

**TQ 4000 SERIES
FLAMMABLE GAS
&
TOXIC GAS SENSOR
CONTROL UNIT**

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TQ ENVIRONMENTAL PLC BS EN ISO 9001

TQ SERIES 4000

1.0 INSTALLATION

- 1.1. Open the front door and locate the three 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 **TQ4000.AA0**. The mains supply should be fused via a 5A spur.
- 1.5. The sensors shall be connected to the instrument in accordance with the Drg Nos. TQ4000.AA0 and TQ4000X0.. 2 or 3 core, 1.5 mm² 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 wired as per page 2 and drawing TQ4000.AA0.
- 1.7. Check all wiring before connecting mains. All units are configured for 240V ac 50Hz unless marked otherwise on the power supply. (Later units are voltage selectable. Refer to Page 4 of this manual)
- 1.8. On power up the unit should go into inhibit mode. This lasts for about 45 seconds and allows the sensors to stabilise before commencing scanning. This inhibit mode may be terminated prematurely by pressing the select button (Drawing TQ4000AJ).
- 1.9. The channels should then scan through 1 at a time depending on the factory setting of the number of channels.
- 1.10. If additional channels are required it will be necessary to fit the relevant extra input card . The unit can be configured for different numbers of channels by 'powering off' (removing battery connection if battery back up is used), depressing the hold button and 'powering back up'. The unit now cycles through 1-4 channels. Wait one complete cycle and then when the desired number of channels are displayed, release the hold button and the unit is programmed for the number of channels. The unit then goes through its warm up inhibit routine.

2.0 RELAYS AND RELAY CONTROL

- 2.1 The unit is factory set so that the channel relays are activated on the first Alarm Point. Additionally there are two other relays Alarm 1 common and Alarm 2 common. The common Alarm 1 relay activates when any of the channels reach their Alarm 1 level. Similarly Alarm 2 common will activate when any of the channels reach their Alarm level 2.

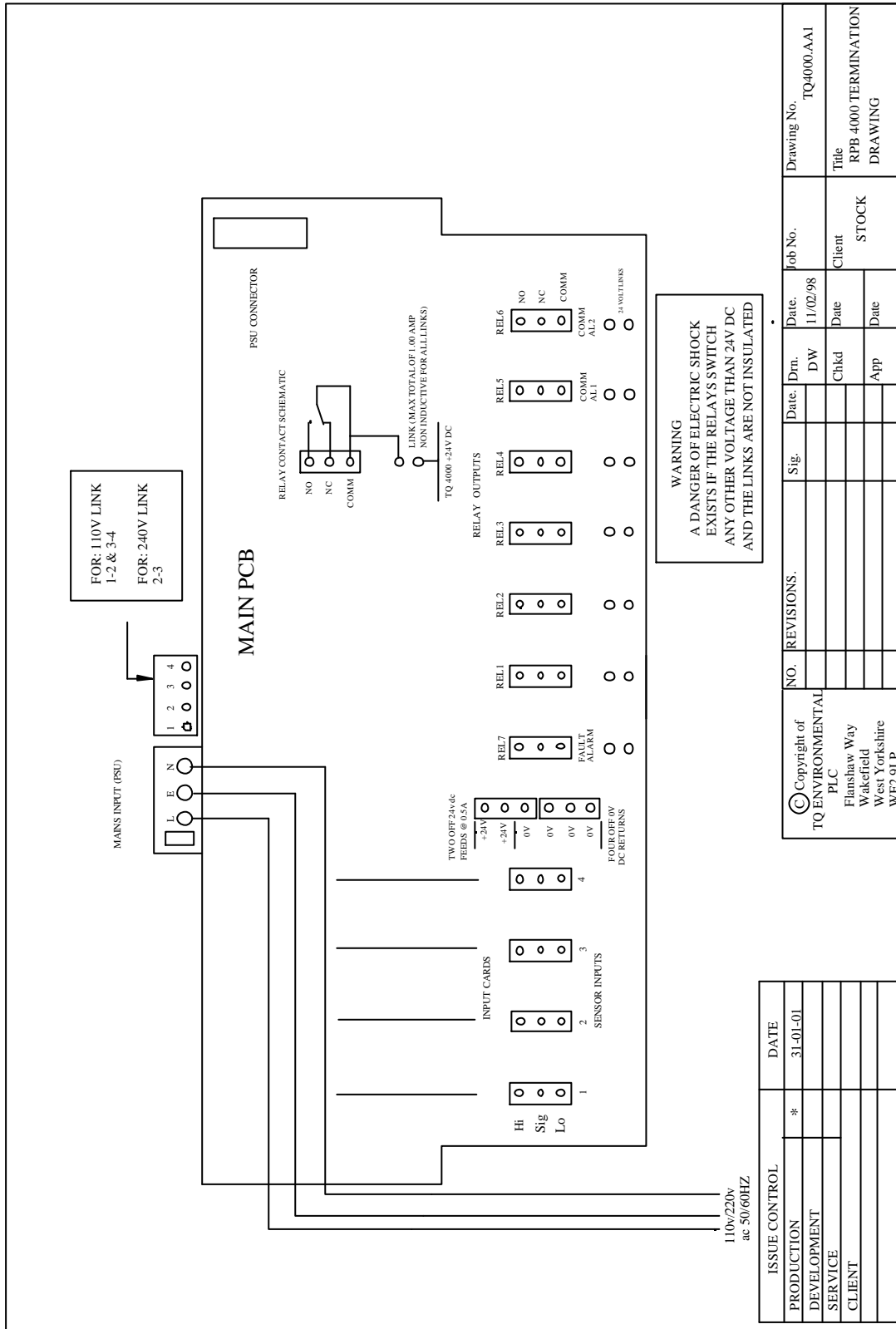
The fault relay will activate on a sensor fault either open or short circuit.

The fault relay also activates **20-30 seconds** after a mains failure when battery back up is used.

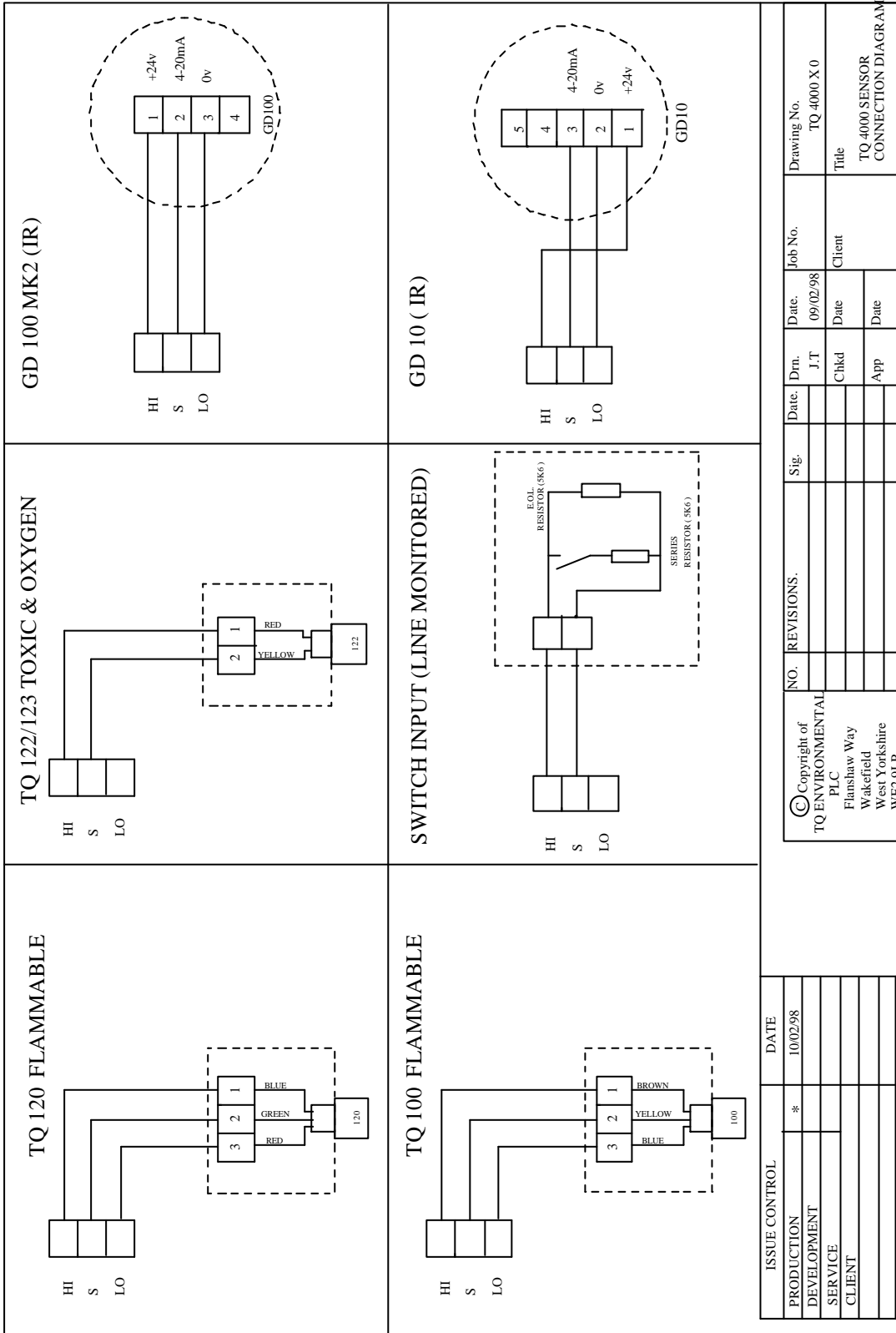
- 2.2 There is a 24V link which can be inserted associated with all the relays, this allows 24V to the common contact of the relay. This can be used for switching small loads of **less than 150mA** non inductive. See drawing TQ4000.AA0.

If this feature is not used and another voltage wired directly to the relay common, the 24V link must not be inserted as this will cause severe damage to the unit. There is also a **potential for electric shock** as the top part of the link is exposed. If the link is not to be used it is recommended that the links are electrically sealed or removed.

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Date.	Dm.	Job No.	Drawing No.	Date.	Title
09/02/98	J.T		TQ 4000 X 0		
Date	Chkd	Client		Date	
	App				
					TQ 4000 SENSOR CONNECTION DIAGRAM

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3.0 TQ4000 SET UP AND CONFIGURATION (version 1.65 and higher)

3.1 The TQ4000 can be configured to display the gas type and the maximum panel range (full scale) can also be set The TQ4000 is designed as a multipurpose gas detection control.
The unit is factory set and configured and should not need altering.

3.2 **O/P Relay Configuration and System configuration.**

There are 7 relays available on the TQ4000 six of which are configurable to any channel and either alarm level 1 or alarm level 2. This allows the flexibility of various permutations of channel and alarm levels to switch on one or more relay. **THE ONLY RELAY THAT IS NOT CONFIGURABLE IS THE FAULT RELAY.**

BEFORE CARRYING OUT CONFIGURATION SET UP THE NUMBER OF CHANNELS THE SYSTEM IS TO CONTAIN (max 4). THE NUMBER OF CHANNELS DEPENDS ON THE NUMBER OF INPUT CARDS USED. PLEASE CONSULT SECTION 1.9 IN THE MANUAL TO DO THIS.

3.3 **TO ENTER THE CONFIGURATION ROUTINE**

Switch the TQ4000 off (including battery back up if fitted)
Press the UP ARROW button on the pcb and at the same time apply the power.

The LCD will display PC or Buttons

3.4 **ALARM LEVEL INVERSION**

Press the select button

The LCD will display AL1 inv. 0000

This is to allow a falling value to cause an Alarm level 1 to become active and is generally only used for the detection of oxygen deficiency. If channel 3 contained an oxygen sensor and alarm level 1 was to be negative going (ie dropping from 21% to 19%) then the up arrow button would be pressed followed by the down arrow until the display read:

AL1 inv 0100

NOTE THAT THE CHANNEL NUMBERS READ RIGHT TO LEFT i.e. CHANNEL 1 IS REPRESENTED BY THE RIGHT HAND 0 AND CHANNEL 4 BY THE LEFT HAND 0.

Press select Button

The LCD will display AL2 inv 0000

The same comments apply to alarm level 2 as for alarm level 1

Press select button

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3.5 RELAY SET UP

The LCD will display CH1 AL1 000001 (or previous value)

This means that an alarm generated on channel 1 at alarm level 1 can now be programmed to drive any of, or any combination of relays by the insertion of a 1 on the appropriate relay. AL1 is selected by pressing the up arrow and the 0, which means the relay is not selected, by the down arrow. The cursor stays static but the display shifts left. Therefore if a mistake is made, up and down arrow keys can be pressed until the correct pattern of ones and zeroes is obtained.

The six positions on the LCD correspond to the following relays:

0	0	0	0	0	0	DISPLAY
REL6	REL5	REL4	REL3	REL2	REL1	RELAY NUMBER
REL1	REL2	REL3	REL4	REL5	REL6	POSITION ON PCB

Example: to turn on REL6 (referred to on the pcb as alarm2 common) when channel 1 alarm level 1 is reached.

The display would read: CH1 AL1 100000

Example: to turn on REL1 at the same time

The display would read CH1 AL1 100001

NOTE THAT THE RELAYS DEPICTED ON THE DISPLAY READ RIGHT TO LEFT AND THE RELAYS ON THE BOARD READ LEFT TO RIGHT.

Once satisfied with the selection press the select button

The display will read CH1 AL2 000010 (previous value)

select the desired relay, if any, by using the up and down arrow keys in the manner described before. Once satisfied with the selection press the select button.

Carry on this sequence until the final selection is complete on CH4 AL2

Press the select button.

The display will read METHANE 100%

Press the select button if you do not wish to alter the gas type. To scroll through the choices available press the up or down arrow key. When the correct gas has been selected on the display press the select button.

The display will read METHANE 100%

To alter the range (the full scale reading) use the up arrow and down arrow. Note that the cursor has moved to the scale field. It is important to match the indicating range on the display with that of the sensor being used. Once the selected range is displayed press the select button and repeat the above for all the channels. If no channels are to be altered press the select each time until reaching the last channel.

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Press the select button until the display shows STORE NV DATA
The TQ4000 is now configured.

- 3.6 IF A MISTAKE IS MADE ON ANY CHAN/ALARM IT IS BEST TO PRESS SELECT ALL THE WAY THROUGH TO THE FINAL "STORE NV DATA". THIS WILL STORE THE PREVIOUS GOOD CHAN/ALARM CONFIGURATIONS. THE PROCEDURE CAN THEN BE REPEATED AGAIN FROM POWER UP AND PRESS SELECT UNTIL REACHING THE CHAN/ALARM TO BE CONFIGURED.

WRITE DOWN THE SEQUENCE YOU WANT BEFORE PROGRAMMING

The default settings are

CH1 AL1 010001
CH1 AL2 100001
CH2 AL1 010010
CH2 AL2 100010
CH3 AL1 010100
CH3 AL2 100100
CH4 AL1 011000
CH4 AL2 101000

These settings are the ones that are factory set and how the unit is shipped unless specifically requested settings are ordered.

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4.0 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 **TQ4000X0 & TQ4000AK**.

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

4.1 Setting the flammable gas sensor head voltage:

With DVM set to a low range measure the Voltage across BH1 & BL0 at the control unit (This is factory set to approximately 2.07 - 2.1V record this reading (RDG1)

Measure the flammable gas sensor head Voltage at the sensor head between the blue and brown wire on DVM with the same range (RDG2) at the sensor head.

Subtract RDG1 - RDG2 = cable voltage loss.

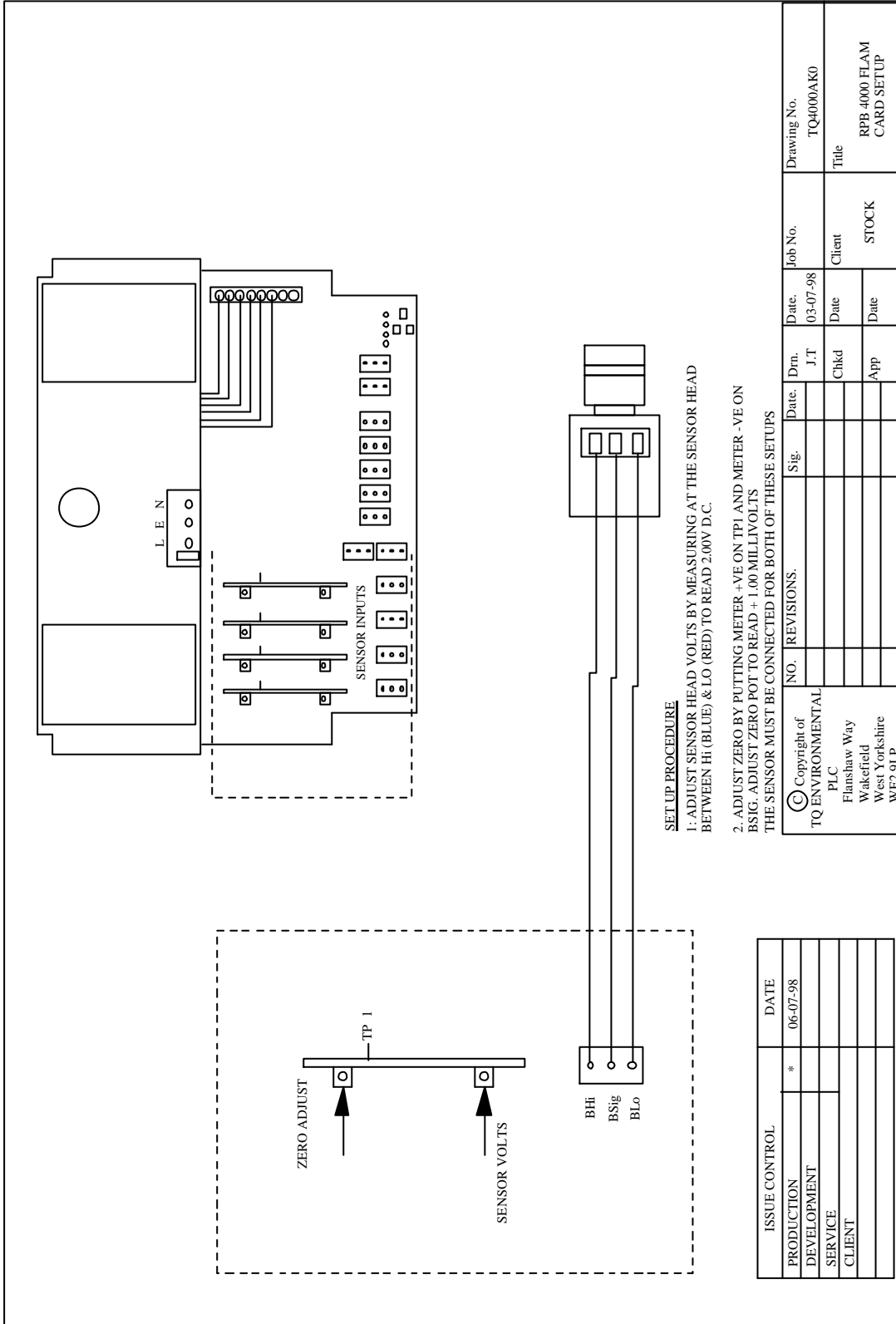
Measure across BH1 and BL0 at control unit on DVM and turn sensor Volts pot to a level equal to RDG1 + cable loss.

4.2. 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.

4.3. These two procedures are repeated for each flammable gas sensor.

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5.0 CALIBRATION AND SET UP
(Drawing TQ4000AJ)

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.

With the unit powered up the channels should be scanning through.

To select a channel to calibrate press the select button as shown in Drawing TQ4000AJ when the appropriate channel is indicated on the front panel. (The select button is on the main pcb).

5.1 ZERO ADJUSTMENT

The zero LED should now be illuminated and the channel selected be inhibited as indicated on the front panel. The zero is now set on the meter 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. The span LED should now be illuminated and the unit can be span adjusted.

5.3 SPAN ADJUSTMENT

MUST ONLY BE DONE WITH CALIBRATION GAS and by qualified personnel. Enter the span mode from the zero mode by pressing the select button. This is indicated on the 4 LEDs adjacent to the select button. Apply the gas to the sensor in the manner prescribed by the sensor manufacturer and with the correct gas. The level indicated on the meter 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. The LED's then indicate the next AL1.

Do not adjust the span without gas on the sensor as this will effect the calibration of the sensor on that channel. The scan can be skipped over by pressing the select button if no adjustment is required.

5.4 AL1 AND AL2 ADJUSTMENT.

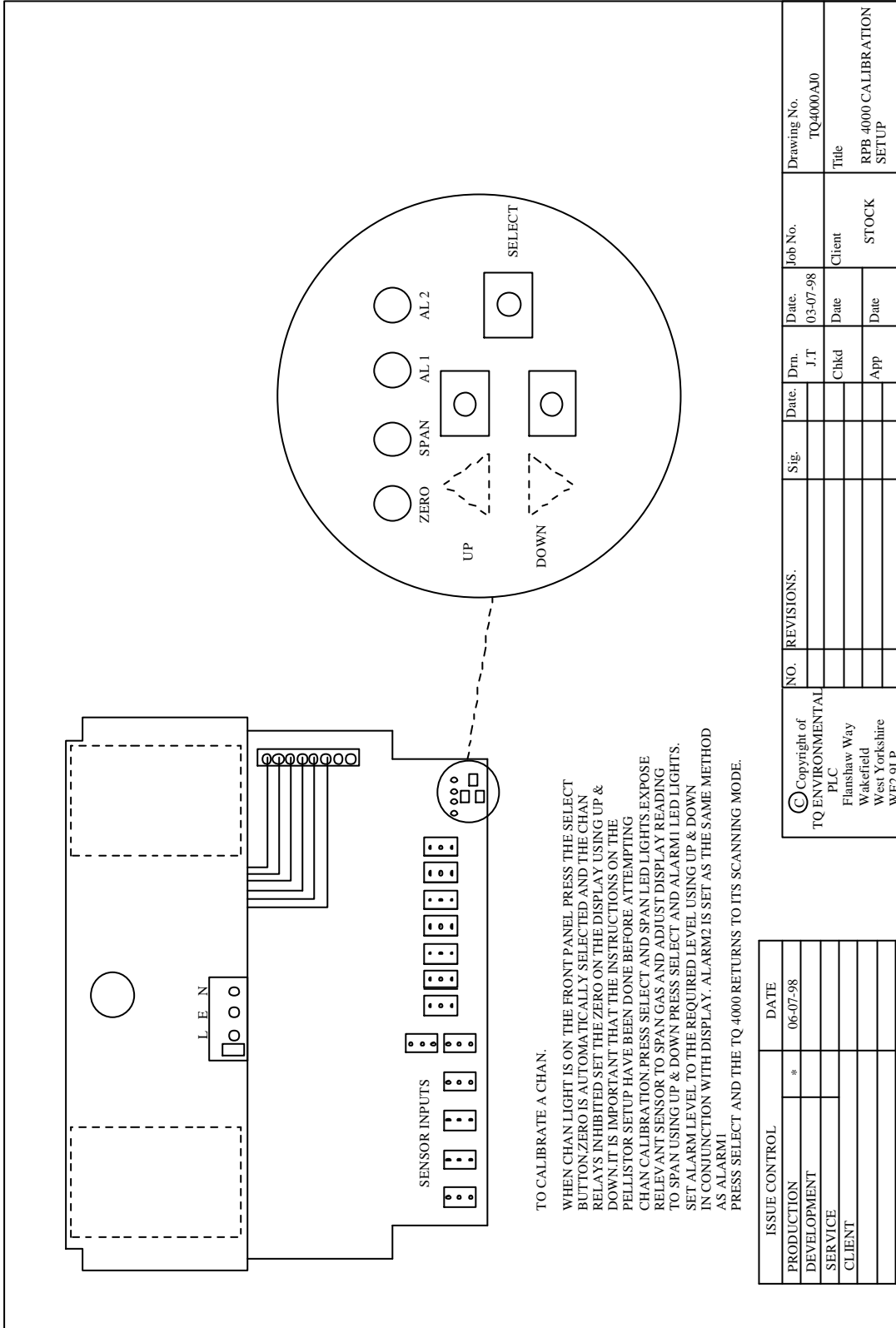
Press select button after going through the zero procedure. If the channel is not being calibrated the span can be omitted by pressing the select button again. This allows adjustment of the alarm setpoint in conjunction with the reading on the meter front panel. Once the desired level has been reached using the up and down buttons, the level is stored in memory by pressing the select button again. At the same time the set up procedure will step on to the final function of alarm level 2 adjustment.

This alarm setpoint is adjusted in exactly the same manner as described for the alarm level 1. When the appropriate level has been reached, the select button is pressed the and unit will now return to its normal scan mode.

When the select is pressed when the unit is scanning, the channel selected is automatically inhibited. This inhibit will reset itself after approximately 10 minutes if the set up procedure is not completed. The inhibit resets itself only when exiting from alarm level 2 adjust.

Any of the functions can be skipped over by pressing the select button.

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NO.	REVISIONS.	Sig.	Date.	Dm.	Date.	Job No.	Drawing No.
				J.T	03-07-98		TQ4000A10
				Chkd		Client	Title
				App		STOCK	RPB 4000 CALIBRATION SETUP

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6.0 **FRONT PANEL WARNING LEDS & PUSH BUTTONS**

Drawing TQ4000AM

6.1 **FRONT PANEL**

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 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.

O/R: When lit this indicates that the sensor related to that channel has gone over range (for more than one second). There is no relay associated with this indicator lamp. 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. For systems with battery back-up the fault relay is also activated by the mains failure, some 20-30 seconds after the mains has failed. Under this failure mode the fault relay is activated but no channel LED would light, the mains LED would be off.

AL1/AL2: Alarm lamp the channel indicated has exceeded the alarm set point for the alarm indicated. The appropriate relays should also have been activated.

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

Mains: Shows healthy mains status.

6.3 **BUTTON FUNCTIONS:**

Reset : (a) Resets alarm on channels where the alarm level is below the level set.

(b) Resets O/R or fault when the condition has been cleared.

Mute : Mutes the internal buzzer (Alarm lights change from Red to flashing red).

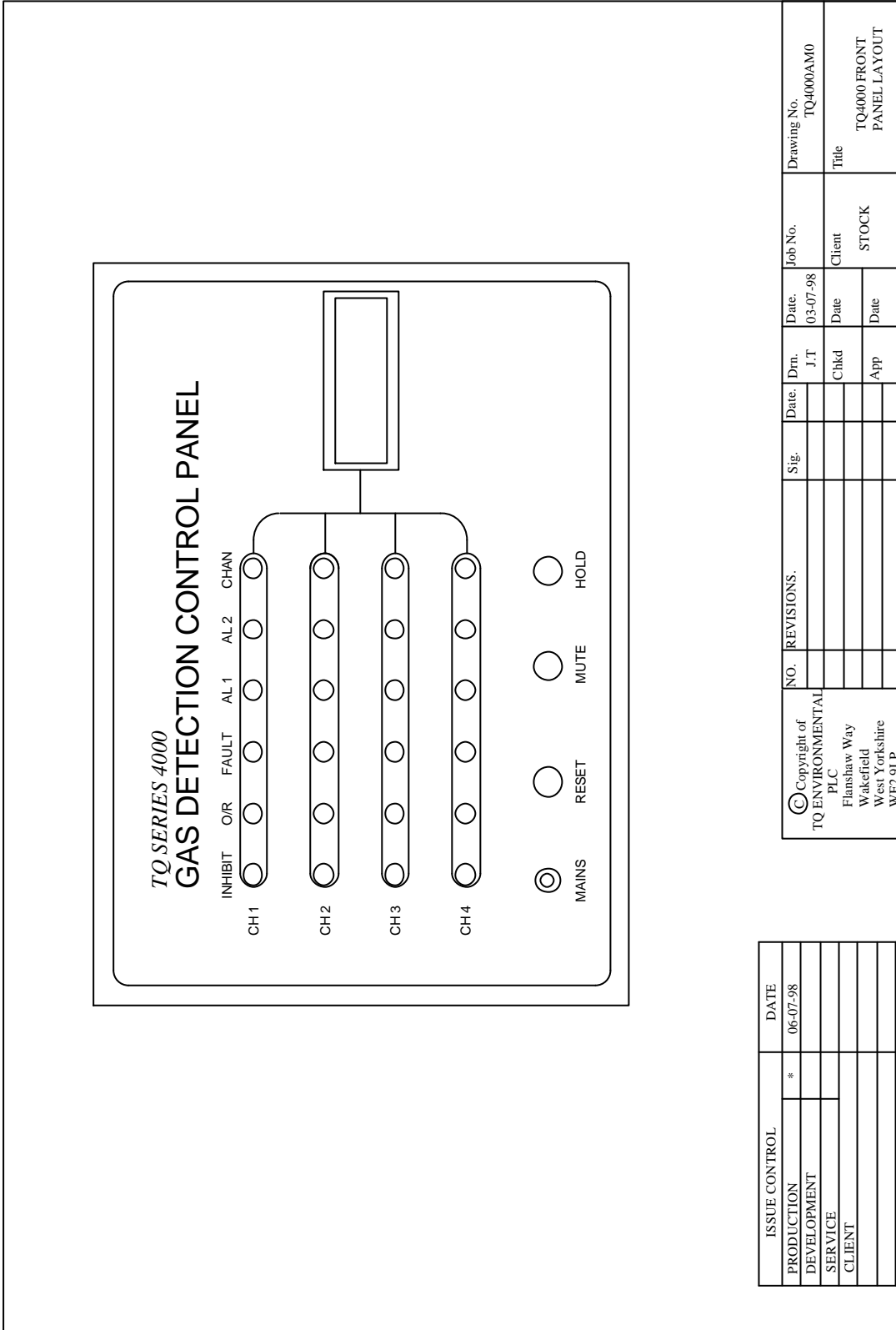
Hold: Holds the display to continuously monitor the channel shown.

Note: the change of state of the channel indicator from steady lamp to flashing lamp. To start the channel scanning press the hold button for 2 seconds and release and after approximately 3 seconds the channel scan will recommence. At all times the alarms are being continuously monitored. The scanning function just displays the gas concentration reading on the meter.

6.4 **EVOKING INHIBIT WHEN CHANNELS ARE SCANNING.**

The relay outputs on a particular channel can be inhibited at anytime when the channels are scanning by pressing the up button (Drawing TQ4000AJ). The inhibit LED will come on relating to the channel selected. To remove the inhibit press the down arrow key when the channel is selected and the inhibit LED will go off. There is an automatic time out when selecting the inhibit of 2 hours from the time of the last inhibit selection. After this period the inhibit will be automatically revoked.

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				03-07-98	J.T			TQ4000AM0
					Chkd		Client	Title
					App		STOCK	TQ4000 FRONT PANEL LAYOUT

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7.0 **SELF TEST FACILITIES**

7.1 **FRONT PANEL**

To self test the front panel, LEDs, and relays, a self test facility can be evoked. Ensure that relays are disconnected as the alarm relays are activated.

Switch off the mains, disconnect the battery back-up if connected. Press the down button (Drawing TQ4000AJ), and reconnect the mains. The unit will now cycle through the Zero, Span, AL1, AL2 LEDs on the pcb and then cycle through the LEDs on the front panel and finally the relays on the main pcb.

The LED's light in sequence and it will be possible to identify if any are faulty. When the unit has completed the self test the unit will return to the power up inhibit mode for 45 seconds before returning to the scanning mode.

7.2 **SYSTEM TEST**

When the installation is complete it is possible to test the system without presenting gas to the sensors. It is recommended to do a complete system test by gassing the sensors to prove connection and calibration. The system test will show that the control panel and associated alarms are working. This test is carried out a channel at a time.

To evoke the system test mode:

Select a channel to be tested with the HOLD button.

Press the Select button (Drawing TQ4000AJ).

The display will now move from zero and begin to ramp up towards full scale. As it passes through each alarm point the internal buzzer will sound, alarm LED's light, and the relevant channel relays activate. When the display reaches its limit it ramps back towards zero.

When the display is above the alarm level the mute button will disable the internal buzzer. When the display is below the alarm level the reset will reset the alarm relays and the front panel LED's.

The alarm points may appear to be above the set level, this is because the system does not use edge triggered alarms and therefore there is a delay.

To Exit the System Test Mode

The display must be stationary this is done by pressing the up button to step the display movement.

Press the select button and then release the channel from hold by pressing the hold button so that channel LED changes from flashing to steady.

If the relays had been inhibited prior to entering into this mode they should be released by pressing the down button before the hold is pressed. Drawing TQ4000AL gives a flow chart representation of this sequence.

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8.0 FAULT FINDING.

8.1 Unit does not power up

Check mains input, fuse on power supply

If using battery back-up system and not connected, disconnect mains and connect battery terminal, unit should power up if batteries @ 24VDC. If unit powers up off batteries possible mains or PSU fault.

8.2 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 (See page 9).

If 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.

8.3 Flammable Gas Sensors 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 (Drawing

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.

8.4 Flammable Gas Sensor moves erratically when gassed

Check the control electronics by evoking test mode and allowing unit to cycle through. If display 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.

8.5 Display is cycling from 0 to almost end of scale and alarms are sounding

The unit is in system test mode. Exit system test by following procedure in Drawing TQ4000AL.

8.6 Cycle between Channels is very slow

Switch off and power up again with select button pressed and then release.

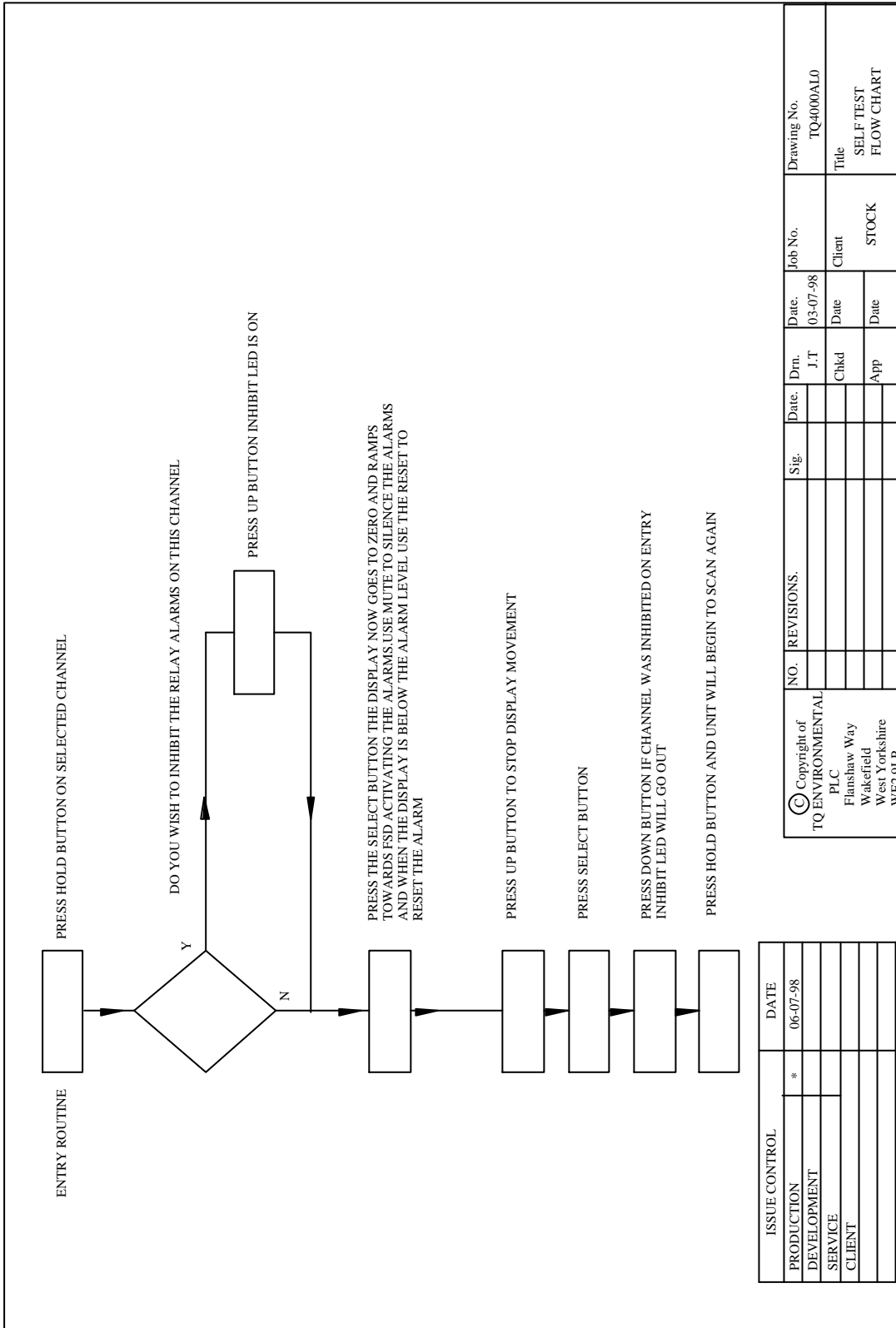
8.7 Relays fail to activate on alarm

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

8.8 Unit seems to reset intermittently

This is not a fault. If the unit detects very high levels of electrical noise or RFI which is likely to corrupt the signal integrity the unit resets for a short period allowing the noise or RFI to subside. This prevents spurious alarms.

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9.0 **SENSOR INFORMATION**

9.1 **FLAMMABLE SENSORS**

The flammable gas sensors are pellistor based flammable gas sensor 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 TQ120 flammable sensors are wire colour coded and should be connected to the control panel in accordance with Drawing TQ4000X.

9.2 **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 4-20 mA 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 **TQ4000X**.

9.3 **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 **3 X 24 Volt 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 1.5 A. The electronics consume approx 0.5 A which leaves approx **1A available to drive sensors and alarms**. The power supply is an easily interchanged unit.

9.4. 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.

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DECLARATION OF CONFORMITY (CE MARKING)

Application of Council Directives: 89/336/EEC
92/31/EEC
73/23/EEC
93/68/EEC

Standards to which conformity is declared: I S EN 50081-1
I S EN 50082-1
I S EN 60950
I S EN 55022 1995
I EC 801 Part 2 1984
I EC 801 Part 3 1984
I EC 801 Part 4 1988

Manufacturer's Name: TQ Environmental PLC
Manufacturer's Address: Flanshaw Industrial Estate
Flanshaw Valley
Wakefield
West Yorkshire
WF2 9LP
United Kingdom (UK)

Type of Equipment: Gas Monitoring Equipment

TQ Standard Product Reference: RPB4000

Year of Manufacture: 1997

The undersigned hereby declares that the equipment specified above conforms to the protection requirements of the directives and standards quoted by this document.

Place: Wakefield, West Yorkshire, United Kingdom (UK)

Date: 4 September 1997

Authorised Signatory:



(Technical Director)

F18/2:Iss1:10.6.97