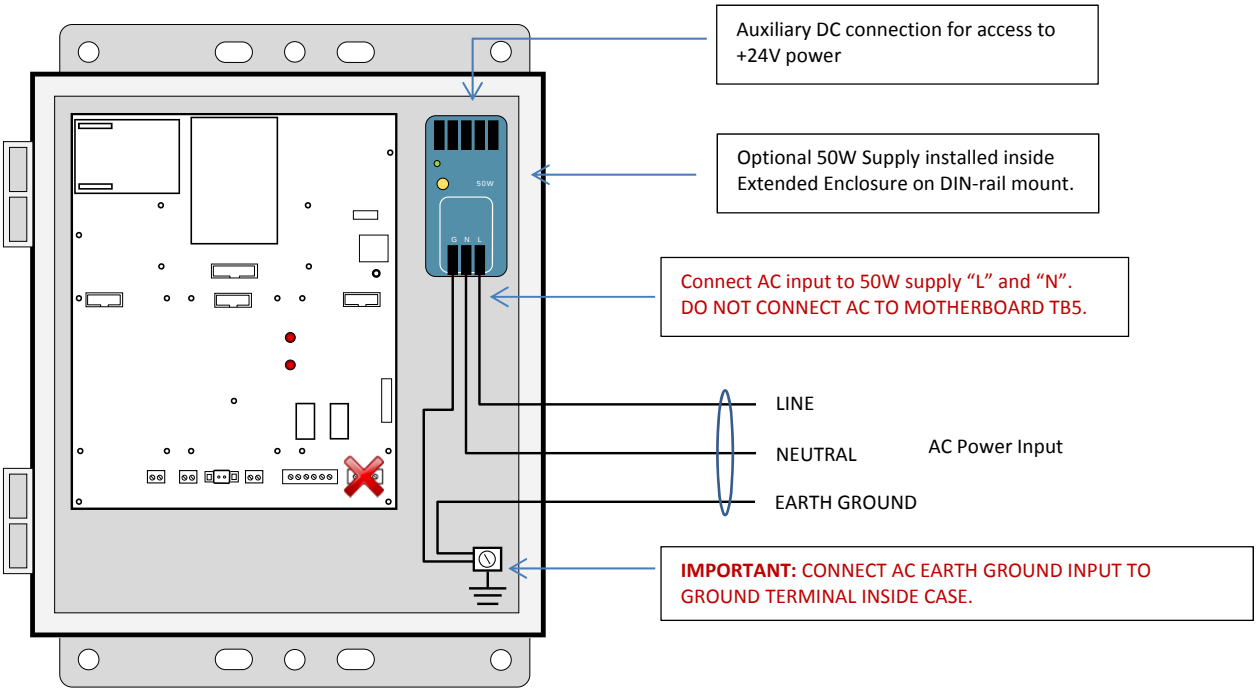


Figure 6-10: Optional 50W Power Supply Wiring

IMPORTANT: WHEN USING THE OPTIONAL 50W POWER SUPPLY, NO DC POWER IS AVAILABLE FROM MOTHERBOARD CONNECTOR TB3. IF +24VDC IS REQUIRED FOR LIGHTS OR HORNS, CONNECT WIRING TO THE UNUSED (+) AND (-) CONNECTIONS ON THE TOP TERMINAL BLOCK OF THE 50W SUPPLY.

7 INTERFACING

TWO-WIRE 4-20MA INPUT

Two-wire ('loop-powered') devices derive their operational power from the current passing through the loop itself and transmit information by controlling the current passing through the device ("current sink"). Examples include the GASMAX EC Gas Monitor and TransMAX EC Gas Monitor and GDS-49 Toxic Sensor Transmitter.

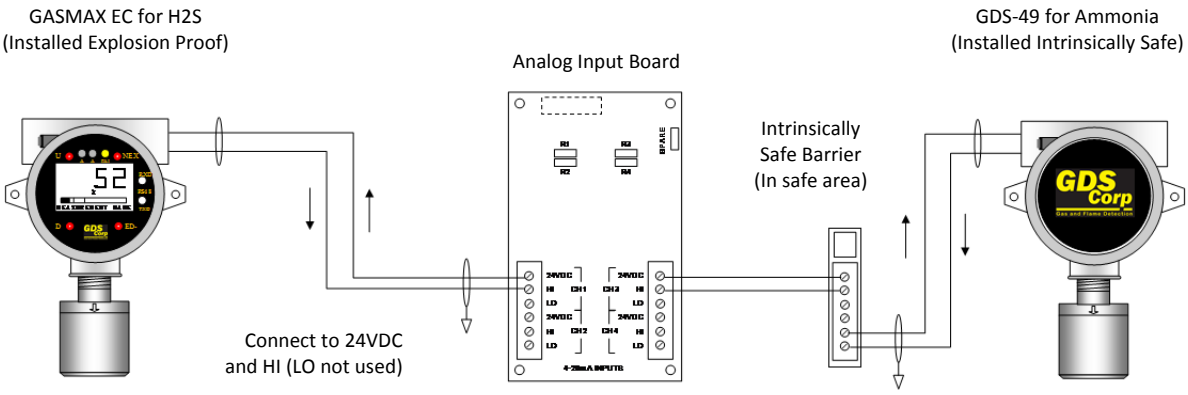


Figure 7-1: Two-wire Gas Monitors and Transmitters

Loop powered devices can also be installed in hazardous areas as 'intrinsically safe' if an Intrinsically Safe barrier is installed in a safe area between the controller and device. For example, the GASMAX EC for H2S can be installed as Explosion Proof in Class I Division 1 areas, but a GASMAX EC for Chlorine must be installed as Intrinsically Safe if used in the same area.

Two–wire, loop-powered devices are connected to the Analog Input board as shown in Figure 7-1. One wire is connected to "24VDC" and the other to the "HI" terminal. If the two-wire device is polarized, be sure to connect the (+) terminal to 24VDC and the (-) terminal to HI. The LO input pin is not used.

To setup the C2 Quad Protector for 2-wire input, the following settings must be programmed:

- Each channel's input must be set for Analog.
  (Find in *System – Input Output Setup – Set Input Type = ANALOG"*)

NOTE: GDS CORP 2-WIRE DEVICES ARE NON-POLARIZED AND THEREFORE EITHER INPUT CAN BE CONNECTED TO +24VDC.

IMPORTANT: DEVICES THAT PROVIDE THEIR OWN CALIBRATION SHOULD NOT BE CALIBRATED USING THE BUILT-IN CALIBRATION PROCEDURE. GAIN AND OFFSET SHOULD ALWAYS BE SET TO "1.00" AND "0.00" RESPECTIVELY WHEN USING THE GASMAX EC OR TRANSMAX EC AS INPUT DEVICES.

THREE-WIRE 4-20MA INPUT

Three wire devices derive their operating power from a third conductor and typically generate an independent 4-20mA output ("current source"). Examples include the GASMAX II, TRANSMAX II and GASMAX CX Gas Monitors, GDS-58XP Sample Draw System as well as the GDS-IR Infrared Combustible Sensor or Spectrex SharpEye Flame Detector.

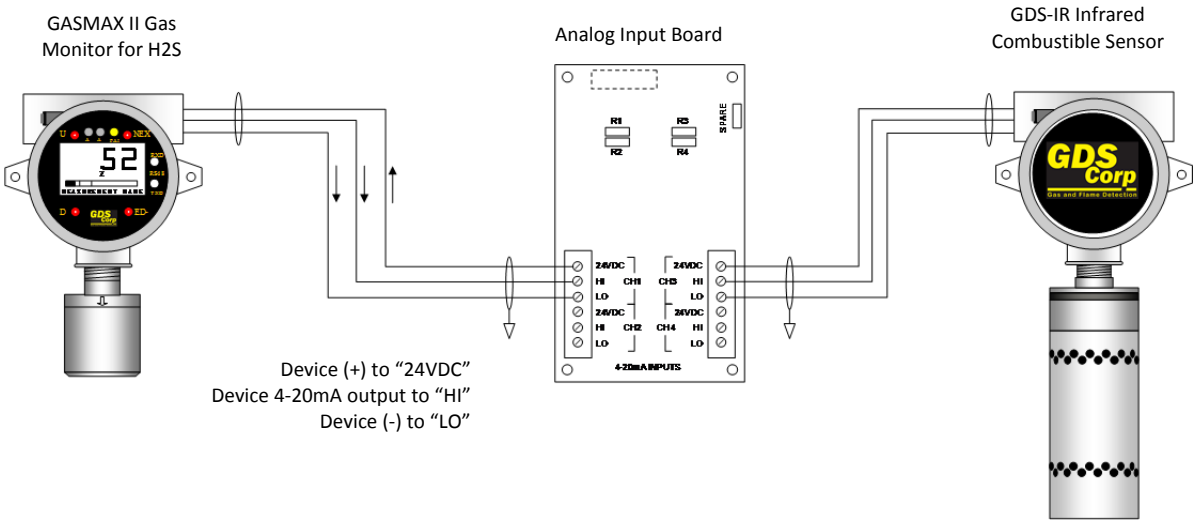


Figure 7-2: Three-Wire Gas Monitors and Transmitters

Three–wire devices are connected to the Analog Input board as shown in Figure 7-2. Device (+) power input is connected to "24VDC", device 4-20mA output is connected to "HI" and device (-) power / signal common is connected to "LO". For four-wire devices, connect both power and signal negative to "LO".

To setup the C2 Quad Protector for 3-wire input, the following settings must be programmed:

- Each channel's input must be set for Analog.
  (Find in *System – Input Output Setup – Set Input Type = ANALOG"*)

IMPORTANT: WHEN CONNECTING THREE-WIRE DEVICES TO THE C2 QUAD PROTECTOR, MAKE SURE THAT SUFFICIENT POWER IS AVAILABLE FOR ALL DEVICES.

For example, since GASMAX II transmitters require 3.5W and GDS-IR infrared sensors require 5W, if more than three GASMAX II transmitters or more than two GDS-IR sensors are required, specify the optional 50W power supply to ensure reliable operation.

IMPORTANT: DEVICES THAT PROVIDE THEIR OWN CALIBRATION SHOULD NOT BE CALIBRATED USING THE BUILT-IN CALIBRATION PROCEDURE. GAIN AND OFFSET SHOULD ALWAYS BE SET TO "1.00" AND "0.00" RESPECTIVELY WHEN USING THE GASMAX II, GASMAX CX AS INPUT DEVICES.

DIRECT BRIDGE SENSOR INPUT

The C2 Quad Protector Bridge Input board directly supports bridge-type sensors such as catalytic bead combustible, SmartIR infrared combustible / CO2 and Photoionization Detectors (PID). These sensors connect using three-wire "Reference", "Common" and "Active" connections. Excitation voltage is provided to the sensor via the "R" and "A" pins and millivolt output signals are generated on the "C" pin.

The C2 Quad Protector Bridge Input board allows channels 3 and 4 to be configured as direct bridge or as 4-20mA if both toxic and combustible sensors are required. To convert channels 3 and 4 to 4-20mA, install the 100 ohm load resistor and set the LEL/mA jumper to "4-20". Note that the "R" pin does not provide +24V for the 4-20mA transmitter.

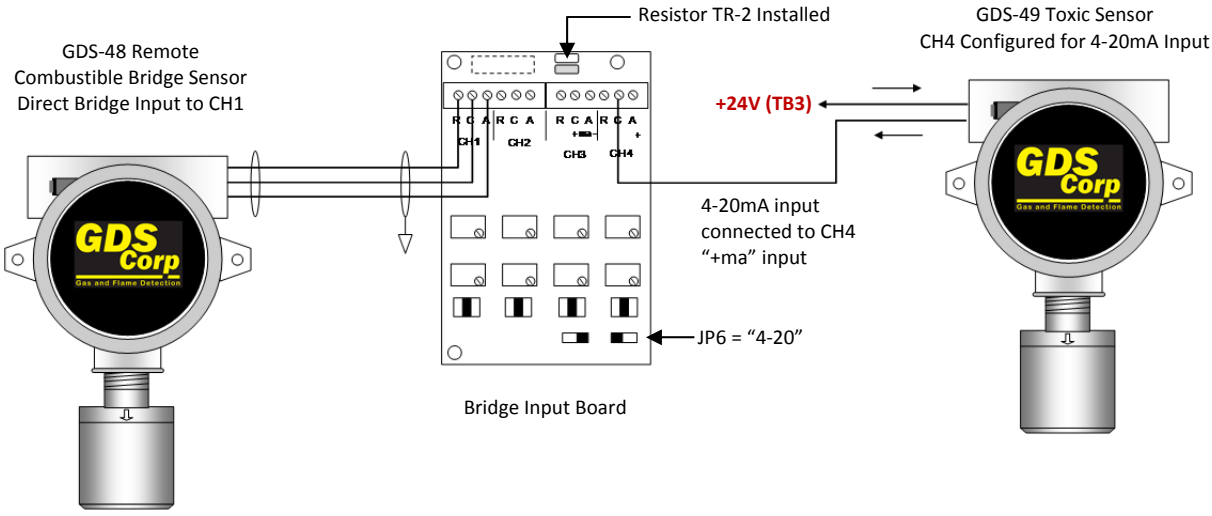


Figure 7-3: Direct Bridge-Type Sensor

IMPORTANT: WHEN INSTALLING REMOTE DIRECT BRIDGE-TYPE SENSORS, ALWAYS CONFIRM PROPER VOLTAGE **AT THE SENSOR JUNCTION BOX** BEFORE INSTALLING SENSOR ELEMENT. **VOLTAGE IN EXCESS OF THE SENSOR'S RATING CAN DESTROY THE SENSOR.**

Bridge Sensor Initial Setup: Bridge sensors vary widely in power requirements and sensitivity and it is therefore important to configure each channel to match the sensor with which it will operate. Sensors attached to the C2 Quad Protector enclosure at the factory have already been configured to operate properly.

1. Prior to connecting any remote sensors, apply power to the system. Measure the voltage between each channel's R and A terminals and set the Voltage Adjust potentiometers ("EXC1" through "EXC4") for the correct sensor excitation voltage. GDS Corp Catalytic Bead sensors require 2.0 V, SmartIR sensors require 4.5 V and PID sensors require 3.5 V. SENSORS MAY BE DAMAGED BY ACCIDENTAL OVER-VOLTAGE CONDITIONS.

2. Remove system power and connect the external sensor wires to the R-C-A terminals. Reapply system power and confirm correct voltage BETWEEN THE REMOTE SENSOR "R" AND "A" TERMINALS. If the sensor is located some distance from the controller, the controller output voltage may have to be increased to compensate for losses in the sensor cable. Once the voltage is adjusted properly, allow the sensor to warm up for several hours.
3. With zero stimulus on the sensor, adjust the Balance potentiometer ("BAL1" through "BAL4") for a ZERO reading on the LCD.
4. Apply 50% span gas to the sensor and allow the reading to stabilize. Place the 3 position Coarse Gain jumper into the position that gives approximately 45 and 65% of scale. 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. When replacing sensors, in most cases only the Balance will need to be readjusted. Final calibration of this channel may now be performed using the built-in calibration procedure described in Section 9.

IMPORTANT: ALWAYS ALLOW A BRIDGE-TYPE SENSOR TO WARM UP THOROUGHLY BEFORE PERFORMING CALIBRATION. IN MOST CASES IT IS BEST TO ALLOW SENSORS TO OPERATE FOR 24 HOURS PRIOR TO THEIR FIRST CALIBRATION PROCEDURE.

WIRED MODBUS INPUT

The C2 Quad Protector can act as a MODBUS master to read data from up to four RS-485 MODBUS devices if the optional #10-0253 MODBUS interface is installed.

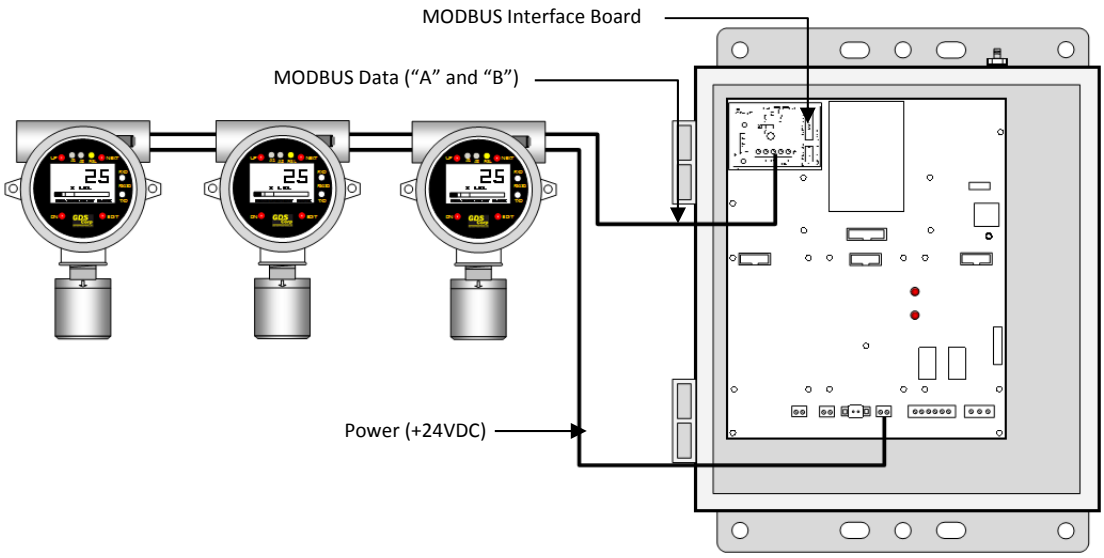


Figure 7-4: Wired MODBUS Master Input

To setup the C2 Quad Protector for MODBUS master, the following settings must be programmed:

- C2 Quad Protector must be set for MODBUS MASTER
  (Find in *System – Communications – Serial Port Setup - Set for “MODBUS MASTER”*)
- Adjust Poll Rate and Timeout to match application requirements
  (Find in *System – Communications – Poll Rate = xxx mSec, Timeout = xxx mSec*)
- Each channel using MODBUS must be programmed for MODBUS input
  (Find in *System – Input Output Setup – Select Channel - Set Input Type = MODBUS*)
- Each channel setting in the C2 Quad Protector must be programmed to match detector’s Remote ID
  (Find in *System – Input Output Setup – Select Channel - Set Rmt Xmitter ID = GASMAX Remote ID*)

IMPORTANT: WHEN CONNECTING THREE-WIRE DEVICES TO THE C2 QUAD PROTECTOR, MAKE SURE THAT SUFFICIENT POWER IS AVAILABLE (10 WATTS MAX IF USING INTERNAL AC SUPPLY).

IMPORTANT: DEVICES THAT PROVIDE THEIR OWN CALIBRATION SHOULD NOT BE CALIBRATED USING THE BUILT-IN CALIBRATION PROCEDURE. GAIN AND OFFSET SHOULD ALWAYS BE SET TO “1.00” AND “0.00” RESPECTIVELY WHEN USING THE GASMAX II, GASMAX CX AS INPUT DEVICES.

FOR MORE DETAILS, SEE GDS CORP “MODBUS WIRING GUIDELINES”, #1200-0857.

WIRELESS GAS MONITOR INPUT

GDS Corp GASMAX wireless gas monitors require the installation of either the 900 MHz radio module or 2.4 GHz radio module and local or remote antenna. Remote installation of the radio module is not supported.

To create a 'network', every radio must have a matching **Hop Channel** and **System ID** setting to enable the transmission and reception of data packets, and each GASMAX must have a unique **Remote ID** to allow the controller to properly identify the source of the transmission. Finally, there must be one device that transmits the **Beacon** signal that all radios use to synchronize their spread spectrum transmission. For GDS Corp networks, this would generally be the C2 Quad Protector Controller / Receiver, GDS-98 Wireless System Manager, C1 *Protector* Controller / Receiver or C64 *Protector* Controller / Receiver.

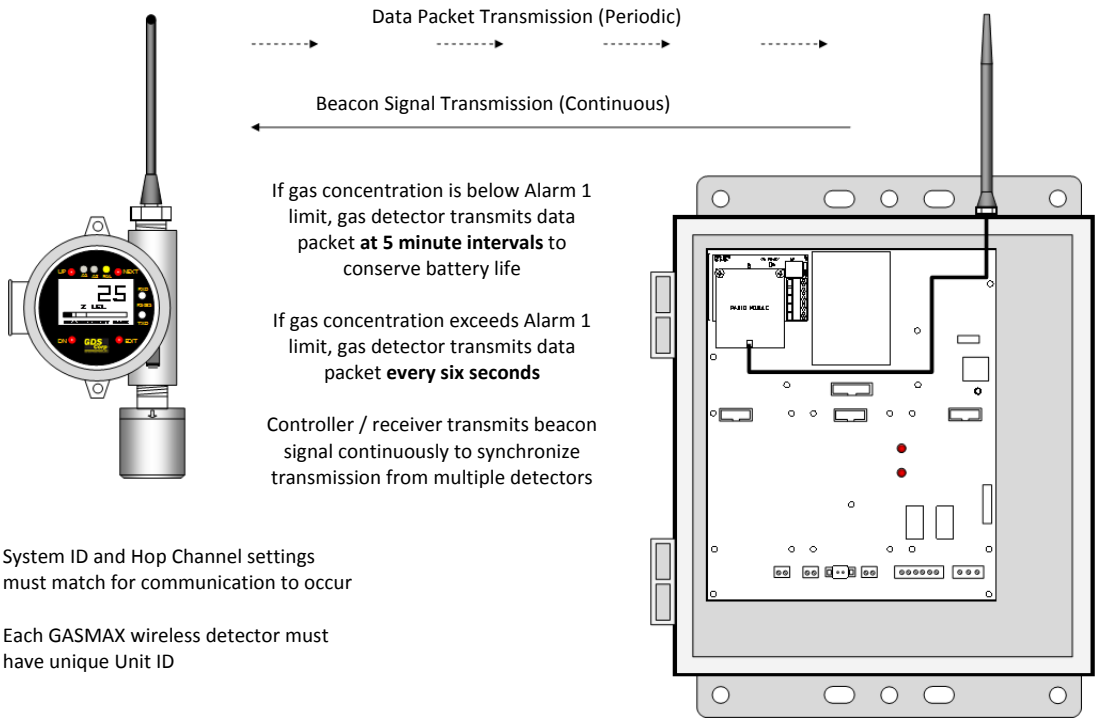


Figure 7-5: GASMAX ECx and GASMAX TX Wireless Gas Monitors

To setup the C2 Quad Protector for wireless gas monitoring, the following settings must be programmed:

- C2 Quad Protector must be set for Wireless Receiver
  (Find in *System – Communications – Set for "Wireless Receiver"*)

- Hop channel value programmed into the C2 Quad Protector and all GASMAX units must be identical
  (Find in *System – Communications – Configure Radio – Set Hop Channel = xxx*)
- System ID values programmed into the C2 Quad Protector and all GASMAX units must be identical.
  (Find in *System – Communications – Configure Radio – Set System ID = xxx*)
- If C2 Quad Protector is primary controller, beacon MODE must be set to SERVER
  (Find in *System – Communications – Configure Radio – Set Mode = Server*)
- Each wireless channel setting in the C2 Quad Protector must be set to wireless mode.
  (Find in *System – Input Output Setup – Select Channel - Set Input Type = Wireless*)
- Each wireless channel setting in the C2 Quad Protector must be programmed to match detector's Remote ID
  (Find in *System – Input Output Setup – Select Channel - Set Rmt Xmitter ID = GASMAX Remote ID*)

Additional settings such as TX Power and RX Timeout can be adjusted as necessary for each application. Additional information on these settings can be found in the section on User Menus.

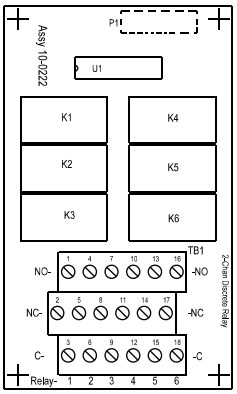
GASMAX ECx and GASMAX TX devices transmit gas values that range from 200 counts ("0") to 1000 counts ("Full Scale") and input MIN and MAX count values should be set to match.

Preconfigured systems from GDS Corp are fully programmed and tested prior to shipment.

IMPORTANT: DEVICES THAT PROVIDE THEIR OWN CALIBRATION SHOULD NOT BE CALIBRATED USING THE BUILT-IN CALIBRATION PROCEDURE. GAIN AND OFFSET SHOULD ALWAYS BE SET TO "1.00" AND "0.00" RESPECTIVELY WHEN USING THE GASMAX ECx AND GASMAX TX WIRELESS DETECTORS.

RELAY OUTPUT

The C2 Quad Protector has two standard 5A SPDT relays with terminals on the motherboard and six additional SPDT relays on the #10-0222 optional relay expansion board. All relays are programmable for normal or FAILSAFE ("normally open held closed") and support voting and channel & alarm specific overrides. See Relay Setup menu for more details.



1	RY1	NO
2	RY1	NC
3	RY1	COMMON
4	RY2	NO
5	RY2	NC
6	RY2	COMMON
7	RY3	NO
8	RY3	NC
9	RY3	COMMON

10	RY4	NO
11	RY4	NC
12	RY4	COMMON
13	RY5	NO
14	RY5	NC
15	RY5	COMMON
16	RY6	NO
17	RY6	NC
18	RY6	COMMON

Figure 7-6: #10-0222 6X Relay Output Board

An easy way to test a specific relay is to toggle the normal / FAILSAFE setting (Find in *System – Relay Setup*).

IMPORTANT: ALL MECHANICAL (DRY CONTACT) RELAYS ARE RATED AT 5 AMP FOR 28 VDC AND 250 ~VAC RESISTIVE LOADS. APPROPRIATE DIODE (DC LOADS) OR MOV (AC LOADS) SNUBBER DEVICES **MUST BE INSTALLED WITH INDUCTIVE LOADS** TO PREVENT RFI NOISE SPIKES.

IMPORTANT: AC OR DC POWER SUPPLIES TO RELAYS ON THE 10-0222 DISCRETE RELAY PCB OPTION MUST BE THE SAME FOR EACH RELAY. **DO NOT MIX +24V and 110VAC LOADS.**

RS-485 / RS-232 WIRED MODBUS OUTPUT

The C2 Quad Protector can be programmed as a MODBUS slave if the optional #10-0253 MODBUS interface is installed. This allows a remote MODBUS Master to read data from the MODBUS database in the C2 Quad Protector. See Section 13 for a complete list of MODBUS registers available.

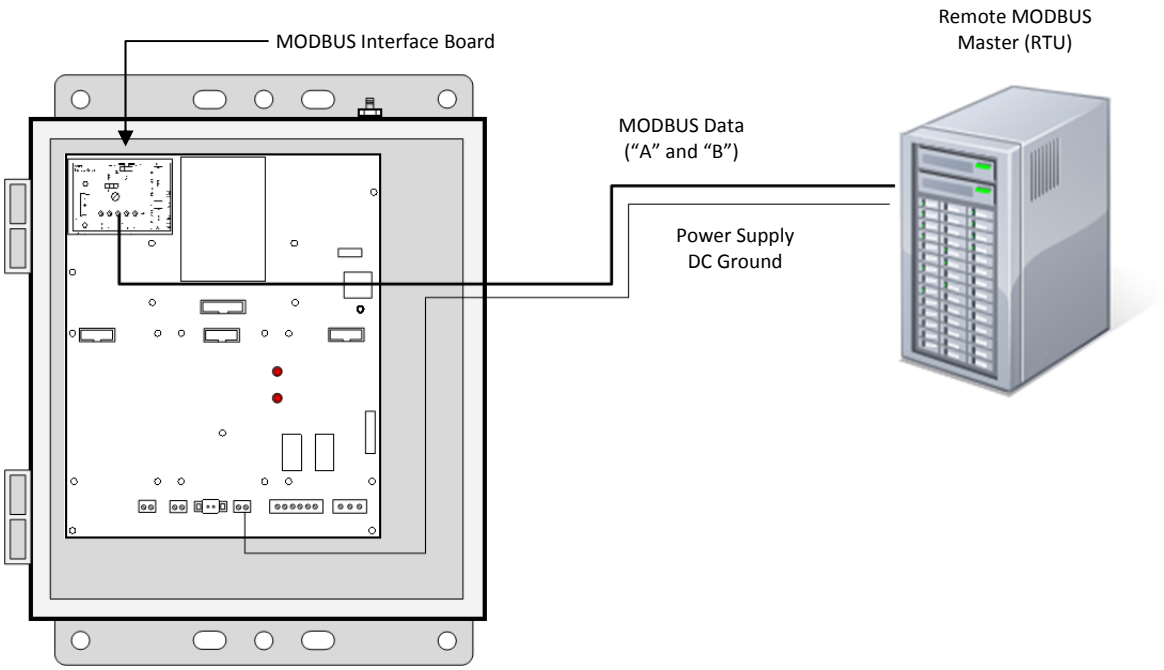


Figure 7-7: Wired MODBUS Slave Output

To setup the C2 Quad Protector for MODBUS slave, the following settings must be programmed:

- C2 Quad Protector must be set for MODBUS SLAVE
  (Find in *System – Communications – Serial Port Setup - Set for "MODBUS SLAVE"*)
- Program MODBUS slave address
  (Find in *System – Communications – Serial Port Setup – MODBUS Slave Address - Set for "xxx"*)

IMPORTANT: WHEN USING NON-ISOLATED RS-485 COMMUNICATIONS, BE SURE TO PROVIDE A HARD-WIRED CONNECTION BETWEEN DC POWER GROUND ON THE C2 QUAD PROTECTOR AND DC POWER GROUND ON THE REMOTE DCS. FOR MORE DETAILS, SEE GDS CORP "MODBUS WIRING GUIDELINES", #1200-0857.

WIRELESS MODBUS OUTPUT

Wireless MODBUS allows one or many C2 Quad Protector Controllers to function as wireless MODBUS *slaves* to a wireless MODBUS *master* such as a DCS or GDS Corp C64 Protector Controller equipped with a compatible radio modem. As in all GDS Corp wireless networks, one device must be designated as the Server and all others as Clients. No special configuration is required by the *master* or *slave* since this is a standard MODBUS network; however, all radios must have the same Hop Channel and System ID settings to communicate.

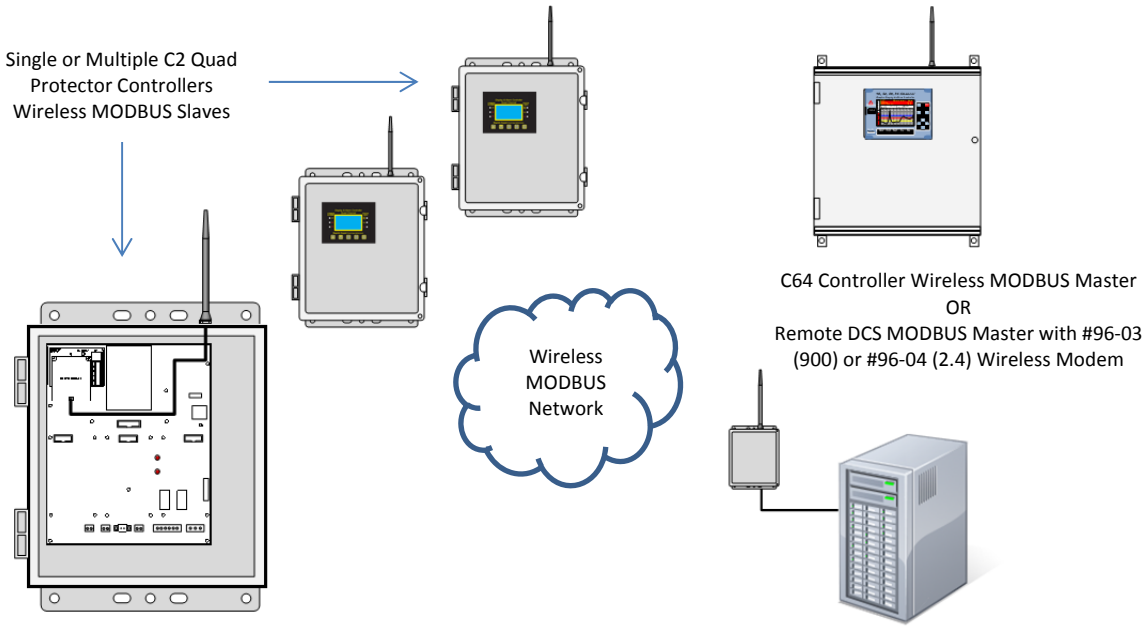


Figure 7-8: MODBUS Wireless Slave

To setup the C2 Quad Protector for wireless MODBUS slave, the following settings must be programmed:

- C2 Quad Protector must be set for Wireless MODBUS
  (Find in *System – Communications – Set for "Wireless MODBUS"*)
- C2 Quad Protector MODBUS Slave ID must be set
  (Find in *System – Communications – Slave ID – set for desired value)*
- Hop channel value programmed into the C2 Quad Protector radio must match network
  (Find in *System – Communications – Configure Radio – Set Hop Channel = xxx*)
- System ID values programmed into the C2 Quad Protector radio must match network
  (Find in *System – Communications – Configure Radio – Set System ID = xxx*)
- If C2 Quad Protector is not designated SERVER, then beacon MODE must be set to CLIENT
  (Find in *System – Communications – Configure Radio – Set Mode = Client*)

8 OPERATION & MAINTENANCE

C2 QUAD PROTECTOR USER CONTROLS

The user interface for the C2 Quad Protector consists of five buttons arranged across the bottom of the display. From left to right, these are “UP”, “DOWN / CAL”, “NEXT”, “EDIT” and “RESET”. With the cover in place, a magnetic wand is used to activate the buttons; with the cover removed there are physical pushbuttons that perform the same function. Press the “NEXT” key to switch display screens, or press the “EDIT” key to access the main user setup menu (See Section 9) Setup mode will exit automatically if no keys are pressed within 5 minutes. Press “DOWN / CAL” to initiate the built-in calibration process for any given channel (See Section 7). Press “RESET” to acknowledge (clear) an alarm.

A set of alarm indication LEDs appear on the left and right side of the LCD display. LEDs on the left indicate an alarm condition in any channel. Alarm LEDs will flash for new alarms and will become steady after an alarm RESET is commanded. Status LEDs on the right side indicate a key entry, an ‘in calibration’ condition and a FAULT condition.

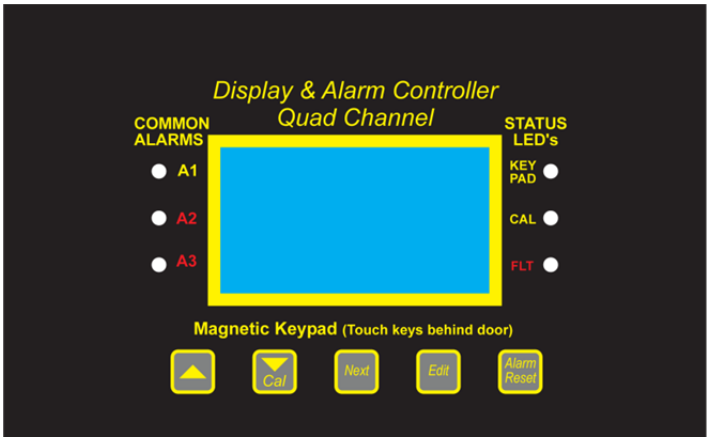


Figure 8-1: C2 Quad Protector Front Panel

C2 QUAD DISPLAY SCREENS

The C2 Quad Protector Controller LCD screen can show three different data display formats. The **Engineering Units** screen shows data from all four channels simultaneously, and includes a live reading, engineering units text and individual alarm status (“A1”, etc). The **Bar Graph** screen also shows all four channels of data in real time using individual real-time bar graphs with ‘tick mark’ indicators for alarm levels. In addition, the **Trend Screen** can be used to view the most recent 30 minute trend for any specific channel. Press the “NEXT” button to switch screens (See Fig. 6-2).

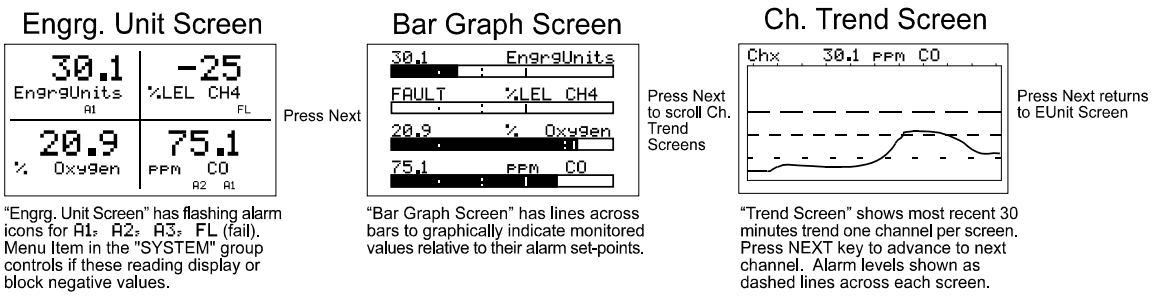


Figure 8-2: C2 Quad Protector Data Display Screens

ENGINEERING UNIT SCREEN

The C2 Quad Protector Engineering Unit screen shown at left in Figure 8-2 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.

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.

TREND SCREEN

The ST-90 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.

NORMAL MAINTENANCE

Normal maintenance for the C2 Quad Protector controller primarily involves checking the display for alarm or communications problems. A periodic inspection of the interior is recommended to determine if water or dust is entering the enclosure.

GDS Corp recommends a full 'end to end' test be performed periodically, where gas is applied to the sensor and the desired output strobe or horn operation is confirmed.

9 LOCAL CALIBRATION

The built-in CAL MODE is designed to make calibration quick, easy and error free for wired devices that do not provide an independent means of calibration. Examples include the GDS-49 Toxic Sensor Transmitter, GDS-50 Combustible Sensor Transmitter or GDS-48 Remote Bridge Sensor.

IMPORTANT: IF A REMOTE DEVICE HAS ITS OWN MEANS OF CALIBRATION (EX: GASMAX II OR GASMAX EC), DO NOT USE THE BUILT-IN CALIBRATION MODE.

During calibration, the (optional) 4-20mA outputs transmit 1.5mA during CAL MODE and 4mA during CAL DELAY to prevent remote alarms In addition, local alarm relays are inhibited. 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.

- Before you begin, verify that you have the appropriate zero air and calibration gas and that the pre-programmed Cal Span Value matches the gas concentration.
- 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.
- 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.
- If the ZERO calibration is successful, CAL MODE automatically proceeds to the SPAN check.
- Apply the SPAN calibration standard that matches the pre-programmed as the Cal Span Value. *After the reading is stable, press the EDIT key* to perform a SPAN calibration.
- If the SPAN calibration is successful, the display flashes "REMOVE CAL GAS" and starts the CAL DELAY.
- CAL MODE will be complete after the end of the CAL DELAY.

The flow chart in Figure 7-1 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.

Set Unity Gain may be used at any time to cancel incorrect calibrations and start again. Unity means Offset = 0.00 and Gain = 1.00.

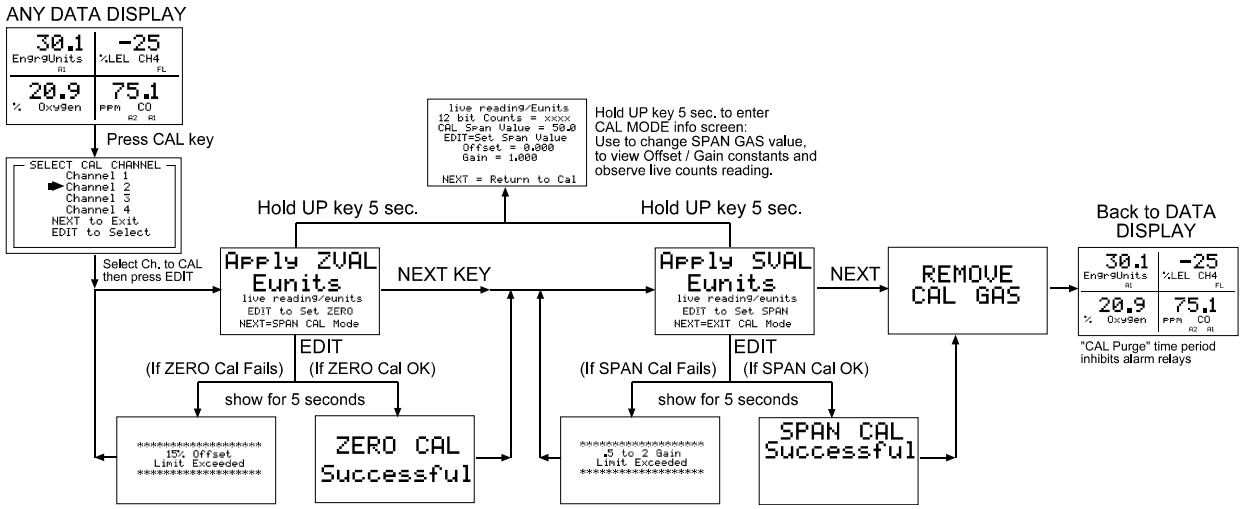


Figure 9-1: C2 Quad Protector Calibration Flowchart

10 WIRELESS OPERATION

WIRELESS RECEIVER MODE

Wireless Receiver mode is exclusively for wireless communication with GDS Corp wireless sensor transmitters, including the GASMAX ECx and GASMAX TX. In Wireless Receiver mode the radio is installed on the C2 Quad motherboard and receives input data from up to four wireless gas monitors. Wired and wireless inputs may be mixed between the C2 Quad Protector's four channels by setting the INPUT TYPE option in the ANALOG SETUP menu on a channel-by-channel basis.

GDS Corp wireless gas monitors utilize a frequency hopping spread spectrum (FHSS) wireless digital network to maintain communications between a central controller or system manager and remote GASMAX monitors. FHSS technology uses a radio signal that 'hops' from frequency to frequency in a predetermined pattern. Only radios whose receivers are in synchronization with the designated 'hop' pattern will receive or transmit data. This eliminates interference and allows multiple radio networks to exist in the same physical location.

Each GASMAX monitor periodically transmits a data packet containing information on gas concentration, battery voltage and alarm status. These transmissions normally occur on 5 minute intervals, but increase to a rate of one packet every six seconds if gas is detected. The C2 Quad Protector monitors these transmissions and activates internal alarm relays if any of the GASMAX monitors show an alarm condition. A separate Communications Error relay is activated if one or more of the GASMAX monitors fail to transmit a data packet within 18 minutes (after approximately three 5-minute cycles).

In any network, one device is designated as the 'server' and transmits the synchronizing beacon signal. Client transceivers listen for this beacon and upon hearing it will indicate **In-Range** with the LED on the radio modem board and synchronize their transmissions with the Server. Each network should consist of only one Server. The Server must be in a powered location and typically should be centrally located since all Clients must receive the beacon in order to communicate.

WIRELESS MODBUS MODE

Wireless MODBUS allows one or many C2 Quad Protector Controllers to function as wireless MODBUS *slaves* to a wireless MODBUS *master* such as a DCS or GDS Corp C64 Protector Controller equipped with a compatible radio modem. As in all GDS Corp wireless networks, one device must be designated as the Server and all others as Clients. All radios must have the same Hop Channel and System ID settings to communicate.

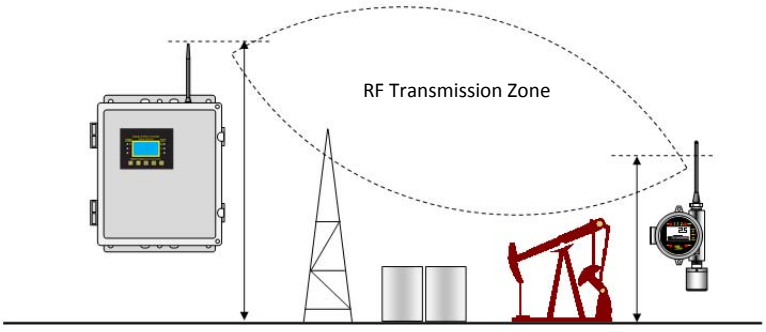
SPECIFYING A WIRELESS SYSTEM

FFSH radio modules for both 900 MHz and 2.4 GHz are available. For North America, the 900 MHz license-free band offers higher (and adjustable) transmit power, longer range and a greater ability to 'see' around obstacles. Radios utilizing 2.4 GHz are usable world-wide and are often more resistant to interference from existing radio sources. A decision on which band to choose should be based on local regulations, physical location, maximum transmission distance, existing RF installations and obstacles that may prevent 'line of sight' reception.

IMPORTANT: CHOICE OF FREQUENCY IS MADE AT TIME OF ORDER. SYSTEMS CONFIGURED FOR 900 MHZ CANNOT BE FIELD UPGRADED TO 2.4 GHZ AND VICE-VERSA.

TRANSMISSION DISTANCE

The distance that wireless signals can travel is dependent on transmitter power, receiver sensitivity and signal loss due to range or obstacles in the path of the RF signal. For best performance, the combined height of the transmitter antenna and receiver antenna should exceed the diameter of the RF Transmission Zone (see Fig. 10-1) and at least 60% of the area inside the zone should be free of obstacles. Although both 900 MHz and 2.4 GHz signals can travel around or through most towers or buildings, structures such as large metal tanks or solid metal buildings may attenuate the signal to the point where reception is marginal.



Combined Antenna Height		
Distance	900 MHz	2.4 GHz
100 Ft	10' / 3m	6' / 2m
500 Ft	22' / 7m	15' / 5m
1000 Ft	30'/ 10m	20' / 6m
3000 Ft	54' / 17m	N/A

Figure 10-1: RF Transmission

Raising the antenna at either end of the path will improve signal strength and reduce transmission errors. GDS Corp recommends placing the C2 Quad Protector Controller at least 6 feet above the surrounding terrain, and even more if possible. However, note that the standard antenna transmits its maximum signal

strength in a relatively flat 'donut-shaped' pattern which may affect the performance of GASMAX ECx monitors located in close proximity to an elevated C2 Quad Protector.

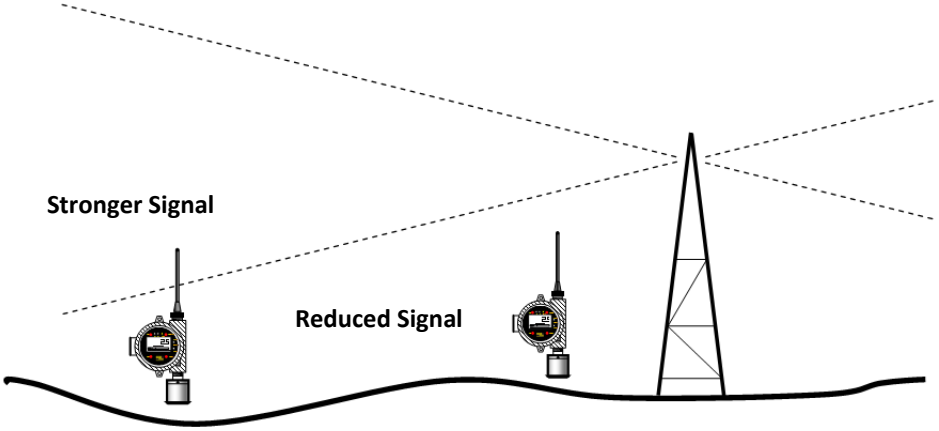


Figure 10-2: Effect of GASMAX Proximity to C2 Quad Protector

When mounting the C2 Quad Protector Controller, take care to keep the antenna away from flat metal surfaces. Placing the antenna within 12 to 18 inches of a solid metal wall or close-pattern mesh structure will disturb the antenna's radiation pattern and reduce the overall performance of the system. Mounting on non-metallic surfaces such as wood, fiberglass or masonry will have no effect. It is always best to mount the C2 Quad such that the antenna has a clear view around a full 360 degree circle.

MONOPOLE AND COLLINEAR ANTENNAS

Monopole "rubber duck" antennas are the most commonly used antennas for portable and semi-portable equipment where extreme range or directional reception is required. When mounted vertically, they provide good 'omnidirectional' reception and transmission from all horizontal directions, and are generally rugged and when sealed properly against moisture can provide years of quality service.

Collinear antennas are more sophisticated and combine several vertical antennas that operate in parallel to increase signal gain and focus the reception pattern in a more horizontal plane.

Rubber duck and collinear antennas provide best performance when installed with at least 1 to 2 "wavelengths" away from walls or steelwork. Since wavelength proportional to frequency, 900 MHz signals have a wavelength to approximately 12 inches and 2.4 GHz signals have a wavelength of about 3 inches**. Therefore, 900 MHZ antennas should be installed with at least 2 feet of clearance and 2.4GHz antennas at least 6 inches of clearance from walls or structures.** Antennas may be mounted with less clearance but output will be reduced; this may not matter if the distances involved are short. It is important the antenna mounting bracket to well connected to "earth" or "ground" for good lightning surge protection.

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. Yagi antennas 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 receiver / controller to have an omni-directional antenna (such as a collinear) and the remote units to have Yagi directional antennas. In this case, as the omni-directional 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 Yagi antennas 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 antenna has drainage holes in the dipole element, do not mount the antenna with the drainage holes covered or facing up.

COAXIAL CABLES

If a coax cable connects to the antenna via connectors, it is very important to weatherproof the connection using #1000-2314 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 (#1000-2314), 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.

SURGE PROTECTION & GROUNDING

Voltage surges can enter the C2 Quad Protector 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 C2 Quad Protector 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.

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 C2 Quad Protector 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 C2 Quad Protector Controller. Antennas are normally mounted to a metal bracket which should be grounded to the C2 Quad Protector Controller 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 coaxial lightning arrestors are recommended to further minimize the effect of surge current in the inner conductor of the coax cable.

Coaxial lightning arrestors 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 earth ground connections will provide adequate protection without a lightning arrestors.

GDS Corp always recommends that a wireless survey be completed at the site to ensure the integrity of the wireless communications link. Special care should be taken to account for moveable obstacles such as cranes, railroad cars, trucks, containers, and any other large 'structures' that could end up being placed – temporarily – in a location that blocks the wireless signal.

11 USER SETUP MENUS

All C2 Quad Protector setup variables are stored in non-volatile memory and can be modified by the end user to match a particular application. Press the EDIT key at any time to access the main SETUP menu.

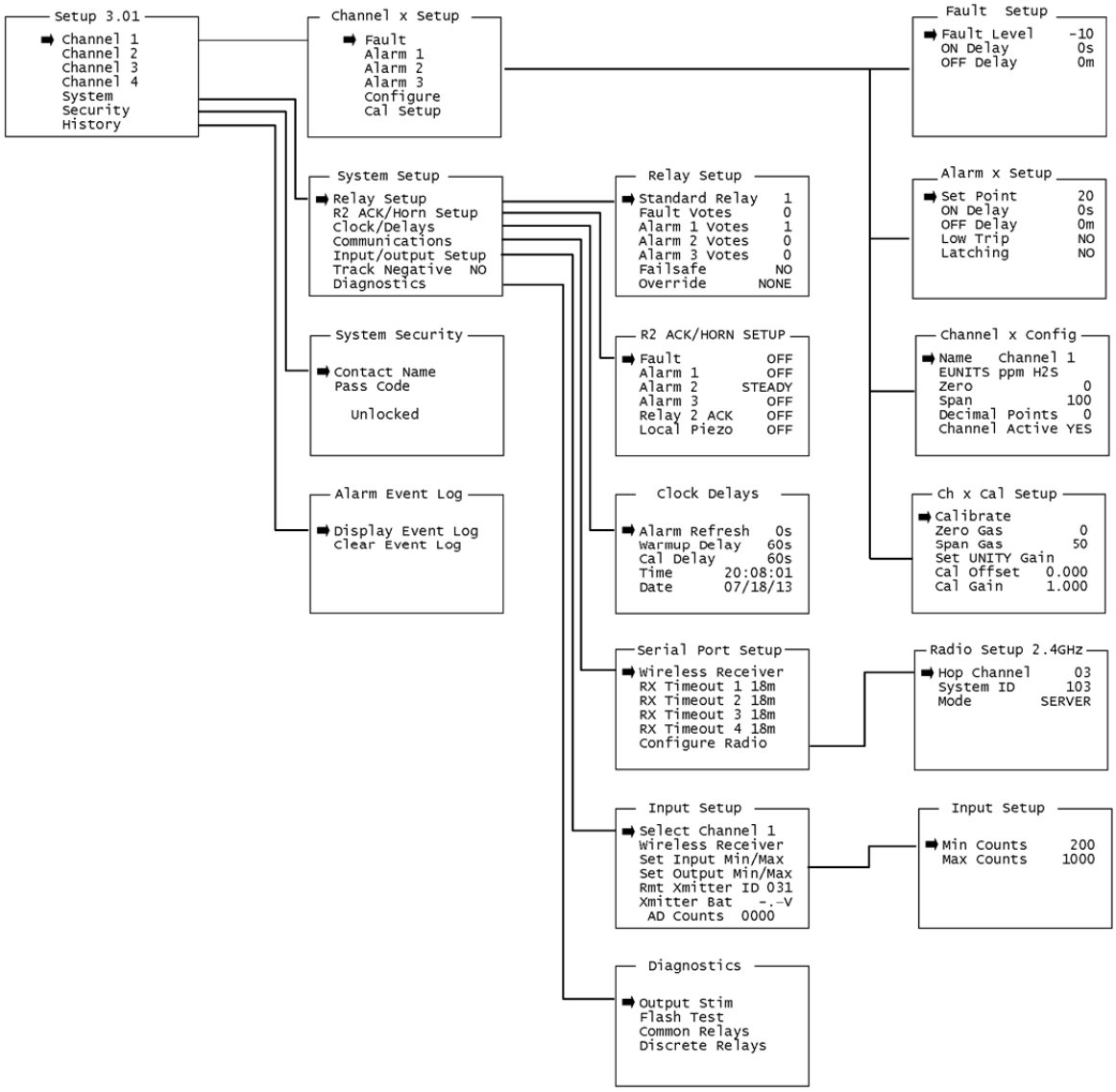


Figure 11-1: C2 Quad Protector Controller Main Menu Tree

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 and can be toggled by pressing the EDIT key. Others, such as Channel ID and Eunits fields may have many ASCII character possibilities. 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.

MAIN SETUP MENU

The SETUP menu 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 firmware revision. Use the **UP/DOWN** keys to move the pointer to the desired menu and press the **EDIT** key to select.

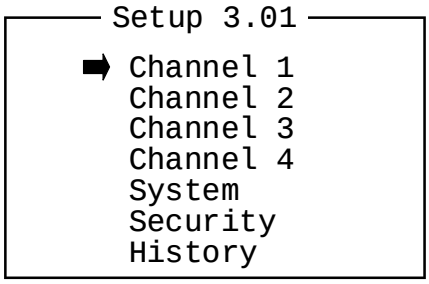


Figure 11-2: Main Setup Menu

CHANNEL CONFIGURATION MENUS

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

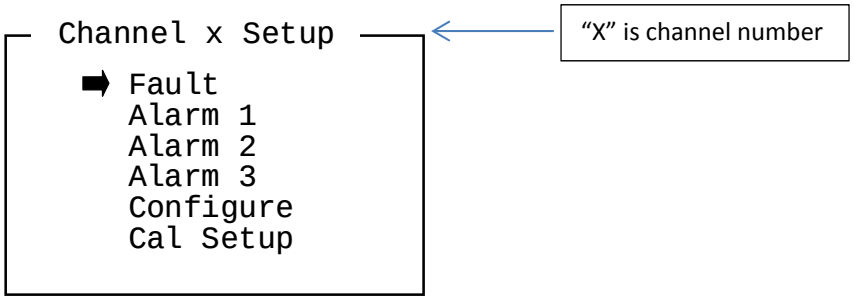


Figure 11-3: Channel Menu

Alarm 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 since their configuration menus are identical. The Fault

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

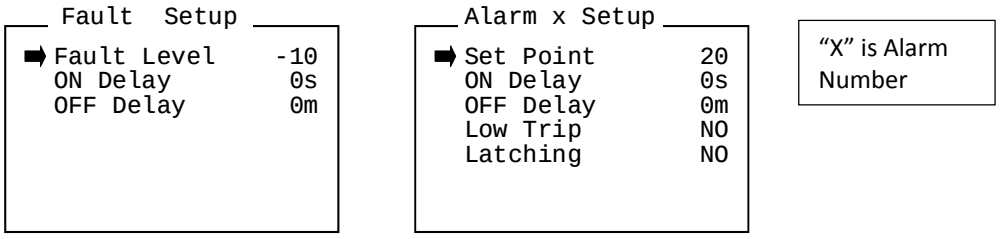


Figure 11-4: Alarm Menu

Set Point is entered in engineering units and determines the value where the alarm trips. For example, if a channel monitors 0-50 ppm H2S 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.

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.

Channel Configure: Allows the user to program the Name and EUNIT 10 digit ASCII fields, defines the measurement range with ZERO & SPAN entries, sets the number of Decimal Points visible and determines if the channel is Active.

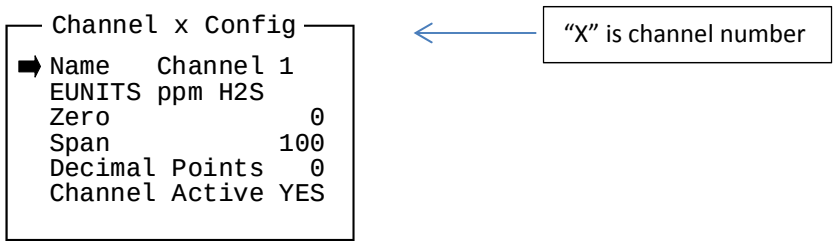


Figure 11-5: Channel Configuration Menu

Name and Eunits: Allows the user to enter 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.

Zero / Span: Allows the user to configure the measurement range displayed. For example, if a channel's input is 4-20mA from a transmitter monitoring 0 to 10 ppm 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.

Decimal Points: Resolution of the displayed channel value is configured 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 100 ppm and two decimal points reads 0.00 at 0 ppm 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 0 ppm 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, 0 ppm reads 0 and 100 ppm reads 100.

Channel Active: OFF causes the controller to not process inputs applied to this channel. As a result, no alarms are tripped nor are data displayed. Inactive channels have a line drawn through them on the Setup screen to indicate it is turned off.

CAL Setup Menu: The C2 Quad Protector 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 is to be performed at another transmitter or monitoring device, the local CAL MODE feature should not be used.

CAL SETUP menu allows entering the correct zero and span gas set-point values needed to calibrate the channel. These are entered in the same engineering units as input range.

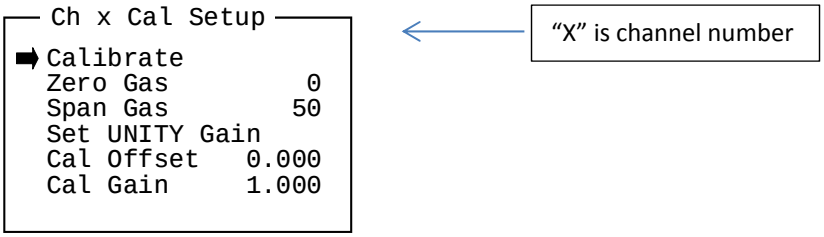


Figure 11-6: Calibration Setup Menu

Zero Gas: Value to be used for lower calibration point. For gas detectors, this value is most always set to zero. However, in some cases, for instance oxygen sensors, the lower calibration point may be set for 2% or 5% instead of 0%.

Span Gas: Value to be used for upper calibration point. GDS Corp recommends that span calibration be set for a point between 25% and 75% of full scale.

Set UNITY Gain: Clears the results from all previous calibrations and resets CAL Gain to 1.000 and CAL Offset to 0.000. Useful if installing a new sensor or if a recent calibration was done incorrectly.

SYSTEM SETUP MENUS

This menu covers items that are system specific instead of channel-specific, and include standard and optional relay setup, real-time clock and programmable delays, MODBUS ports and input/output setup parameters.

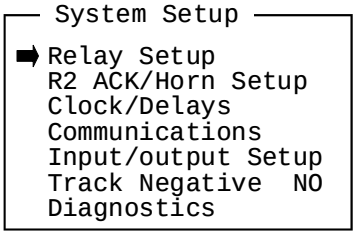


Figure 11-7: System Setup Menu

Relay Setup Menu: The menu shown allows the user to configure both the two standard motherboard relays and the six optional relays on the #10-0222 discrete relay option board. 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 if installed).

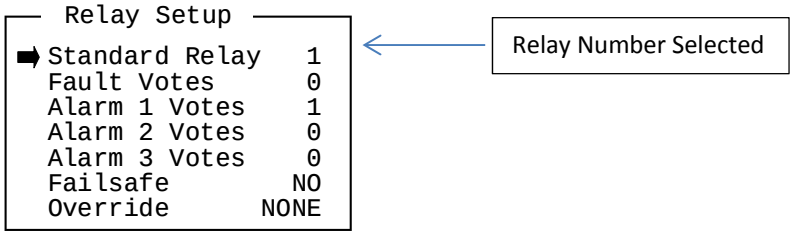


Figure 11-8: Relay Setup Menu

Votes Menus: The Fault, Alarm 1, Alarm2 and Alarm 3 Votes menu adds additional "voting" flexibility by controlling channel alarm combinations that will trip the selected relay. Each Votes entry establishes the quantity of channel alarms that must be active to trigger the relay. As illustrated above, Standard Relay 1 activates when any 2 channels have Alarm 1 active, OR any one channel has an Alarm 2 condition, OR if Channel 1 Alarm 2 alarm is active. Fault Votes and Alarm 3 Votes values are 0 therefore Fault and Alarm 3 conditions will not affect this relay.

Failsafe: 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: The 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.

R2 ACK/Horn Setup Menu: The Relay 2 ACK / Horn Setup menu controls how each alarm type will affect the onboard horn driver 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.

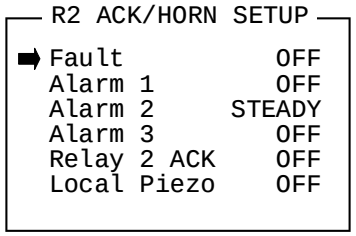


Figure 11-9: R2 ACK/HORN Setup Menu

Relay 2 ACK: 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: Local Piezo set to ON causes the tiny local piezo adjacent to the LCD to mimic the J2 horn output.

Clock Delays Menu: The C2 Quad includes timers that accommodate inputs that may require varying times to stabilize after power is applied or after calibration is complete.

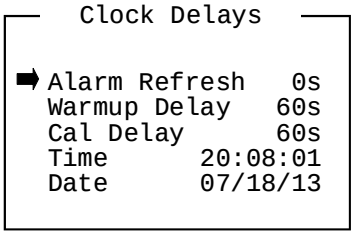


Figure 11-10: Clock / Delays Menu

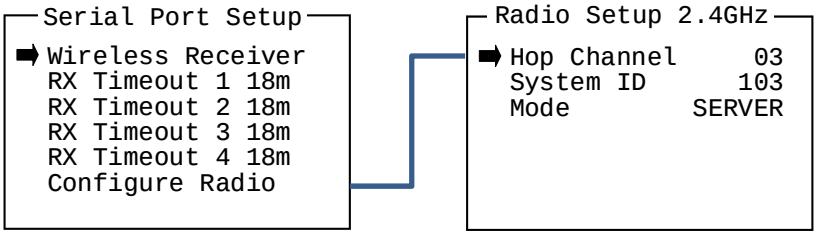
Alarm Refresh Delay: Alarm Refresh menu allows reactivation of Acknowledged alarms after the time period expires. This feature is used primarily to restart audible alarm devices after having been silenced by an acknowledge function (via serial port or pressing the Alarm Reset button). An entry of 0 seconds effectively disables the Alarm Refresh function.

Warm-Up Delay: Warm Up Delay determines how long alarm relays remain disabled after power is applied.

Cal Delay: Cal Delay determines how long alarm relays are inhibited after completing a calibration.

Time and Date: The C2 Quad Protector controller 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 as 18:00:00.

Comm Setup Menu: The C2 Quad Protector includes an optional RS-485 serial MOBDUS port that can be configured for MODBUS Master or MODBUS Slave.



If an RS-485 Serial MODBUS interface card is installed, the following menu items are available:

Modbus Master 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 allows the communication port to be polled by any Modbus master device using the MODBUS RTU protocol. The slave port is addressable, allowing multiple controllers to be connected to a single RS-485 cable. A converter is available to add Ethernet TCP/IP network capability.

Poll Rate sets the time between each MODBUS master transmission. Default is 250 milliseconds.

Timeout set the maximum time that the C2 Quad Protector will wait for a response from a given MODBUS slave device. A COMM ERROR is indicated if the number of sequential missed replies exceeds a pre-programmed value.

If a wireless radio module is installed, the following menu items are available:

Configure Radio allows the user to set the wireless radio parameters

Hop Channel for 900 MHz radios may be set from 1-32 and assigns the pseudo-random radio frequency hopping pattern. Hop Channel settings for 2.4 GHz radios may be set from 0 to 39, where the lower 20 settings include the EU "low band" frequencies from 2.408 through 2.435 GHz, and the upper 20 settings include the EU "high band" frequencies from 2.444 through 2.472 GHz. Different Hop Channel designations may be used to prevent radios in one network from listening to transmissions of another. Installations with more than one Server network should also have different hop channels for each network. **All devices in the same network must have identical hop channel settings to communicate.**

System ID may be set from 1-255 and is similar to a password character or network number and makes network eavesdropping more difficult. **All devices the same network must have identical system ID values to communicate.**

TX Power for 900 MHz models may be set to 10 mW, 200 mW, 400 mW or 1 watt. **Unless there are gas monitors in the immediate vicinity, TX Power should be set for 1 watt.** For 2.4 GHz radios, TX Power is fixed at 50 mW.

Mode may be set for CLIENT or SERVER. There should only be one SERVER in any given network. The radio designated as SERVER should be powered and should be within range of all radios on the network.

Wireless Receiver or Wireless MODBUS selects radio function. Wireless Receiver is used when receiving data from GASMAX TX or GASMAX ECx wireless gas monitors. Wireless MODBUS is used if the C2 Quad Protector is part of a wireless MODBUS network.

If Wireless Receiver is selected, the following menu item is available:

RX Timeout determines the maximum amount of time that can pass without the successful reception of a transmitted gas packet before a Communications Error (COM ERR) is generated. A different value can be programmed for each channel.

If Wireless MODBUS is selected, the following menu item is available:

Slave ID sets the C2 Quad Protector's MODBUS slave ID value. Remote MODBUS master devices use this slave ID value to address this specific C2 Quad.

Input / Output Setup Menu: The system Input / Output menu allow setting the input A/D (analog to digital) counts and the output D/A (digital to analog) counts for each of the four channels as well as the input type (analog or wireless). 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.

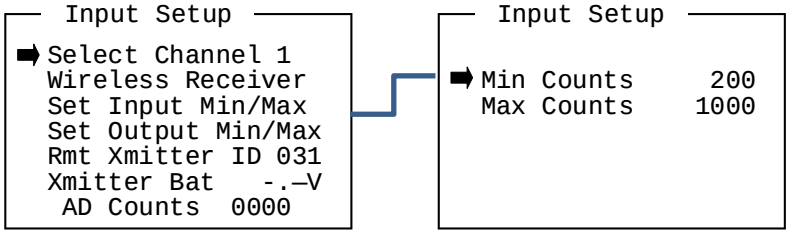


Figure 11-11: Analog Setup Menu

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.

INPUT Min / Max Counts entries in the INPUT SETUP menus define the input A/D counts range for Zero and Span readings. 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.

OUTPUT Min / Max Counts entries in the OUTPUT SETUP menus define the output D/A counts range for Zero and Span readings. OUTPUT SETUP menus are only used when the C2 Quad Protector is equipped with the optional 4-20mA output option. 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.

Input Type selects the source of the channel's input data. Options include ANALOG and WIRELESS.
If setting is WIRELESS the following two items are shown:

RMT Xmitter ID sets the value of a remote MODBUS or wireless device "Remote ID" associated with the currently selected channel

Xmitter Batt indicates the battery voltage of a remote GASMAX TX or GASMAX ECx wireless gas monitor currently associated with this channel.

Diagnostics Menu: The Diagnostics menu provides an easy way to activate alarms or test controller subsystems.

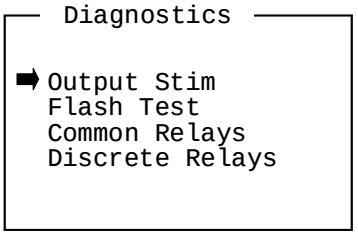


Figure 11-12: Diagnostics Menu

Output Stim: Used to force the 4-20mA output channels to specific values without applying gas or input stimulus. Useful when performing initial system checkout or when troubleshooting.

Flash Test: Tests non-volatile FLASH memory.

Common Relays: Used to activate either of the two standard SPDT relays.

Discrete Relays: Used to activate one of the six optional discrete relays if the discrete relay board is installed.

NOTE: ALARM PROCESSING DOES NOT OCCUR WHILE IN DIAGNOSTICS MODE!

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.

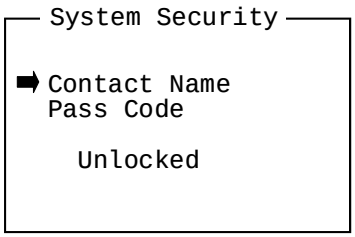


Figure 11-13: Security Menu

HISTORY MENU

Display event log will bring up the Event Log on the LCD display. The Event Log shows date in "mm/dd/yy" format, time in "hh/mm/ss" format and the associated event. If the event is channel specific then "CHx" will precede the event. For example, "071713 16:41:31 CH1 A2I" indicates that on July 17th, 2013, at 4:16:31 pm, Channel 1 Alarm 2 was recorded as "IN".

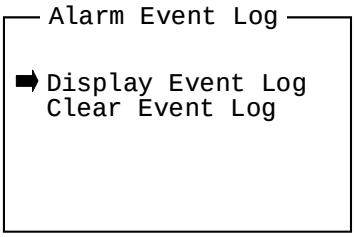


Figure 11-14: Alarm Event Menu

Use the UP and DOWN keys to scroll through the Event Log. To exit the Event Log press the NEXT key.

Clear Event Log will clear all data from the Event Log. There is no 'are you sure' message.

12 MODBUS REGISTERS

The C2 Quad Protector features a full complement of user-accessible MODBUS registers to provide a complete snapshot of the controller's configuration and current status. This includes all real-time data, preset zero, span and calibration values and user-programmable text.

LIST OF C2 QUAD MODBUS VARIABLES

Variable Name	Alias	Read FC	Write FC	Notes
Alarm Ack / Reset	*2001*	*1*	*5*	*Reverts to FALSE after TRUE write*
Ch 1 Fault	12001	2	N/A	Modbus Coils (read only)
Ch 1 Alarm 1	12002	2	N/A	
Ch 1 Alarm 2	12003	2	N/A	
Ch 1 Alarm 3	12004	2	N/A	
Ch 2 Fault	12005	2	N/A	
Ch 2 Alarm 1	12006	2	N/A	
Ch 2 Alarm 2	12007	2	N/A	
Ch 2 Alarm 3	12008	2	N/A	
Ch 3 Fault	12009	2	N/A	
Ch 3 Alarm 1	12010	2	N/A	
Ch 3 Alarm 2	12011	2	N/A	
Ch 3 Alarm 3	12012	2	N/A	
Ch 4 Fault	12013	2	N/A	
Ch 4 Alarm 1	12014	2	N/A	
Ch 4 Alarm 2	12015	2	N/A	
Ch 4 Alarm 3	12016	2	N/A	
Standard Relay 1	12017	2	N/A	
Standard Relay 2	12018	2	N/A	
Optional Relay 1	12019	2	N/A	
Optional Relay 2	12020	2	N/A	
Optional Relay 3	12021	2	N/A	
Optional Relay 4	12022	2	N/A	
Optional Relay 5	12023	2	N/A	
Optional Relay 6	12024	2	N/A	
Input Fault Relay	12025	2	N/A	

Product ID	30001	4	N/A	Read Only, returns “1000”
Firmware Version	30002	4	N/A	Read Only, returns version / 100
Ch 1 D2A Post CAL	31001	4	N/A	12 bit value; 800 = 4mA, 4000 = 20mA
Ch 2 D2A Post CAL	31002	4	N/A	12 bit value; 800 = 4mA, 4000 = 20mA
Ch 3 D2A Post CAL	31003	4	N/A	12 bit value; 800 = 4mA, 4000 = 20mA
Ch 4 D2A Post CAL	31004	4	N/A	12 bit value; 800 = 4mA, 4000 = 20mA
Ch 1 Status Word	31005	4	N/A	See Channel Status bit definition
Ch 2 Status Word	31006	4	N/A	See Channel Status bit definition
Ch 3 Status Word	31007	4	N/A	See Channel Status bit definition
Ch 4 Status Word	31008	4	N/A	See Channel Status bit definition
System Status Word	31009	4	N/A	See System Status bit definition
Alarm Status Word	31010	4	N/A	See Alarm Status bit definition
LED Blink Status Word	31011	4	N/A	See LED Blink bit definition
Relay Status Word	31012	4	N/A	See Relay Status bit definition
Sympathy Register	40004	N/A	6	Contact factory
Ch 1 User Info	40401 - 40405	3	N/A	10 ASCII characters (2 per register)
Ch 2 User Info	40406 – 40410	3	N/A	10 ASCII characters (2 per register)
Ch 3 User Info	40411 - 40415	3	N/A	10 ASCII characters (2 per register)
Ch 4 User Info	40416 – 40420	3	N/A	10 ASCII characters (2 per register)
Ch 1 EUNITS	40421 – 40425	3	N/A	10 ASCII characters (2 per register)
Ch 2 EUNITS	40426 – 40430	3	N/A	10 ASCII characters (2 per register)
Ch 3 EUNITS	40431 – 40435	3	N/A	10 ASCII characters (2 per register)
Ch 4 EUNITS	40436 – 40440	3	N/A	10 ASCII characters (2 per register)
Ch 1 ASCII Reading	40441 – 40443	3	N/A	6 ASCII characters (2 per register)
Ch 2 ASCII Reading	40444 – 40446	3	N/A	6 ASCII characters (2 per register)
Ch 3 ASCII Reading	40447 – 40449	3	N/A	6 ASCII characters (2 per register)
Ch 4 ASCII Reading	40450 – 40452	3	N/A	6 ASCII characters (2 per register)
Firmware Version	40453 – 40455	3	N/A	4 ASCII characters (2 per register)
Ch 1 Zero Real	41001	3	N/A	Real value without decimal point
Ch 1 Zero Divisor	41002	3	N/A	Divisor = 1, 10, 100 or 1000

Ch 1 Span Real	41003	3	N/A	
Ch 1 Span Divisor	41004	3	N/A	
Ch 1 Fault Real	41005	3	N/A	
Ch 1 Fault Divisor	41006	3	N/A	
Ch 1 Alarm 1 Real	41007	3	N/A	
Ch 1 Alarm 1 Divisor	41008	3	N/A	
Ch 1 Alarm 2 Real	41009	3	N/A	
Ch 1 Alarm 2 Divisor	41010	3	N/A	
Ch 1 Alarm 3 Real	41011	3	N/A	
Ch 1 Alarm 3 Divisor	41012	3	N/A	
Ch 2 Zero Real	41013	3	N/A	Real value without decimal point
Ch 2 Zero Divisor	41014	3	N/A	Divisor = 1, 10, 100 or 1000
Ch 2 Span Real	41015	3	N/A	
Ch 2 Span Divisor	41016	3	N/A	
Ch 2 Fault Real	41017	3	N/A	
Ch 2 Fault Divisor	41018	3	N/A	
Ch 2 Alarm 1 Real	41019	3	N/A	
Ch 2 Alarm 1 Divisor	41020	3	N/A	
Ch 2 Alarm 2 Real	41021	3	N/A	
Ch 2 Alarm 2 Divisor	41022	3	N/A	
Ch 2 Alarm 3 Real	41023	3	N/A	
Ch 2 Alarm 3 Divisor	41024	3	N/A	
Ch 3 Zero Real	41025	3	N/A	Real value without decimal point
Ch 3 Zero Divisor	41026	3	N/A	Divisor = 1, 10, 100 or 1000
Ch 3 Span Real	41027	3	N/A	
Ch 3 Span Divisor	41028	3	N/A	
Ch 3 Fault Real	41029	3	N/A	
Ch 3 Fault Divisor	41030	3	N/A	
Ch 3 Alarm 1 Real	41031	3	N/A	
Ch 3 Alarm 1 Divisor	41032	3	N/A	
Ch 3 Alarm 2 Real	41033	3	N/A	
Ch 3 Alarm 2 Divisor	41034	3	N/A	
Ch 3 Alarm 3 Real	41035	3	N/A	
Ch 3 Alarm 3 Divisor	41036	3	N/A	

Ch 4 Zero Real	41037	3	N/A	Real value without decimal point
Ch 4 Zero Divisor	41038	3	N/A	Divisor = 1, 10, 100 or 1000
Ch 4 Span Real	41039	3	N/A	
Ch 4 Span Divisor	41040	3	N/A	
Ch 4 Fault Real	41041	3	N/A	
Ch 4 Fault Divisor	41042	3	N/A	
Ch 4 Alarm 1 Real	41043	3	N/A	
Ch 4 Alarm 1 Divisor	41044	3	N/A	
Ch 4 Alarm 2 Real	41045	3	N/A	
Ch 4 Alarm 2 Divisor	41046	3	N/A	
Ch 4 Alarm 3 Real	41047	3	N/A	
Ch 4 Alarm 3 Divisor	41048	3	N/A	

CHANNEL STATUS WORD BIT DEFINITION

Channel Status Word	Bit 0	Reserved
	Bit 1	Alarm 1 Below (1), Alarm 2 Above (0)
	Bit 2	Alarm 2 Below (1), Alarm 3 Above (0)
	Bit 3	Alarm 3 Below (1), Alarm 3 Above (0)
	Bit 4	Wireless Input Selected
	Bit 5	Alarm 1 Latch (1), Alarm 3 not latch (0)
	Bit 6	Alarm 2 Latch (1), Alarm 3 not latch (0)
	Bit 7	Alarm 3 Latch (1), Alarm 3 not latch (0)
	Bit 8	Reserved
	Bit 9	Channel Disabled (1), Channel Active (0)
	Bit 10	Channel Cal Bit (1), Normal (0)
	Bit 11-15	Reserved

SYSTEM STATUS WORD BIT DEFINITION

System Status Word	Bit 0	Track Negative (1), do not display negative values (0)
	Bit 1	Wireless receiver mode (1), wireless MODBUS (0)
	Bit 2-14	Reserved
	Bit 15	Security Lock Enabled (1), not locked (0)

ALARM STATUS WORD BIT DEFINITION

Alarm Status Word	Bit 0	Ch 1 Fault (1 = active)
	Bit 1	Ch 1 Alarm 1
	Bit 2	Ch 1 Alarm 2

	Bit 3	Ch 1 Alarm 3
	Bit 4	Ch 2 Fault (1 = active)
	Bit 5	Ch 2 Alarm 1
	Bit 6	Ch 2 Alarm 2
	Bit 7	Ch 2 Alarm 3
	Bit 8	Ch 3 Fault (1 = active)
	Bit 9	Ch 3 Alarm 1
	Bit 10	Ch 3 Alarm 2
	Bit 11	Ch 3 Alarm 3
	Bit 12	Ch 4 Fault (1 = active)
	Bit 13	Ch 4 Alarm 1
	Bit 14	Ch 4 Alarm 2
	Bit 15	Ch 4 Alarm 3

LED BLINK STATUS WORD BIT DEFINITION

LED Blink Status Word	Bit 0	Ch 1 Fault (1 = blinking, 0 = steady)
	Bit 1	Ch 1 Alarm 1
	Bit 2	Ch 1 Alarm 2
	Bit 3	Ch 1 Alarm 3
	Bit 4	Ch 2 Fault (1 = blinking, 0 = steady)
	Bit 5	Ch 2 Alarm 1
	Bit 6	Ch 2 Alarm 2
	Bit 7	Ch 2 Alarm 3
	Bit 8	Ch 3 Fault (1 = blinking, 0 = steady)
	Bit 9	Ch 3 Alarm 1
	Bit 10	Ch 3 Alarm 2
	Bit 11	Ch 3 Alarm 3
	Bit 12	Ch 4 Fault (1 = blinking, 0 = steady)
	Bit 13	Ch 4 Alarm 1
	Bit 14	Ch 4 Alarm 2
	Bit 15	Ch 4 Alarm 3

RELAY STATUS WORD BIT DEFINITION

Relay Status Word	Bit 0	Standard Relay 1 (1 = energized, 0 = de-energized)
	Bit 1	Standard Relay 2 (1 = energized, 0 = de-energized)

	Bit 2	Optional Relay 1 (1 = energized, 0 = de-energized)
	Bit 3	Optional Relay 2 (1 = energized, 0 = de-energized)
	Bit 4	Optional Relay 3 (1 = energized, 0 = de-energized)
	Bit 5	Optional Relay 4 (1 = energized, 0 = de-energized)
	Bit 6	Optional Relay 5 (1 = energized, 0 = de-energized)
	Bit 7	Optional Relay 6 (1 = energized, 0 = de-energized)
	Bit 8	Common Fault (no relay, bit value only)
	Bit 9-15	Reserved

13 TROUBLESHOOTING GUIDE

C2 QUAD DISPLAY BLANK

- Lack of AC or DC power to the C2 Quad Protector
- Display / CPU board ribbon cable not plugged in
- Motherboard fuse blown or defective

CHANNEL DATA READINGS APPEAR INCORRECT

- Channel zero and span settings do not set to match sensor zero and span settings (if using 4-20mA input)
- Channel Min/Max counts settings not set properly (if using MODBUS). For example, GASMAX MODBUS output is 200 to 1000 counts; default C2 Quad input values are 400 to 2000 counts.
- Data input on wrong channel.

C2 QUAD COMM ERROR FOR ONE REMOTE WIRELESS GASMAX MONITOR

- GASMAX Hop Channel or System ID values do not match C2 Quad
- GASMAX not in range or not receiving Beacon signal
- C2 Quad channel Input / Output setup not programmed for GASMAX Remote ID
- GASMAX battery low or depleted

C2 QUAD COMM ERROR FOR ALL REMOTE WIRELESS GASMAX MONITOR

- Hop Channel and System ID not programmed properly
- Wireless radio mode not set for SERVER, or no SERVER present in the network
- Antenna malfunction or moisture in coaxial cable connections

C2 QUAD ALARM RELAY DOES NOT ACTIVATE

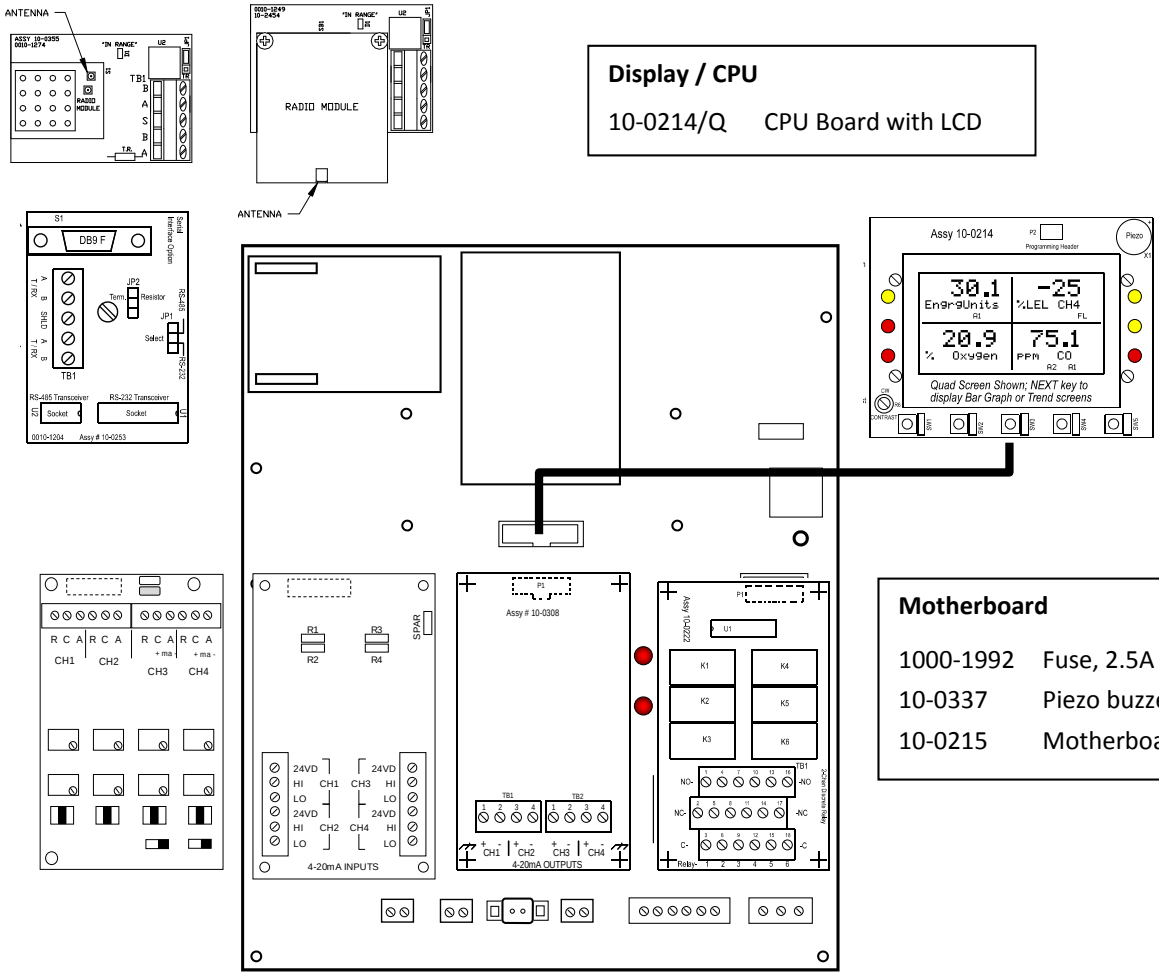
- Relay programming incorrect
- Channel alarm thresholds set improperly
- Relay set for FAILSAFE

14 SPARE PARTS

MODBUS / Wireless Options	
10-0253	RS-485 Serial Interface
10-0328	900 MHz radio module
10-0355	2.4 GHz radio module

Antenna	
1000-2189	900 MHz
1000-2300	2.4 GHz

Display / CPU	
10-0214/Q	CPU Board with LCD



Motherboard	
1000-1992	Fuse, 2.5A
10-0337	Piezo buzzer
10-0215	Motherboard Assy

Input boards	
10-0221/Q	Analog Input Board
10-0309	Bridge Input Board

Output boards	
10-0308	4-20mA Analog Output Board
10-0222	6X Discrete Relay Output Board

Figure 14-1: C2 Quad Protector Spare Parts

15 DRAWINGS AND DIMENSIONS

The C2 Quad Protector "Type 0" enclosure is a NEMA 4X polycarbonate wall mount *compact* enclosure designed for medium duty applications

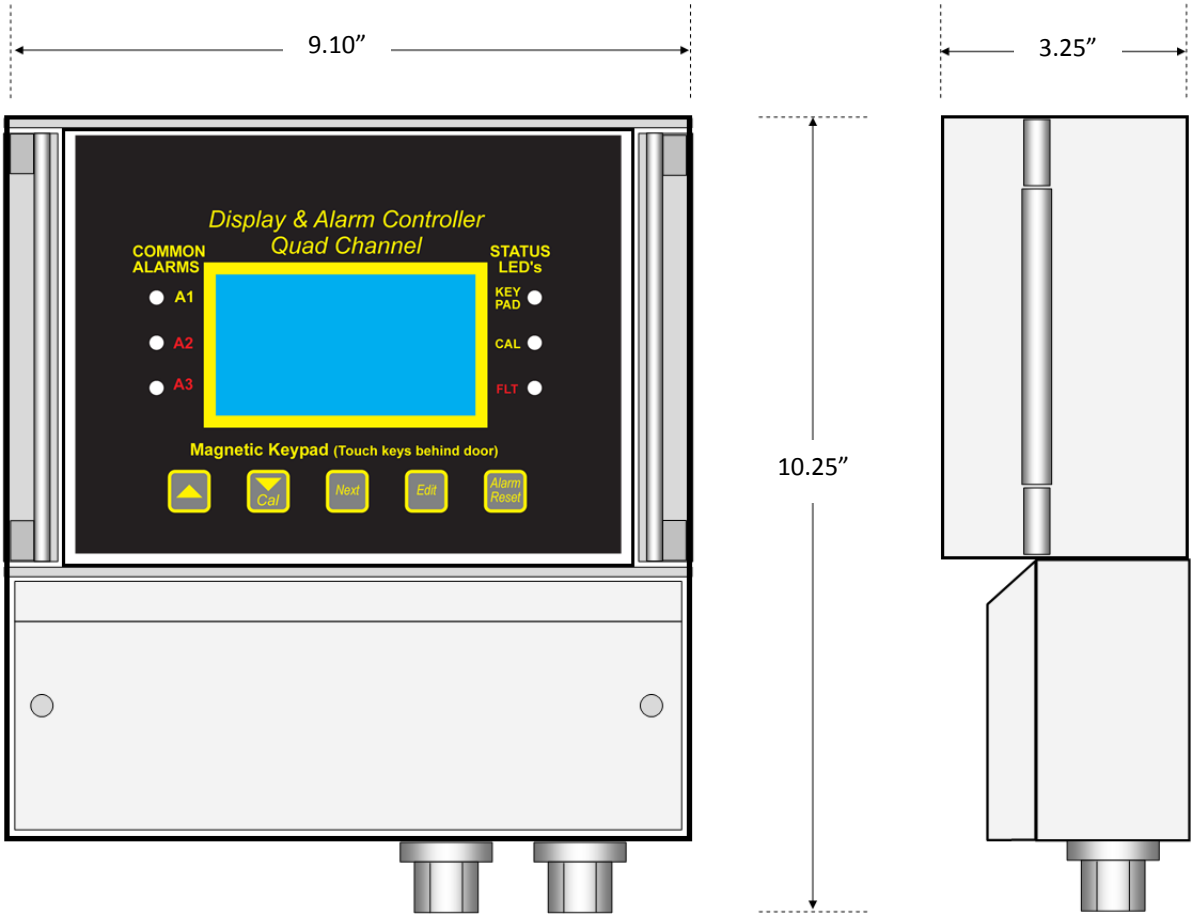


Figure 15-1: NEMA 4X Compact Enclosure

IMPORTANT: 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.

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.

The C2 Quad Protector "Type 1" enclosure is a NEMA 4X polycarbonate wall mount extended enclosure designed for medium duty applications.

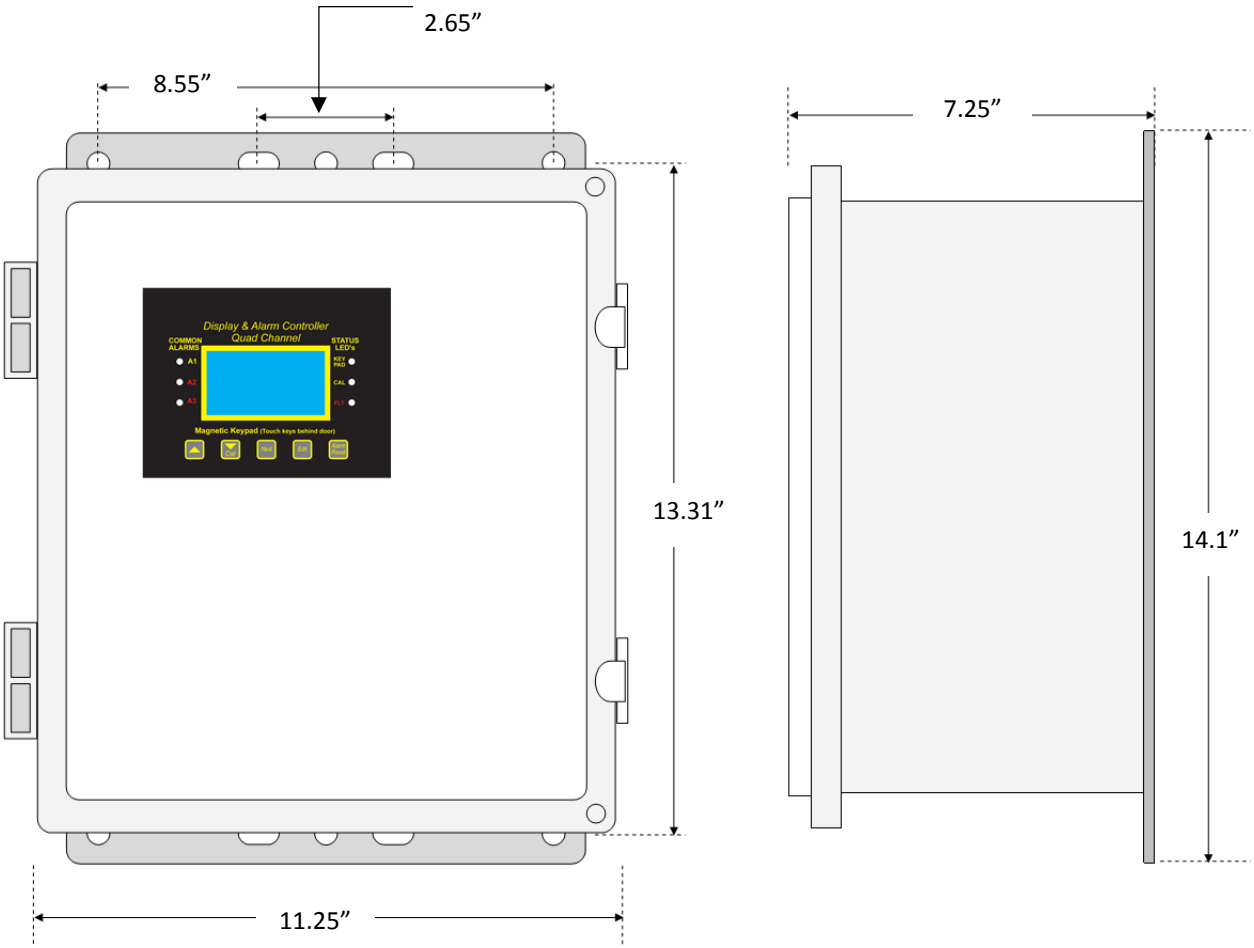


Figure 15-2: NEMA 4X Polycarbonate Enclosure

IMPORTANT: 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.

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.

The C2 Quad Protector "Type 2" enclosure is a NEMA 4X Painted Carbon Steel wall mount extended enclosure designed for non-corrosive installations.

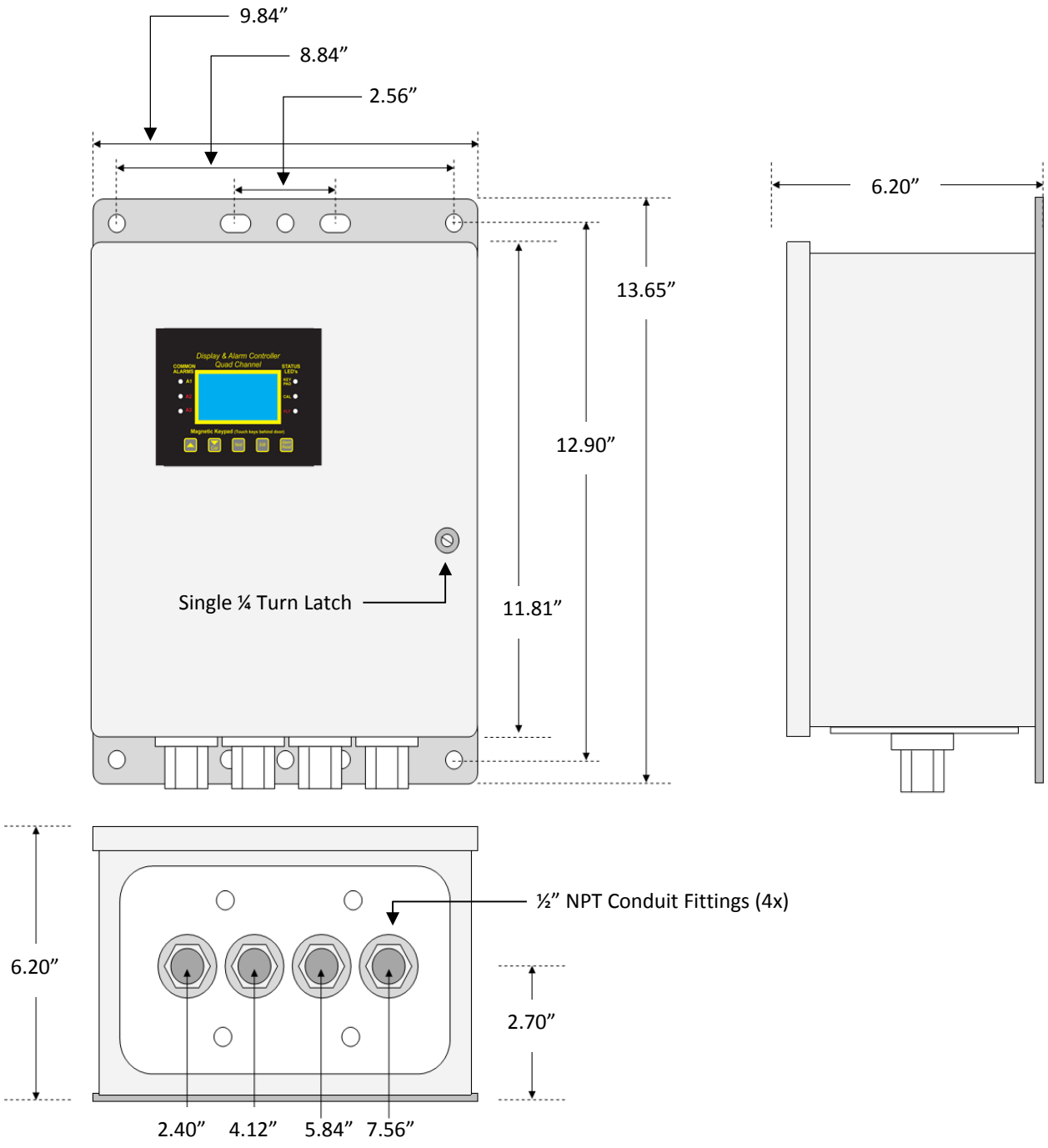


Figure 15-3: NEMA 4X Painted Steel & Stainless Steel Wall Mount

The C2 Quad Protector "Type 3" enclosure is a 316 Stainless Steel NEMA 4X wall mount extended enclosure designed for corrosive installations.

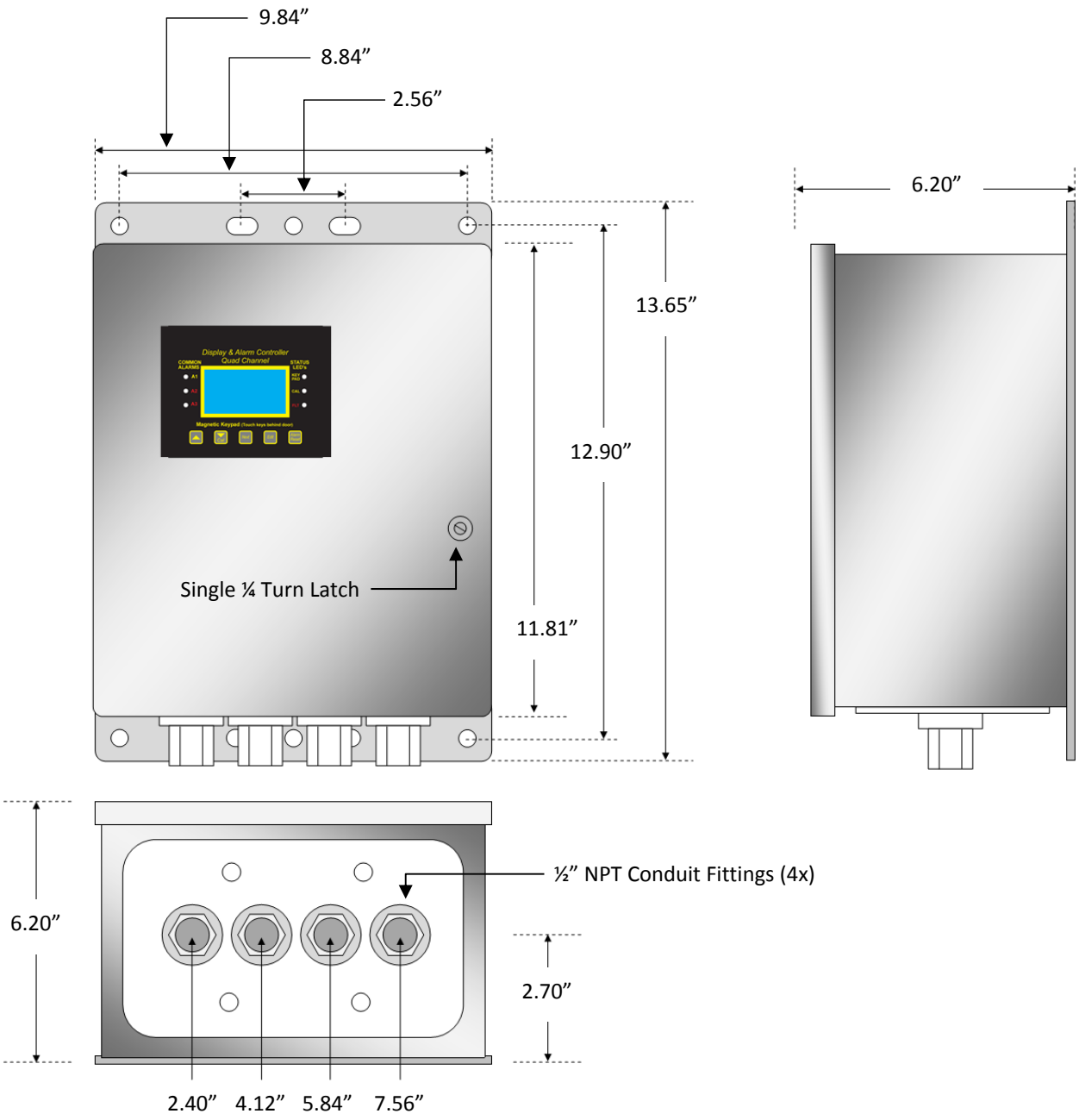


Figure 15-4: NEMA 4X Stainless Steel Enclosure

The C2 Quad Protector "Type 4" enclosure is an aluminum wall mount designed for mounting in potentially hazardous areas.

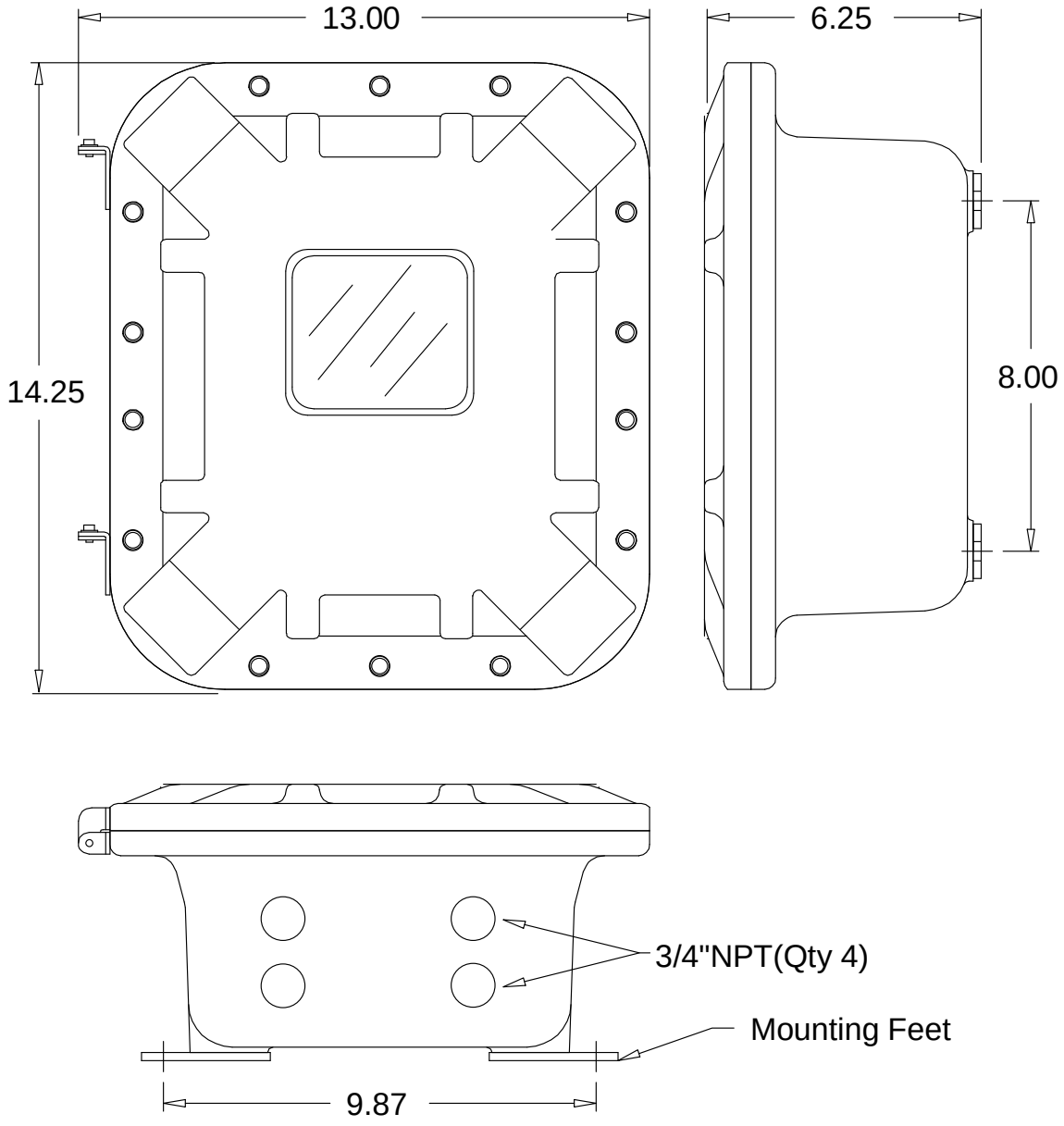


Figure 15-5: NEMA 7 Explosion Proof Enclosure

16 C2 QUAD CONFIGURATION SHEET

CHANNEL CONFIGURATION						
	Tag / Measurement Name	Eunits	Zero	Span	Decimal Points	Active?
CH1						
CH2						
CH3						
CH4						

ALARM CONFIGURATION						
	Alarm	Set Point	On Delay (s)	Off Delay (m)	Low Trip?	Latching?
CH1	Fault					
	Alarm 1					
	Alarm 2					
	Alarm 3					
CH2	Fault					
	Alarm 1					
	Alarm 2					
	Alarm 3					
CH3	Fault					
	Alarm 1					
	Alarm 2					
	Alarm 3					
CH4	Fault					
	Alarm 1					
	Alarm 2					
	Alarm 3					

RELAY SETUP						
	Fault Votes	A1 Votes	A2 Votes	A3 Votes	Failsafe?	Override
STD RY1						
STD RY2						
OPT RY1						
OPT RY2						
OPT RY3						
OPT RY4						
OPT RY5						
OPT RY6						

R2 / ACK HORN SETUP						
	Fault	A1 Votes	A2 Votes	A3 Votes	ACK?	Piezo?
STD R2						

INPUT / OUTPUT SETUP						
	Counts					
	Input Min	Input Max	Output Min	Output Max	Input Type	Remote ID
CH1						
CH2						
CH3						
CH4						

SYSTEM CONFIGURATION VARIABLES			
	Parameter	Value	Comment
Delays	Alarm Refresh		
	Warmup Delay		
	Cal Delay		
Display	Track Negative?		
Wireless Radio	Hop Channel		
	System ID		
	Power Level		
	Slave ID		
Security	Pass Code		
User			