

TQ4000

4 Channel Toxic and
Flammable Gas Sensor
Control Unit

OPERATING MANUAL



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Warnings identify an operating or maintenance procedure, practice, condition, or statement that, if not strictly followed, could result in death or injury to personnel.

Cautions, which appear elsewhere in this manual, identify an operating or maintenance procedure, practice, condition, or statement that if not strictly followed could result in equipment damage or serious impairment of system operation.

Notes highlight certain operating or maintenance conditions or statements that are essential but not of known hazardous nature as indicated by Warnings and Cautions.

Warnings, Cautions and Notes are included throughout this manual, as required. Additionally, this section contains important Warnings that may not be contained elsewhere within this instruction manual.

SAFETY WARNINGS

- **FOR SAFETY REASONS, THE TQ4000 MUST BE INSTALLED, OPERATED AND SERVICED BY QUALIFIED PERSONNEL ONLY. READ AND UNDERSTAND THIS INSTRUCTION MANUAL COMPLETELY BEFORE OPERATING THE TQ4000**
- **THE OPERATION DESCRIBED IN THIS DOCUMENT IS THE INTENDED USE OF THE TQ4000. TQ ENVIRONMENTAL LTD CANNOT BE HELD RESPONSIBLE IF THE TQ4000 IS USED FOR ANY OTHER PURPOSE OTHER THAN THAT STATED. ANY OTHER USE OF THE TQ4000 WILL RENDER ANY CERTIFICATES ISSUED INAPPLICABLE.**

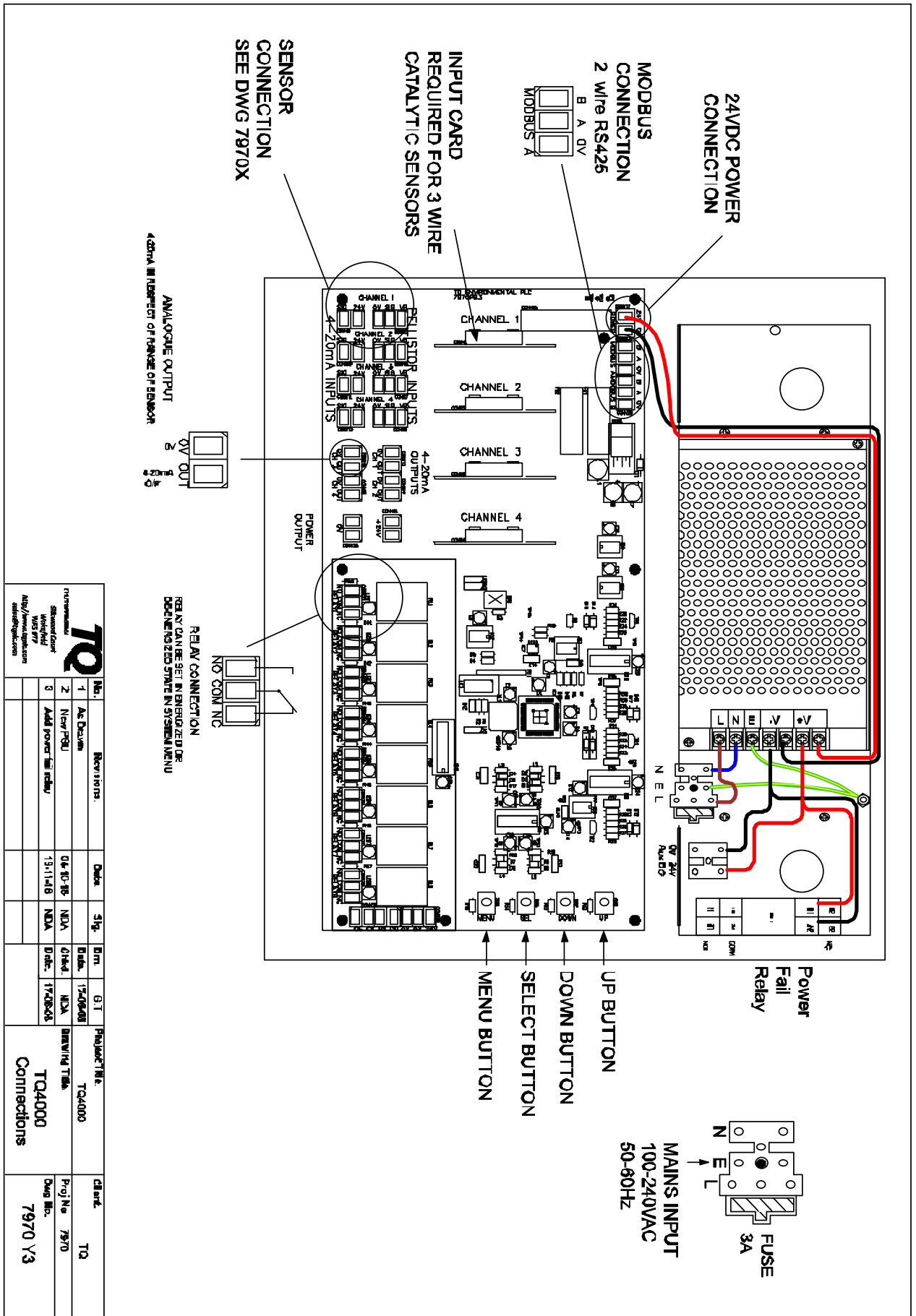
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1. Installation

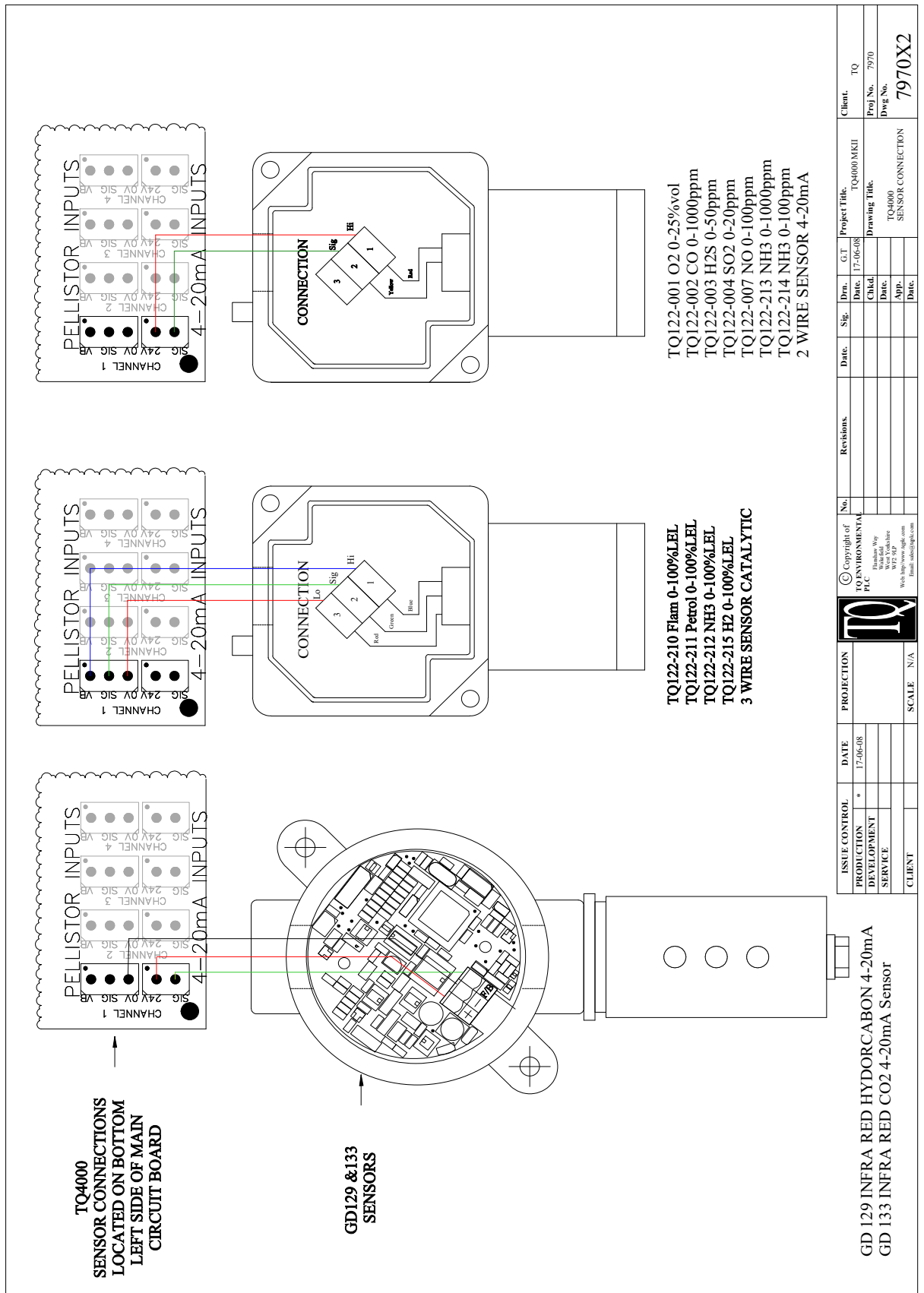
- 1.1.** Open the front door and locate the mounting holes in the base of the unit. Pay special attention to ensure that swarf or dust does not enter the PCB area.
- 1.2.** Drill out the required number of cable glands in the detachable gland plates.
- 1.3.** Fit the gas detection control unit to the wall in the appropriate position. The TQ4000 can be fixed in any position to allow cable entry top or bottom. It is recommended that the unit be situated away from heavy electrical loads or equipment that emits high levels of RFI.
- 1.4.** The mains are connected to the unit via the power supply unit. It is very important that the Live, Earth, and Neutral go to the correct position as indicated in drawing **7970Y**. The mains supply should be fused via a 5A spur.
- 1.5.** The sensors shall be connected to the instrument in accordance with drawing numbers **7970X**, **7970Y**. 2 or 3 cores; 1.5mm² cable with overall screen is used. The number of cores is sensor dependent. An earth point for the screens is provided adjacent to the connector blocks. The screen should **not** be earthed at the sensor.
- 1.6.** Alarm relays are connected in accordance with drawing **7970Y**.
- 1.7.** Check all wiring before connecting mains. All units are configured for 240V, 50Hz unless marked otherwise on the power supply.
- 1.8.** On power up, the unit will inhibit its' alarms. This lasts for 90 seconds and allows the sensors to stabilise before commencing scanning. This inhibit mode may be terminated prematurely by pressing the *SELECT* button on the main PCB.
- 1.9.** The channels should then scan through one at a time depending on factory settings of the number of channels.
- 1.10.** If additional channels are required it will be necessary to fit the relevant extra input card.



TO		Revision:		Date:	Site:	Dist:	Q.T.	Package/Kit:	Client:
No.	1	Ac Drive		04/10/05	NDA	01/01/05	NDA	TD4000	TD
	2	New PCB		13/11/08	NDA	01/01/08	NDA	TD4000 Connections	7970 Y3
	3	Add power fail relay							

7970H8
 TD4000
 TD4000 Connections
 7970 Y3

TQ Environmental LTD
Product Manual TQ 4000



ISSUE CONTROL	DATE	PROJECTION	No.	Revisions	Date.	Sig.	Drn.	C.T.	Project Title	Client.
PRODUCTION	17-06-08	TQ ENVIRONMENTAL						17-06-08	TQ4000 MKII	TQ
DEVELOPMENT		P.C. Farnham Way							Drawing Title.	Prof No. 7970
SERVICE		Widewater							TQ4000	Dwg No.
CLIENT		W12 5AP							SENSOR CONNECTION	7970X2
		www.tqenv.com								
		SCALE N/A								

2. TQ4000 Setup and Configuration

The TQ4000 can be configured via a menu system. The menu system is manipulated using the *MENU*, *UP*, *DOWN*, and *SELECT* buttons on the TQ4000 main board. The Menu System is password protected and when the *MENU* button is pressed the user is prompted to enter the system password. The default password is **6197**. The user must use the *UP* and *DOWN* buttons to select the required digit and then press the *SELECT* button to accept that digit. After the four digits are input the password is checked for validity. If the password is accepted the LCD will display the menu options which may be navigated by using the *UP* and *DOWN* buttons, which will enable the user to scroll through the menu items. The menu items will wrap around from the last menu item to the first menu item and vice-versa. To select the desired menu item, the user must press the *SELECT* button.

2.1. Set Number of Channel

The number of channels may be selected by pressing the *UP* and *DOWN* buttons to display the required number of channels. The *SELECT* button is pressed to accept the displayed number.

2.2. Set Number of Relays

The number of relays may be selected by pressing the *UP* and *DOWN* buttons to display the required number of relays. The *SELECT* button is pressed to accept the displayed number.

2.3. Configure Channel

Channel parameters may be set and edited by entering the ***Configure Channel*** menu option. Once entered, the display will prompt the user to select a desired channel for editing. The user must press the *UP* and *DOWN* buttons to display the required channel location and then press the *SELECT* button to accept that channel location.

2.3.1. Set Location

The channel locations are set by default to "CHANNEL 1", "CHANNEL 2", etc. This option will allow the user to change the name of the channel locations to a more meaningful description up to 20 characters in length, including the **<SPACE>** character.

The user must use the *UP* or *DOWN* buttons to cycle through the alphanumeric characters, pressing the *UP* and *DOWN* buttons simultaneously will toggle between uppercase and lowercase characters. Press the *SELECT* button, when the display shows the desired character, to accept that character. To leave spaces, select the

<SPACE> character and press the *SELECT* button. When the *SELECT* button has been pressed the next character on the right will be displayed. To accept the channel location description the user must press the *MENU* button.

2.3.2. Set Gas Name

This option is used to set a particular gas to a particular channel location. The current channel location is the one entered at the beginning of the **Configure Channel** menu. To set a particular gas the user must press the *UP* and *DOWN* buttons to cycle through the available gasses. This option will allow the user to change the name of the sensor gas type to a more meaningful description up to 10 characters in length, including the <SPACE> character.

The user must use the *UP* or *DOWN* buttons to cycle through the alphanumeric characters, pressing the *UP* and *DOWN* buttons simultaneously will toggle between uppercase and lowercase characters. Press the *SELECT* button, when the display shows the desired character, to accept that character. To leave spaces, select the <SPACE> character and press the *SELECT* button. When the *SELECT* button has been pressed the next character on the right will be displayed. To accept the sensor gas type description the user must press the *MENU* button.

2.3.3. Set Sensor Range

This option allows the user to set the desired gas sensor range. The user may scroll through standard fixed sensor range values or the user may select the **user defined** sensor range using the *UP* and *DOWN* buttons. The standard available sensor range values are as follows: 25.0, 50.0, 100.0, 100, and 50000.

For the **user defined** sensor range option, if the user holds the *UP* or *DOWN* buttons for 10 seconds the display values will start to increment / decrement in multiples of 10. Holding the same buttons for a period above 20 seconds the display values will increment / decrement in multiples of 100 and for a button held for more than 30 seconds the display values will increment / decrement by 1000. The decimal point can be toggled on and off by pressing the *MENU* button. The user may accept the displayed value by pressing the *SELECT* button.

2.3.4. Set Sensor Units

This option will allow the user to select the appropriate sensor units corresponding to the gas type. The user may scroll through standard fixed sensor units or the user may select the **user defined** sensor units

using the *UP* and *DOWN* buttons. The standard available sensor units are as follows: *PPM*, *%LEL*, *%VOL*, and *MGM*.

For the ***user defined*** sensor units option, the user must use the *UP* or *DOWN* buttons to cycle through the alphanumeric characters, pressing the *UP* and *DOWN* buttons simultaneously will toggle between uppercase and lowercase characters. Press the *SELECT* button, when the display shows the desired character, to accept that character. To leave spaces, select the **<SPACE>** character and press the *SELECT* button. When the *SELECT* button has been pressed the next character on the right will be displayed. To accept the sensor units' description the user must press the *MENU* button.

2.3.5. Set Alarms

The user is prompted to select the desired alarm number and therefore must press the *UP* and *DOWN* buttons to display the desired alarm number and then press the *SELECT* button to accept that alarm number.

2.3.5.1. Set Alarm Level

This option will allow the user to change the alarm point level. The alarm point level will increase or decrease in steps of 1 if the *UP* or *DOWN* buttons are held down for less than 10 seconds. If the buttons are still held down then the alarm point level will increase or decrease in steps of 10 for the next 20 seconds. If the buttons are still held down the alarm point level will increase or decrease in steps of 100.

When the desired alarm point level is displayed, the user must press the *SELECT* button to accept the displayed value.

2.3.5.2. Set Alarm Type

This option allows the user to specify a rising alarm (+) or a falling alarm (-). A rising alarm will activate if the gas concentration rises above the alarm set point whereas a falling alarm will activate if the gas concentration falls below the alarm set point. The *UP* and *DOWN* buttons are used to toggle between rising and falling alarms. To accept the ***alarm type*** the user must press the *SELECT* button.

2.3.5.3. Set Alarm Delay

This option allows the user to specify a delay time, in seconds, from when the gas concentration level has exceeded the alarm set point

before the alarm is generated. During the alarm delay the appropriate alarm LED's will flash intermittently while the gas concentration has exceeded the alarm set point. The default setting is for no alarm delay, that is, 0 seconds. The alarm delay time is altered using the *UP* and *DOWN* buttons. To accept the **alarm delay** the user must press the *SELECT* button.

2.3.5.4. Set Alarm 1 Latch State

This option allows the user to toggle between latched alarms or unlatched alarms for the first alarm point level. If set for latched alarms, the user must press the *RESET* button to reset the alarm. If set for unlatched alarms, the system will automatically clear the alarm condition provided the gas concentration is back within the alarm point level. The default setting is for latched alarms. The *UP* and *DOWN* buttons are used to toggle between latched and unlatched alarms. To accept the **alarm 1 latch state** the user must press the *SELECT* button.

2.3.5.5. Set Alarm 2 Latch State

This option allows the user to toggle between latched alarms or unlatched alarms for the second alarm point level. If set for latched alarms, the user must press the *RESET* button to reset the alarm. If set for unlatched alarms, the system will automatically clear the alarm condition provided the gas concentration is back within the alarm point level. The default setting is for latched alarms. The *UP* and *DOWN* buttons are used to toggle between latched and unlatched alarms. To accept the **alarm 2 latch state** the user must press the *SELECT* button.

2.3.5.6. Set Alarm 3 Latch State

This option allows the user to toggle between latched alarms or unlatched alarms for the third alarm point level. If set for latched alarms, the user must press the *RESET* button to reset the alarm. If set for unlatched alarms, the system will automatically clear the alarm condition provided the gas concentration is back within the alarm point level. The default setting is for latched alarms. The *UP* and *DOWN* buttons are used to toggle between latched and unlatched alarms. To accept the **alarm 3 latch state** the user must press the *SELECT* button.

2.3.5.7. Exit Sub Menu

Pressing the *SELECT* button will exit from the alarms sub menu and return the user to the main menu.

2.4. Set Relays

This option is applicable to the selected channel only. If, for example, the **Fault** Relay number is required to be applicable for all channels then it would be more convenient to use the **Set Common Relays** menu option.

2.4.1. Select Relay Number

The user is prompted to select the desired relay number and therefore must press the *UP* and *DOWN* buttons to display the desired relay number and then press the *SELECT* button to accept that relay number.

2.4.2. Assign Relay Fault

Pressing the *SELECT* button will assign the selected relay as the **Fault** relay.

2.4.3. Clear Relay Fault

Pressing the *SELECT* button will clear the selected relay as the **Fault** relay.

2.4.4. Set Relay Fault Type

The **fault relay type** may be toggled between normally on and normally off. This is done by pressing the *UP* or *DOWN* buttons. The *SELECT* button will accept the displayed option. **NB. The Fault Relay is always a latched alarm, i.e. it will NOT automatically clear a fault condition, and it requires the user to press the RESET Button to clear a fault condition.**

2.4.5. Set Alarm 1 Relay

Pressing the *SELECT* button will assign the selected relay as the **Alarm 1** relay.

2.4.6. Clear Alarm 1 Relay

Pressing the *SELECT* button will clear the selected relay as the **Alarm 1** relay.

2.4.7. Set Alarm 2 Relay

Pressing the *SELECT* button will assign the selected relay as the **Alarm 2** relay.

2.4.8. Clear Alarm2 Relay

Pressing the *SELECT* button will clear the selected relay as the **Alarm 2** relay.

2.4.9. Set Alarm3 Relay

Pressing the *SELECT* button will assign the selected relay as the **Alarm 3** relay.

2.4.10. Clear Alarm3 Relay

Pressing the *SELECT* button will clear the selected relay as the **Alarm 3** relay.

2.4.11. Exit Sub Menu

Pressing the *SELECT* button will exit from the **alarms sub menu** and return the user to the main menu.

2.5. Set Common Relays

This option operates the same as the **Set Relays** option above; however, it is applicable for all channels.

2.6. Clear Relays

This option will allow the user to clear all the relay assignments for the selected channel.

2.7. Display Relays

This option will display the current relay assignments for the selected channel. The channel location, alarm relay, and relay number will be displayed for one second on the LCD. If more than one relay has been assigned to the selected channel then the subsequent relays will be displayed in one second intervals.

2.8. Calibrate Channel

This option will allow the Calibration of a sensor. Once entered, the display will prompt the user to select a desired channel for calibration. The user must

press the *UP* and *DOWN* buttons to display the required channel location and then press the *SELECT* button to accept that channel location.

2.8.1. Set Zero

The user may press the *MENU* button to toggle between gas zero and 4-20mA zero calibration.

The user must apply zero gas to the sensor and adjust the value appropriately on the LCD using the *UP* and *DOWN* buttons. Once the desired value is displayed the user may press the *SELECT* button to accept this zero level.

2.8.2. Set Span

The user may press the *MENU* button to toggle between gas span and 4-20mA span calibration.

The user must apply span gas to the sensor and adjust the value appropriately on the LCD using the *UP* and *DOWN* buttons. Once the desired value is displayed the user may press the *SELECT* button to accept this span level.

2.8.3. Exit Sub Menu

Pressing the *SELECT* button will exit from the ***Calibrate Channel*** sub menu and return the user to the main menu.

2.9. Change Password

This option allows the user to change the default password. The user is prompted to enter the new four digit password, using the *UP* and *DOWN* buttons to change the digits and the *SELECT* button to accept the digit. Once the password is entered the user is prompted to re-enter the password to ensure that the required password was correct.

2.10. Exit Menu

Pressing the *SELECT* button will exit from the main menu and the TQ4000 system will resume normal system operation.

3. Initial Setting Up Of Flammable Sensor Cards

On flammable sensors there is a requirement to set the zero on the electronic zero on the associated flammable sensor card.

This is only required to be done once at installation, after installation any drift can be compensated by the zero procedure in set up.

Refer to drawing **7970X, 7970V**.

Connect up the flammable gas sensor as shown, open the front panel to give access to the flammable gas sensor card.

3.1. Setting the Flammable Gas Sensor Head Voltage

With DVM set to a low range measure the voltage across VB and 0V at the control unit. (This is factory set to approximately 2.07 - 2.1V record this reading (V1).

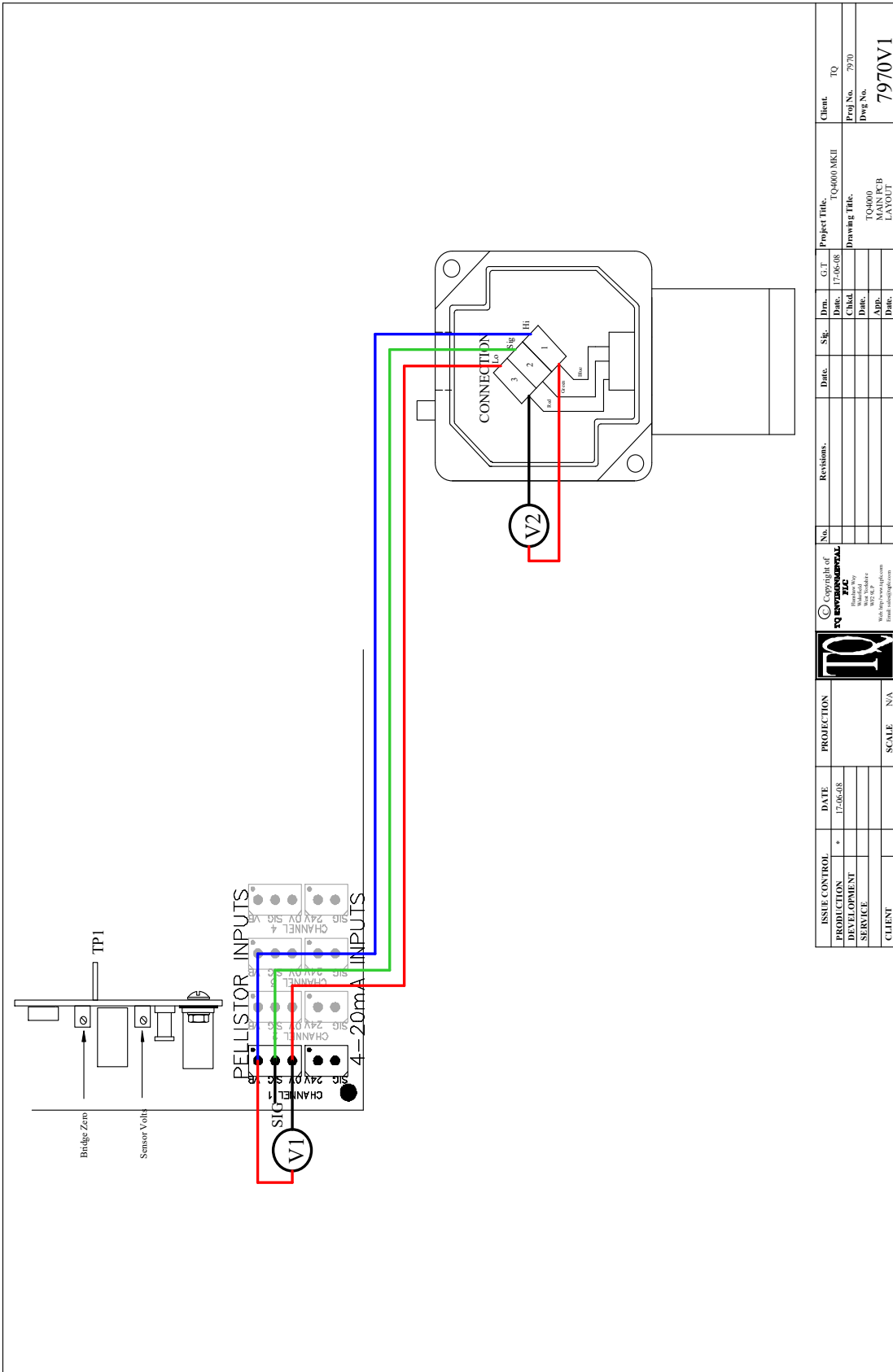
Measure the flammable gas sensor head Voltage at the sensor head between the blue and brown wire on DVM with the same range (V2) at the sensor head

Subtract $V1 - V2 = \text{cable voltage loss}$.

Measure across VB and 0V at the control unit on the DVM and turn the sensor Volts pot to a level equal to $V1 + \text{cable voltage loss}$.

3.2. Setting the Sensor Zero

With DVM on dc and most sensitive range connect negative probe to B sig and positive probe to TP1. TP1 is a long leg left on a resistor. Adjust the zero adjust pot to give +1.00mV (milliVolts) on the DVM. It is important that the reading is +ve. Hence the reading can be set anywhere between +1.0 mV and 0mV. It is important the probes are the correct way around.



4. Calibration and Setup

It is important to ensure that the initial set up of all types of sensor is performed to ensure that they are wired correctly and pre calibration set ups have been observed and are used in the manner described.

4.1. Zero Adjustment

Enter the sensor zero mode using the menu system. The zero is now set on the display by using the *UP* and *DOWN* buttons. It is important to ensure that the sensor being zeroed is not exposed to any gas whilst this is happening, refer to sensor information to ascertain if any particular gas is required to zero the instrument. Once zero is set press the *SELECT* button.

4.2. Span Adjustment

MUST ONLY BE DONE WITH CALIBRATION GAS and by qualified personnel. Enter the sensor span mode using the menu system. Apply the gas to the sensor in the manner prescribed by the sensor manufacturer and with the correct gas. The level indicated on the display is then adjusted up or down with the *UP* and *DOWN* buttons. The level is adjusted to read that indicated on the span gas being physically applied to the sensor. The span/calibration factor is then stored in the memory by pressing the *SELECT* button.

Do not adjust the span without gas on the sensor as this will effect the calibration of the sensor on that channel.

5. Front Panel Warning LED's And Buttons

5.1. Front Panel Warning Lamps

Inhibit: When lit indicates that the channel indicated has had its output relays inhibited by a setup or hold function. The inhibit function has a time out on it and will clear automatically if not cleared manually after a period that is factory set. All the other channels are being monitored and will activate their appropriate relays.

To inhibit a channel, that is, disable the relays for a particular channel; the user must press the *UP* button on the TQ4000 main board when the **CHANNEL LED** is indicating the desired channel. The **INHIBIT LED** will illuminate. To release the *inhibit* function the user must press the *DOWN* button on the TQ4000 main board when the **CHANNEL LED** is indicating the desired channel. The **INHIBIT LED** will switch off.

O/R: When lit this indicates that the sensor related to that channel has gone over range. The fault relay will activate under this condition. The O/R indication is latching and will require resetting by the reset button. If the O/R has come on it is most prudent to check the functionality and calibration of the sensor.

Fault: The channel indicated has displayed a fault and the fault relay should also be activated.

AL1/AL2/AL3: The channel indicated has exceeded the alarm set point for the alarm indicated. The appropriate relays should also have been activated if not previously been inhibited.

Chan: Channel lamp shows the channel which is currently displayed on the LCD, nominally five seconds per cycle.

Mains: Shows healthy mains status.

Watchdog: shows when the unit has had a catastrophic breakdown.

5.2. Front Panel Button Functions

5.2.1. Reset

The *RESET* button may be used to reset an alarm if the appropriate alarm condition has cleared. If the **BUZZER** was activated, that is, not previously muted, the *RESET* button will also de-activate the **BUZZER**. The alarm LED's will switch off and the relays will be reset.

5.2.2. Mute

When an alarm has occurred the **BUZZER** will activate and the appropriate alarm LED's will illuminate indicating the active alarms. The user may de-activate the **BUZZER** by pressing the **MUTE** button. The appropriate channel alarm LED's will continuously flash to indicated that they have been muted.

5.2.3. Hold

The user must press the **HOLD** button on the front panel when the **CHANNEL LED** is indicating the desired channel. The **CHANNEL LED** will continuously flash to indicate that the channel is held. To release the hold function the user must keep the **HOLD** button pressed for a minimum of two seconds. The TQ4000 will then resume normal scanning of channels.

5.2.4. Lamp Test

To test the front panel LED's are operational, the user may press the **LAMP TEST** button, mounted on the rear of the door panel. This will illuminate all front panel LED's for the duration that the **LAMP TEST** button is pressed. The front panel LED's will revert to their previous state when the **LAMP TEST** button is released.

5.2.5. Dimmer

The user may alter the brightness of the **POWER LED** and the LCD by pressing and holding the **DIMMER UP** and **DIMMER DOWN** buttons accordingly, these are mounted on the rear of the door panel.

6. Self Test Facilities

A system test may be performed on a selected channel. This will simulate a ramp up of the gas concentration and activate the appropriate alarms and relays at the set alarm points. When the concentration is at the sensor range level the system will ramp down the concentration back to the zero level. The user may use the *MUTE* and *RESET* buttons as in normal TQ4000 system operation. To initiate the system test the user must **hold** the desired channel. The user must then press the *SELECT* button on the TQ4000 main board to start the system test. To exit the system test the user must press the *UP* button on the TQ4000 main board. The TQ4000 will revert to normal system operation.

7. Fault Finding

7.1. Unit does not power up

Check mains input, fuse on power supply

7.2. Flammable gas sensors will not go to zero on setup

Usual problem is that the flammable gas card has not been set up in accordance with procedure. Check in particular the sensor zero is at 1.00mV positive.

If the flammable gas card is set up correctly remove sensor and insert dummy load resistors 3R3 1% to simulate sensor and adjust zero. If display now moves towards zero when down is pressed the sensor or sensor wiring is suspect.

Another problem may be damaged up and down push buttons, physically check the push button.

7.3. Flammable gas sensor when gassed do not span high enough

Most likely problem is that the sensor head voltage is below the required 2 volts. Measure the voltage at the sensor head, not the input terminal on the PCB. Bring voltage up to 2.00V and recalibrate.

Check that gas can is not empty and that there is an airtight seal around the gassing cup. For TQ flammable sensors use TQ gassing cup.

7.4. Flammable gas sensor moves erratically when gassed

Check the control electronics by evoking test mode and allowing unit to cycle through. If the display is still erratic as opposed to a steady sweep, electronics are suspect.

Check that gassing is being done at a rate of not greater than 0.5litre/min and that a gassing cup is used.

7.5. Display is cycling from 0 to end of scale and alarms are sounding

The unit is in system test mode. Exit system test by following procedure described in point 6 above.

7.6. Relays fail to activate on alarm

Check that channel is not inhibited if it is release by pressing down key.

8. Sensor Information

8.1. Flammable Sensors

The flammable gas sensors are pellistor based flammable gas sensors operating in the range 0-100% LEL (Lower Explosive Limit).

There are a number of components which inhibit flammable gas sensors. For this reason regular checking will help maintain any pellistor based system in good operating condition.

AVOID exposure to silicones, chlorinated hydrocarbons, lead and sulphur containing compounds, halogenated compounds.

The TQ122 flammable sensors are wire colour coded and should be connected to the control panel in accordance with Drawing **7970V**.

8.2. Toxic Sensors

Most toxic sensors are 4-20 mA based and the majority of these are two wire. The TQ4000 can interface to almost any 2 wire sensor. The TQ4000 source voltage is 24V and the 4-20mA is developed into 220 R. In general the supply +ve to the sensor is taken from the input pin marked BHI and the 4-20mA returned to the middle pin which is SIG. **It is very important to ensure that the correct input card is used.** If a flammable input card is used it may cause severe damage to the sensor, similar comments apply if a 4-20mA is used on a flammable sensor. Connection detail for the TQ122/123 series of sensor is shown in drawing **7970V**.

8.3. Infra-red and other 3-wire 4-20mA Sensors

3 wire systems indicate that the sensor at the end of the TQ4000 requires power. The TQ4000 can adequately drive up to **3x24Volt sensors each requiring less than 0.25W per sensor**. The voltage available falls towards the lower limit of 18Volts when loaded with 4 sensors of this power and may cause intermittent operation of the sensors. When using higher rated sensors it is advisable to order a larger capacity power supply to cope with the additional demand. The power supply in the TQ4000 is designed to deliver 18-24V at 1.5A. The electronics consume approx 0.5A which leaves approx **1A available to drive sensors and alarms**. The power supply is an easily interchanged unit.

Connection is made to the BHI for the 24V, the 0V is obtained at the BLO terminal and the 4-20mA is returned to the SIG terminal for the selected channel. **It is very important to ensure that the correct input card is used.** The 4-20mA input card must be used for this application.

9. Modbus Communications

The TQ4000 unit features dual channel Modbus communications over 2 serial RS485 lines. This communication allows remote interrogation of the channel concentrations and the status of the channel alarms and fault conditions. It is also possible for remote alarm mute and alarm reset functions to be performed. The Modbus register addresses are detailed in the following table:

Modbus Register Addresses For TQ4000

Input Register (0x04)	Starting Address(High)	Starting Address(Low)	Number of Registers(High)	Number of Registers(Low)	Number of Bytes
Station Number Read (0x04) Write (0x10)	0x00	0x01	0x00	0x01	2
Channel 1 Conc.	0x00	0x02	0x00	0x01	2
Channel 2 Conc.	0x00	0x03	0x00	0x01	2
Channel 3 Conc.	0x00	0x04	0x00	0x01	2
Channel 4 Conc.	0x00	0x05	0x00	0x01	2
Discrete Inputs (0x02)					
Alarm Status	0x00	0x01	0x00	0x01	2
	Input Number				
Channel 1 AL 1	1				
Channel 1 AL 2	2				
Channel 1 AL 3	3				
Channel 2 AL 1	4				
Channel 2 AL 2	5				
Channel 2 AL 3	6				
Channel 3 AL 1	7				
Channel 3 AL 2	8				
Channel 3 AL 3	9				
Channel 4 AL 1	10				
Channel 4 AL 2	11				
Channel 4 AL 3	12				
Channel 1 FLT	13				
Channel 2 FLT	14				
Channel 3 FLT	15				
Channel 4 FLT	16				
Write Coil (0x05)					
Alarm Action	0x00	0x01	0x00	0x01	2
	Input Number				
Reset Alarms	1				
Mute Alarms	2				
Communications Protocol					
Baud Rate	Data Bits	Parity	Stop Bits	Transmission	Check
19200	8	Even	1	RTU	CRC-16

TQ Environmental LTD
Product Manual TQ 4000

TQ4000

4 Channel Toxic and
Flammable Gas Sensor
Control Unit

OPERATING MANUAL



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WARNINGS, CAUTIONS AND NOTES

Warnings identify an operating or maintenance procedure, practice, condition, or statement that, if not strictly followed, could result in death or injury to personnel.

Cautions, which appear elsewhere in this manual, identify an operating or maintenance procedure, practice, condition, or statement that if not strictly followed could result in equipment damage or serious impairment of system operation.

Notes highlight certain operating or maintenance conditions or statements that are essential but not of known hazardous nature as indicated by Warnings and Cautions.

Warnings, Cautions and Notes are included throughout this manual, as required. Additionally, this section contains important Warnings that may not be contained elsewhere within this instruction manual.

SAFETY WARNINGS

- **FOR SAFETY REASONS, THE TQ4000 MUST BE INSTALLED, OPERATED AND SERVICED BY QUALIFIED PERSONNEL ONLY. READ AND UNDERSTAND THIS INSTRUCTION MANUAL COMPLETELY BEFORE OPERATING THE TQ4000**
- **THE OPERATION DESCRIBED IN THIS DOCUMENT IS THE INTENDED USE OF THE TQ4000. TQ ENVIRONMENTAL LTD CANNOT BE HELD RESPONSIBLE IF THE TQ4000 IS USED FOR ANY OTHER PURPOSE OTHER THAN THAT STATED. ANY OTHER USE OF THE TQ4000 WILL RENDER ANY CERTIFICATES ISSUED INAPPLICABLE.**

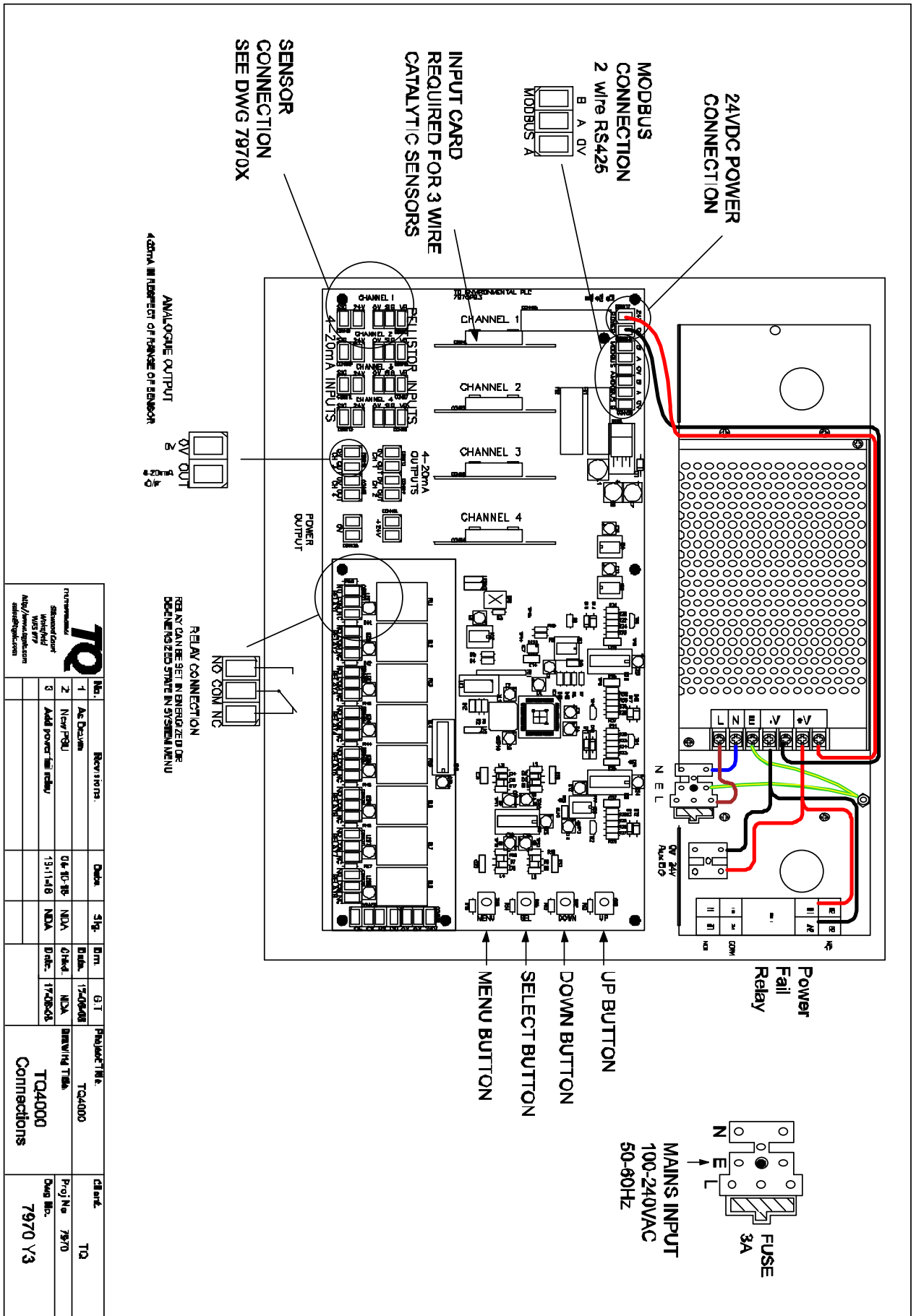
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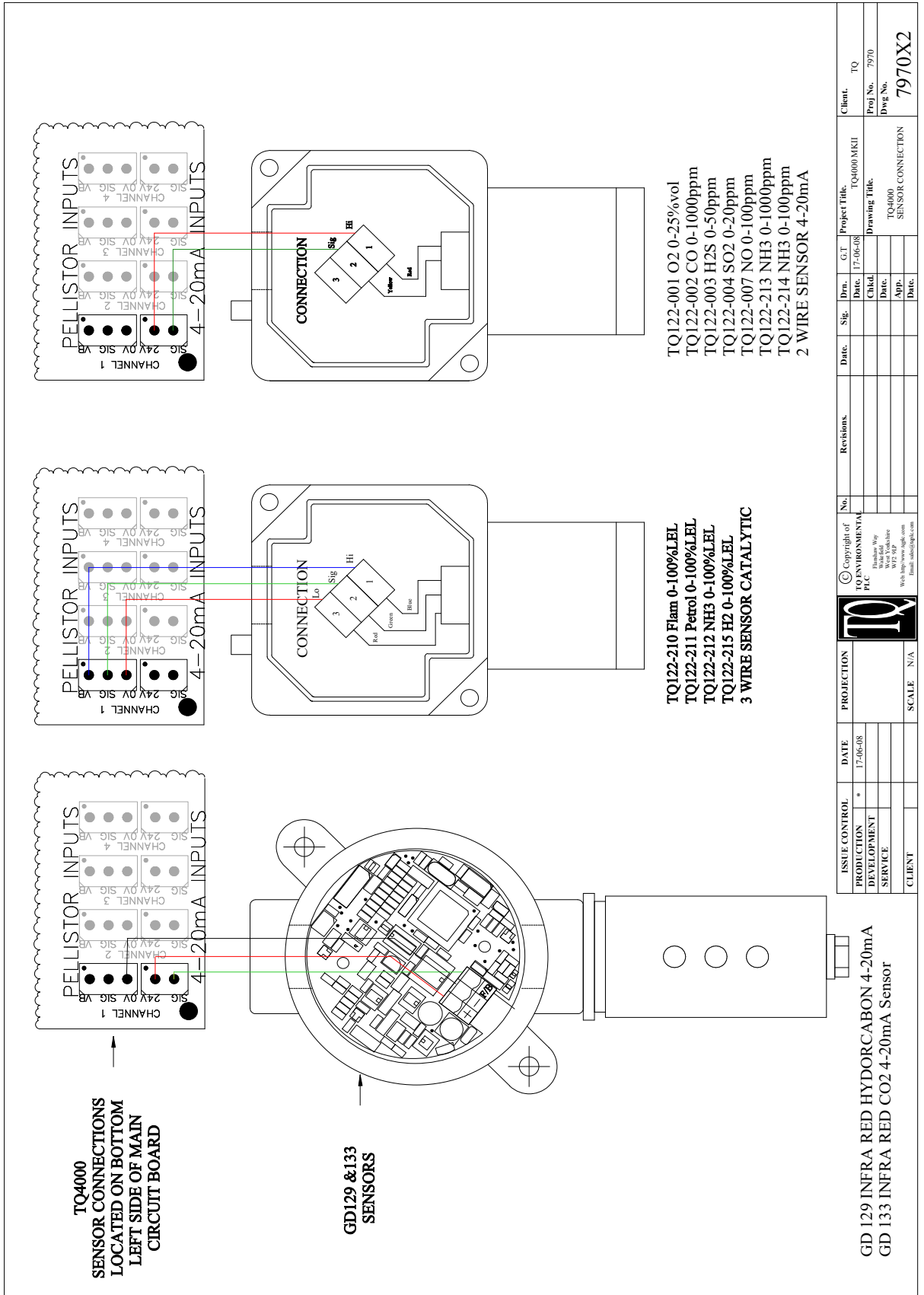
1. Installation

- 1.1.** Open the front door and locate the mounting holes in the base of the unit. Pay special attention to ensure that swarf or dust does not enter the PCB area.
- 1.2.** Drill out the required number of cable glands in the detachable gland plates.
- 1.3.** Fit the gas detection control unit to the wall in the appropriate position. The TQ4000 can be fixed in any position to allow cable entry top or bottom. It is recommended that the unit be situated away from heavy electrical loads or equipment that emits high levels of RFI.
- 1.4.** The mains are connected to the unit via the power supply unit. It is very important that the Live, Earth, and Neutral go to the correct position as indicated in drawing **7970Y**. The mains supply should be fused via a 5A spur.
- 1.5.** The sensors shall be connected to the instrument in accordance with drawing numbers **7970X**, **7970Y**. 2 or 3 cores; 1.5mm² cable with overall screen is used. The number of cores is sensor dependent. An earth point for the screens is provided adjacent to the connector blocks. The screen should **not** be earthed at the sensor.
- 1.6.** Alarm relays are connected in accordance with drawing **7970Y**.
- 1.7.** Check all wiring before connecting mains. All units are configured for 240V, 50Hz unless marked otherwise on the power supply.
- 1.8.** On power up, the unit will inhibit its' alarms. This lasts for 90 seconds and allows the sensors to stabilise before commencing scanning. This inhibit mode may be terminated prematurely by pressing the *SELECT* button on the main PCB.
- 1.9.** The channels should then scan through one at a time depending on factory settings of the number of channels.
- 1.10.** If additional channels are required it will be necessary to fit the relevant extra input card.



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No.	REVISIONS	Date	By	DT	Project File	Client
1	As Drawn			15/06/05	TQ4000	TQ
2	New PCB	04-10-05	NDA	01/01/06	DRW/14 TTB	
3	Add power fail relay	13/11/08	NDA	17/08/08		
TQ4000 Connections						Drawn By: 7970 Y3

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2. TQ4000 Setup and Configuration

The TQ4000 can be configured via a menu system. The menu system is manipulated using the *MENU*, *UP*, *DOWN*, and *SELECT* buttons on the TQ4000 main board. The Menu System is password protected and when the *MENU* button is pressed the user is prompted to enter the system password. The default password is **6197**. The user must use the *UP* and *DOWN* buttons to select the required digit and then press the *SELECT* button to accept that digit. After the four digits are input the password is checked for validity. If the password is accepted the LCD will display the menu options which may be navigated by using the *UP* and *DOWN* buttons, which will enable the user to scroll through the menu items. The menu items will wrap around from the last menu item to the first menu item and vice-versa. To select the desired menu item, the user must press the *SELECT* button.

2.1. Set Number of Channel

The number of channels may be selected by pressing the *UP* and *DOWN* buttons to display the required number of channels. The *SELECT* button is pressed to accept the displayed number.

2.2. Set Number of Relays

The number of relays may be selected by pressing the *UP* and *DOWN* buttons to display the required number of relays. The *SELECT* button is pressed to accept the displayed number.

2.3. Configure Channel

Channel parameters may be set and edited by entering the ***Configure Channel*** menu option. Once entered, the display will prompt the user to select a desired channel for editing. The user must press the *UP* and *DOWN* buttons to display the required channel location and then press the *SELECT* button to accept that channel location.

2.3.1. Set Location

The channel locations are set by default to "CHANNEL 1", "CHANNEL 2", etc. This option will allow the user to change the name of the channel locations to a more meaningful description up to 20 characters in length, including the **<SPACE>** character.

The user must use the *UP* or *DOWN* buttons to cycle through the alphanumeric characters, pressing the *UP* and *DOWN* buttons simultaneously will toggle between uppercase and lowercase characters. Press the *SELECT* button, when the display shows the desired character, to accept that character. To leave spaces, select the

<SPACE> character and press the *SELECT* button. When the *SELECT* button has been pressed the next character on the right will be displayed. To accept the channel location description the user must press the *MENU* button.

2.3.2. Set Gas Name

This option is used to set a particular gas to a particular channel location. The current channel location is the one entered at the beginning of the ***Configure Channel*** menu. To set a particular gas the user must press the *UP* and *DOWN* buttons to cycle through the available gasses. This option will allow the user to change the name of the sensor gas type to a more meaningful description up to 10 characters in length, including the <SPACE> character.

The user must use the *UP* or *DOWN* buttons to cycle through the alphanumeric characters, pressing the *UP* and *DOWN* buttons simultaneously will toggle between uppercase and lowercase characters. Press the *SELECT* button, when the display shows the desired character, to accept that character. To leave spaces, select the <SPACE> character and press the *SELECT* button. When the *SELECT* button has been pressed the next character on the right will be displayed. To accept the sensor gas type description the user must press the *MENU* button.

2.3.3. Set Sensor Range

This option allows the user to set the desired gas sensor range. The user may scroll through standard fixed sensor range values or the user may select the ***user defined*** sensor range using the *UP* and *DOWN* buttons. The standard available sensor range values are as follows: 25.0, 50.0, 100.0, 100, and 50000.

For the ***user defined*** sensor range option, if the user holds the *UP* or *DOWN* buttons for 10 seconds the display values will start to increment / decrement in multiples of 10. Holding the same buttons for a period above 20 seconds the display values will increment / decrement in multiples of 100 and for a button held for more than 30 seconds the display values will increment / decrement by 1000. The decimal point can be toggled on and off by pressing the *MENU* button. The user may accept the displayed value by pressing the *SELECT* button.

2.3.4. Set Sensor Units

This option will allow the user to select the appropriate sensor units corresponding to the gas type. The user may scroll through standard fixed sensor units or the user may select the ***user defined*** sensor units

using the *UP* and *DOWN* buttons. The standard available sensor units are as follows: *PPM*, *%LEL*, *%VOL*, and *MGM*.

For the ***user defined*** sensor units option, the user must use the *UP* or *DOWN* buttons to cycle through the alphanumeric characters, pressing the *UP* and *DOWN* buttons simultaneously will toggle between uppercase and lowercase characters. Press the *SELECT* button, when the display shows the desired character, to accept that character. To leave spaces, select the **<SPACE>** character and press the *SELECT* button. When the *SELECT* button has been pressed the next character on the right will be displayed. To accept the sensor units' description the user must press the *MENU* button.

2.3.5. Set Alarms

The user is prompted to select the desired alarm number and therefore must press the *UP* and *DOWN* buttons to display the desired alarm number and then press the *SELECT* button to accept that alarm number.

2.3.5.1. Set Alarm Level

This option will allow the user to change the alarm point level. The alarm point level will increase or decrease in steps of 1 if the *UP* or *DOWN* buttons are held down for less than 10 seconds. If the buttons are still held down then the alarm point level will increase or decrease in steps of 10 for the next 20 seconds. If the buttons are still held down the alarm point level will increase or decrease in steps of 100.

When the desired alarm point level is displayed, the user must press the *SELECT* button to accept the displayed value.

2.3.5.2. Set Alarm Type

This option allows the user to specify a rising alarm (+) or a falling alarm (-). A rising alarm will activate if the gas concentration rises above the alarm set point whereas a falling alarm will activate if the gas concentration falls below the alarm set point. The *UP* and *DOWN* buttons are used to toggle between rising and falling alarms. To accept the ***alarm type*** the user must press the *SELECT* button.

2.3.5.3. Set Alarm Delay

This option allows the user to specify a delay time, in seconds, from when the gas concentration level has exceeded the alarm set point

before the alarm is generated. During the alarm delay the appropriate alarm LED's will flash intermittently while the gas concentration has exceeded the alarm set point. The default setting is for no alarm delay, that is, 0 seconds. The alarm delay time is altered using the *UP* and *DOWN* buttons. To accept the **alarm delay** the user must press the *SELECT* button.

2.3.5.4. Set Alarm 1 Latch State

This option allows the user to toggle between latched alarms or unlatched alarms for the first alarm point level. If set for latched alarms, the user must press the *RESET* button to reset the alarm. If set for unlatched alarms, the system will automatically clear the alarm condition provided the gas concentration is back within the alarm point level. The default setting is for latched alarms. The *UP* and *DOWN* buttons are used to toggle between latched and unlatched alarms. To accept the **alarm 1 latch state** the user must press the *SELECT* button.

2.3.5.5. Set Alarm 2 Latch State

This option allows the user to toggle between latched alarms or unlatched alarms for the second alarm point level. If set for latched alarms, the user must press the *RESET* button to reset the alarm. If set for unlatched alarms, the system will automatically clear the alarm condition provided the gas concentration is back within the alarm point level. The default setting is for latched alarms. The *UP* and *DOWN* buttons are used to toggle between latched and unlatched alarms. To accept the **alarm 2 latch state** the user must press the *SELECT* button.

2.3.5.6. Set Alarm 3 Latch State

This option allows the user to toggle between latched alarms or unlatched alarms for the third alarm point level. If set for latched alarms, the user must press the *RESET* button to reset the alarm. If set for unlatched alarms, the system will automatically clear the alarm condition provided the gas concentration is back within the alarm point level. The default setting is for latched alarms. The *UP* and *DOWN* buttons are used to toggle between latched and unlatched alarms. To accept the **alarm 3 latch state** the user must press the *SELECT* button.

2.3.5.7. Exit Sub Menu

Pressing the *SELECT* button will exit from the alarms sub menu and return the user to the main menu.

2.4. Set Relays

This option is applicable to the selected channel only. If, for example, the **Fault** Relay number is required to be applicable for all channels then it would be more convenient to use the **Set Common Relays** menu option.

2.4.1. Select Relay Number

The user is prompted to select the desired relay number and therefore must press the *UP* and *DOWN* buttons to display the desired relay number and then press the *SELECT* button to accept that relay number.

2.4.2. Assign Relay Fault

Pressing the *SELECT* button will assign the selected relay as the **Fault** relay.

2.4.3. Clear Relay Fault

Pressing the *SELECT* button will clear the selected relay as the **Fault** relay.

2.4.4. Set Relay Fault Type

The **fault relay type** may be toggled between normally on and normally off. This is done by pressing the *UP* or *DOWN* buttons. The *SELECT* button will accept the displayed option. **NB. The Fault Relay is always a latched alarm, i.e. it will NOT automatically clear a fault condition, and it requires the user to press the RESET Button to clear a fault condition.**

2.4.5. Set Alarm 1 Relay

Pressing the *SELECT* button will assign the selected relay as the **Alarm 1** relay.

2.4.6. Clear Alarm 1 Relay

Pressing the *SELECT* button will clear the selected relay as the **Alarm 1** relay.

2.4.7. Set Alarm 2 Relay

Pressing the *SELECT* button will assign the selected relay as the **Alarm 2** relay.

2.4.8. Clear Alarm2 Relay

Pressing the *SELECT* button will clear the selected relay as the **Alarm 2** relay.

2.4.9. Set Alarm3 Relay

Pressing the *SELECT* button will assign the selected relay as the **Alarm 3** relay.

2.4.10. Clear Alarm3 Relay

Pressing the *SELECT* button will clear the selected relay as the **Alarm 3** relay.

2.4.11. Exit Sub Menu

Pressing the *SELECT* button will exit from the **alarms sub menu** and return the user to the main menu.

2.5. Set Common Relays

This option operates the same as the **Set Relays** option above; however, it is applicable for all channels.

2.6. Clear Relays

This option will allow the user to clear all the relay assignments for the selected channel.

2.7. Display Relays

This option will display the current relay assignments for the selected channel. The channel location, alarm relay, and relay number will be displayed for one second on the LCD. If more than one relay has been assigned to the selected channel then the subsequent relays will be displayed in one second intervals.

2.8. Calibrate Channel

This option will allow the Calibration of a sensor. Once entered, the display will prompt the user to select a desired channel for calibration. The user must

press the *UP* and *DOWN* buttons to display the required channel location and then press the *SELECT* button to accept that channel location.

2.8.1. Set Zero

The user may press the *MENU* button to toggle between gas zero and 4-20mA zero calibration.

The user must apply zero gas to the sensor and adjust the value appropriately on the LCD using the *UP* and *DOWN* buttons. Once the desired value is displayed the user may press the *SELECT* button to accept this zero level.

2.8.2. Set Span

The user may press the *MENU* button to toggle between gas span and 4-20mA span calibration.

The user must apply span gas to the sensor and adjust the value appropriately on the LCD using the *UP* and *DOWN* buttons. Once the desired value is displayed the user may press the *SELECT* button to accept this span level.

2.8.3. Exit Sub Menu

Pressing the *SELECT* button will exit from the ***Calibrate Channel*** sub menu and return the user to the main menu.

2.9. Change Password

This option allows the user to change the default password. The user is prompted to enter the new four digit password, using the *UP* and *DOWN* buttons to change the digits and the *SELECT* button to accept the digit. Once the password is entered the user is prompted to re-enter the password to ensure that the required password was correct.

2.10. Exit Menu

Pressing the *SELECT* button will exit from the main menu and the TQ4000 system will resume normal system operation.

3. Initial Setting Up Of Flammable Sensor Cards

On flammable sensors there is a requirement to set the zero on the electronic zero on the associated flammable sensor card.

This is only required to be done once at installation, after installation any drift can be compensated by the zero procedure in set up.

Refer to drawing **7970X, 7970V**.

Connect up the flammable gas sensor as shown, open the front panel to give access to the flammable gas sensor card.

3.1. Setting the Flammable Gas Sensor Head Voltage

With DVM set to a low range measure the voltage across VB and 0V at the control unit. (This is factory set to approximately 2.07 - 2.1V record this reading (V1).

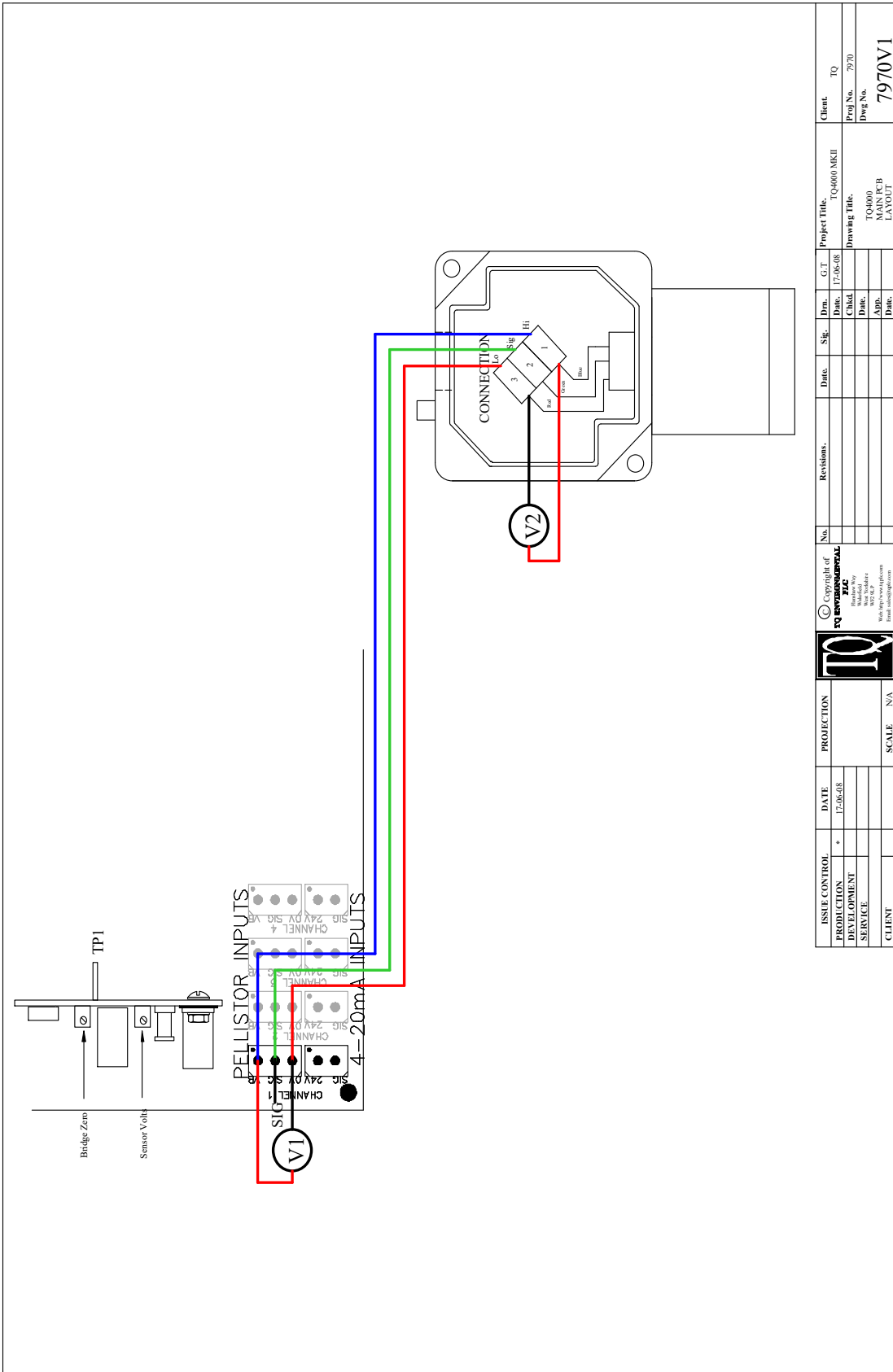
Measure the flammable gas sensor head Voltage at the sensor head between the blue and brown wire on DVM with the same range (V2) at the sensor head

Subtract $V1 - V2 = \text{cable voltage loss}$.

Measure across VB and 0V at the control unit on the DVM and turn the sensor Volts pot to a level equal to $V1 + \text{cable voltage loss}$.

3.2. Setting the Sensor Zero

With DVM on dc and most sensitive range connect negative probe to B sig and positive probe to TP1. TP1 is a long leg left on a resistor. Adjust the zero adjust pot to give +1.00mV (milliVolts) on the DVM. It is important that the reading is +ve. Hence the reading can be set anywhere between +1.0 mV and 0mV. It is important the probes are the correct way around.



ISSUE CONTROL		DATE	PROJECTION	Copyright of		No.	Revisions	Date	S.G.	G.T	Project Title	Client
PRODUCTION	*	17-06-08		TQ						17-06-08	TQ4000 MKII	TQ
DEVELOPMENT				TQC							Drawing Title	Proj No. 7970
SERVICE				TQC							TQ4000 PCB LAYOUT	Dwg No. 7970V1
CLIENT			SCALE N/A	TQC								

4. Calibration and Setup

It is important to ensure that the initial set up of all types of sensor is performed to ensure that they are wired correctly and pre calibration set ups have been observed and are used in the manner described.

4.1. Zero Adjustment

Enter the sensor zero mode using the menu system. The zero is now set on the display by using the *UP* and *DOWN* buttons. It is important to ensure that the sensor being zeroed is not exposed to any gas whilst this is happening, refer to sensor information to ascertain if any particular gas is required to zero the instrument. Once zero is set press the *SELECT* button.

4.2. Span Adjustment

MUST ONLY BE DONE WITH CALIBRATION GAS and by qualified personnel. Enter the sensor span mode using the menu system. Apply the gas to the sensor in the manner prescribed by the sensor manufacturer and with the correct gas. The level indicated on the display is then adjusted up or down with the *UP* and *DOWN* buttons. The level is adjusted to read that indicated on the span gas being physically applied to the sensor. The span/calibration factor is then stored in the memory by pressing the *SELECT* button.

Do not adjust the span without gas on the sensor as this will effect the calibration of the sensor on that channel.

5. Front Panel Warning LED's And Buttons

5.1. Front Panel Warning Lamps

Inhibit: When lit indicates that the channel indicated has had its output relays inhibited by a setup or hold function. The inhibit function has a time out on it and will clear automatically if not cleared manually after a period that is factory set. All the other channels are being monitored and will activate their appropriate relays.

To inhibit a channel, that is, disable the relays for a particular channel; the user must press the *UP* button on the TQ4000 main board when the **CHANNEL LED** is indicating the desired channel. The **INHIBIT LED** will illuminate. To release the *inhibit* function the user must press the *DOWN* button on the TQ4000 main board when the **CHANNEL LED** is indicating the desired channel. The **INHIBIT LED** will switch off.

O/R: When lit this indicates that the sensor related to that channel has gone over range. The fault relay will activate under this condition. The O/R indication is latching and will require resetting by the reset button. If the O/R has come on it is most prudent to check the functionality and calibration of the sensor.

Fault: The channel indicated has displayed a fault and the fault relay should also be activated.

AL1/AL2/AL3: The channel indicated has exceeded the alarm set point for the alarm indicated. The appropriate relays should also have been activated if not previously been inhibited.

Chan: Channel lamp shows the channel which is currently displayed on the LCD, nominally five seconds per cycle.

Mains: Shows healthy mains status.

Watchdog: shows when the unit has had a catastrophic breakdown.

5.2. Front Panel Button Functions

5.2.1. Reset

The *RESET* button may be used to reset an alarm if the appropriate alarm condition has cleared. If the **BUZZER** was activated, that is, not previously muted, the *RESET* button will also de-activate the **BUZZER**. The alarm LED's will switch off and the relays will be reset.

5.2.2. Mute

When an alarm has occurred the **BUZZER** will activate and the appropriate alarm LED's will illuminate indicating the active alarms. The user may de-activate the **BUZZER** by pressing the **MUTE** button. The appropriate channel alarm LED's will continuously flash to indicated that they have been muted.

5.2.3. Hold

The user must press the **HOLD** button on the front panel when the **CHANNEL LED** is indicating the desired channel. The **CHANNEL LED** will continuously flash to indicate that the channel is held. To release the hold function the user must keep the **HOLD** button pressed for a minimum of two seconds. The TQ4000 will then resume normal scanning of channels.

5.2.4. Lamp Test

To test the front panel LED's are operational, the user may press the **LAMP TEST** button, mounted on the rear of the door panel. This will illuminate all front panel LED's for the duration that the **LAMP TEST** button is pressed. The front panel LED's will revert to their previous state when the **LAMP TEST** button is released.

5.2.5. Dimmer

The user may alter the brightness of the **POWER LED** and the LCD by pressing and holding the **DIMMER UP** and **DIMMER DOWN** buttons accordingly, these are mounted on the rear of the door panel.

6. Self Test Facilities

A system test may be performed on a selected channel. This will simulate a ramp up of the gas concentration and activate the appropriate alarms and relays at the set alarm points. When the concentration is at the sensor range level the system will ramp down the concentration back to the zero level. The user may use the *MUTE* and *RESET* buttons as in normal TQ4000 system operation. To initiate the system test the user must **hold** the desired channel. The user must then press the *SELECT* button on the TQ4000 main board to start the system test. To exit the system test the user must press the *UP* button on the TQ4000 main board. The TQ4000 will revert to normal system operation.

7. Fault Finding

7.1. Unit does not power up

Check mains input, fuse on power supply

7.2. Flammable gas sensors will not go to zero on setup

Usual problem is that the flammable gas card has not been set up in accordance with procedure. Check in particular the sensor zero is at 1.00mV positive.

If the flammable gas card is set up correctly remove sensor and insert dummy load resistors 3R3 1% to simulate sensor and adjust zero. If display now moves towards zero when down is pressed the sensor or sensor wiring is suspect.

Another problem may be damaged up and down push buttons, physically check the push button.

7.3. Flammable gas sensor when gassed do not span high enough

Most likely problem is that the sensor head voltage is below the required 2 volts. Measure the voltage at the sensor head, not the input terminal on the PCB. Bring voltage up to 2.00V and recalibrate.

Check that gas can is not empty and that there is an airtight seal around the gassing cup. For TQ flammable sensors use TQ gassing cup.

7.4. Flammable gas sensor moves erratically when gassed

Check the control electronics by evoking test mode and allowing unit to cycle through. If the display is still erratic as opposed to a steady sweep, electronics are suspect.

Check that gassing is being done at a rate of not greater than 0.5litre/min and that a gassing cup is used.

7.5. Display is cycling from 0 to end of scale and alarms are sounding

The unit is in system test mode. Exit system test by following procedure described in point 6 above.

7.6. Relays fail to activate on alarm

Check that channel is not inhibited if it is release by pressing down key.

8. Sensor Information

8.1. Flammable Sensors

The flammable gas sensors are pellistor based flammable gas sensors operating in the range 0-100% LEL (Lower Explosive Limit).

There are a number of components which inhibit flammable gas sensors. For this reason regular checking will help maintain any pellistor based system in good operating condition.

AVOID exposure to silicones, chlorinated hydrocarbons, lead and sulphur containing compounds, halogenated compounds.

The TQ122 flammable sensors are wire colour coded and should be connected to the control panel in accordance with Drawing **7970V**.

8.2. Toxic Sensors

Most toxic sensors are 4-20 mA based and the majority of these are two wire. The TQ4000 can interface to almost any 2 wire sensor. The TQ4000 source voltage is 24V and the 4-20mA is developed into 220 R. In general the supply +ve to the sensor is taken from the input pin marked BHI and the 4-20mA returned to the middle pin which is SIG. **It is very important to ensure that the correct input card is used.** If a flammable input card is used it may cause severe damage to the sensor, similar comments apply if a 4-20mA is used on a flammable sensor. Connection detail for the TQ122/123 series of sensor is shown in drawing **7970V**.

8.3. Infra-red and other 3-wire 4-20mA Sensors

3 wire systems indicate that the sensor at the end of the TQ4000 requires power. The TQ4000 can adequately drive up to **3x24Volt sensors each requiring less than 0.25W per sensor**. The voltage available falls towards the lower limit of 18Volts when loaded with 4 sensors of this power and may cause intermittent operation of the sensors. When using higher rated sensors it is advisable to order a larger capacity power supply to cope with the additional demand. The power supply in the TQ4000 is designed to deliver 18-24V at 1.5A. The electronics consume approx 0.5A which leaves approx **1A available to drive sensors and alarms**. The power supply is an easily interchanged unit.

Connection is made to the BHI for the 24V, the 0V is obtained at the BLO terminal and the 4-20mA is returned to the SIG terminal for the selected channel. **It is very important to ensure that the correct input card is used.** The 4-20mA input card must be used for this application.

9. Modbus Communications

The TQ4000 unit features dual channel Modbus communications over 2 serial RS485 lines. This communication allows remote interrogation of the channel concentrations and the status of the channel alarms and fault conditions. It is also possible for remote alarm mute and alarm reset functions to be performed. The Modbus register addresses are detailed in the following table:

Modbus Register Addresses For TQ4000

Input Register (0x04)	Starting Address(High)	Starting Address(Low)	Number of Registers(High)	Number of Registers(Low)	Number of Bytes
Station Number Read (0x04) Write (0x10)	0x00	0x01	0x00	0x01	2
Channel 1 Conc.	0x00	0x02	0x00	0x01	2
Channel 2 Conc.	0x00	0x03	0x00	0x01	2
Channel 3 Conc.	0x00	0x04	0x00	0x01	2
Channel 4 Conc.	0x00	0x05	0x00	0x01	2
Discrete Inputs (0x02)					
Alarm Status	0x00	0x01	0x00	0x01	2
	Input Number				
Channel 1 AL 1	1				
Channel 1 AL 2	2				
Channel 1 AL 3	3				
Channel 2 AL 1	4				
Channel 2 AL 2	5				
Channel 2 AL 3	6				
Channel 3 AL 1	7				
Channel 3 AL 2	8				
Channel 3 AL 3	9				
Channel 4 AL 1	10				
Channel 4 AL 2	11				
Channel 4 AL 3	12				
Channel 1 FLT	13				
Channel 2 FLT	14				
Channel 3 FLT	15				
Channel 4 FLT	16				
Write Coil (0x05)					
Alarm Action	0x00	0x01	0x00	0x01	2
	Input Number				
Reset Alarms	1				
Mute Alarms	2				
Communications Protocol					
Baud Rate	Data Bits	Parity	Stop Bits	Transmission	Check
19200	8	Even	1	RTU	CRC-16

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