

# **TQ4300**

Multi Channel  
Sampling System

## **OPERATING MANUAL**



**TQ Environmental Ltd.**  
Silkwood Court  
Wakefield  
WF5 9TP  
United Kingdom

**Tel: +44 (0) 1924 271013**

**Email: [sales@tqenv.com](mailto:sales@tqenv.com)**

**Web: [www.tqenv.com](http://www.tqenv.com)**

# **TQ4300MK2 GAS SAMPLING SYSTEM**

## **OPERATING MANUAL**

© TQ Environmental Ltd 2022

This manual must not be copied or reproduced in part without the express written permission of TQ Environmental LTD. All information contained herein is subject to modification.

TQ Environmental Ltd, Silkwood Court, WAKEFIELD. WF5 9TP

☎ +44 (0) 1924 271013.

E-mail: [sales@tqenv.com](mailto:sales@tqenv.com)

Web Site: [www.tqenv.com](http://www.tqenv.com)

***TQ ENVIRONMENTAL LTD BS EN ISO 9001***

Date of Issue: 14<sup>th</sup> January 2022

Author: W Cawood

## CONTENTS

<b>1.</b>	<b>INTRODUCTION</b>	<b>4</b>
<b>2.</b>	<b>SYSTEM DESCRIPTION</b>	<b>5</b>
<b>2.1.</b>	<b>Pneumatics</b>	<b>5</b>
<b>2.2.</b>	<b>Sensors</b>	<b>6</b>
2.2.1.	Infrared Sensor (TQ 129, GD133, & GD131)	6
2.2.2.	Electro-chemical Type.	6
<b>2.3.</b>	<b>Control and Display Electronics</b>	<b>7</b>
2.3.1.	The TQ4300 Front Panel Display	8
<b>2.4.</b>	<b>Outputs</b>	<b>8</b>
<b>2.5.</b>	<b>MODBUS Communication</b>	<b>9</b>
<b>2.6.</b>	<b>Technical Specification</b>	<b>11</b>
<b>3.</b>	<b>OPERATION</b>	<b>12</b>
<b>3.1.</b>	<b>System Start-up</b>	<b>12</b>
<b>3.2.</b>	<b>Pressure Test</b>	<b>12</b>
<b>3.3.</b>	<b>Auto-Zero Sensor</b>	<b>12</b>
<b>3.4.</b>	<b>Normal Operation</b>	<b>13</b>
<b>3.5.</b>	<b>Panel Controls</b>	<b>14</b>
3.5.1.	Download Default Data	14
3.5.2.	Enter Password	15
<b>3.6.</b>	<b>Alarm Conditions</b>	<b>16</b>
3.6.1.	Fault Conditions	16
3.6.1.1.	Sensor Fault	16
3.6.1.2.	Flow Fail	17
3.6.1.	Concentration Alarms	17
<b>3.7.</b>	<b>Relay Board</b>	<b>19</b>
<b>3.8.</b>	<b>Channel Functions</b>	<b>19</b>
3.8.1.	Goto Channel	20
3.8.2.	Hold Channel	21
3.8.3.	Skip Channel	22
3.8.4.	Display Alarms	23
3.8.5.	Erase Alarms	24
<b>4.</b>	<b>SYSTEM SETTINGS</b>	<b>25</b>
<b>4.1.</b>	<b>Parameters Menu</b>	<b>25</b>
4.1.1.	Parameters Sub Menu - Set Location	25
4.1.2.	Parameters Sub Menu – Allocate Sensor	27
4.1.3.	Parameters Sub Menu - Set Gas Name	28
4.1.4.	Parameters Sub Menu - Set Sensor Units	29
4.1.5.	Parameters Sub Menu - Set Alarms	29
4.1.6.	Parameters Sub Menu - Set Alarm Type	31
4.1.7.	Parameters Sub Menu - Set Alarm Latch	31
4.1.8.	Parameters Sub Menu - Set Alarm Delay	32
4.1.9.	Parameters Sub Menu - Set Dwell Time	32
4.1.10.	Parameters Sub Menu - Set Purge Time	33
<b>4.2.</b>	<b>Technician Menu</b>	<b>34</b>
4.2.1.	Technician Sub Menu - Set Number of Channels	34
4.2.2.	Technician Sub Menu - Set Number of Sensors	35
4.2.3.	Technician Sub Menu – Calibrate Gas	35
4.2.3.1.	Set Zero	36
4.2.3.2.	Set Span	37
4.2.3.3.	Clear Calibration	38
4.2.3.4.	Exit Sub Menu	38
4.2.4.	Technician Sub Menu – Set Sensor Range	39
4.2.5.	Technician Sub Menu – Set Sensor Offset	40
4.2.6.	Technician Sub Menu – Set Modbus Address (Station Number)	41
4.2.7.	Technician Sub Menu – Set Serial Configuration	41
4.2.8.	Technician Sub Menu – Set Fault Relay Type	42
4.2.9.	Technician Sub Menu – Set Channel Relays	42

<b>5.</b>	<b>INSTALLATION</b>	<b>43</b>
5.1.	TQ4300 Analysing Unit	43
5.2.	End of Line filters	43
5.3.	In-Line Filters	44
5.4.	Sample Lines	44
<b>6.</b>	<b>COMMISSIONING</b>	<b>45</b>
6.1.	Installation.	45
6.2.	System Power Up	45
6.3.	Setting the Flow Rate	46
6.4.	Sample Location Set-Up Test	46
6.5.	Testing Gas Concentration Alarms	46
<b>7.</b>	<b>SCHEDULED MAINTENANCE</b>	<b>47</b>
7.1.	System Confidence Test Sequential Sampling Part	47
7.2.	Filter Check	47
7.3.	System Calibration (All Sensors)	48
7.4.	Pump Service	48
<b>8.</b>	<b>PARTS LIST</b>	<b>48</b>

## 1. INTRODUCTION

The **TQ4300 sampling system** is a multipoint, sequential, aspirated, gas sampling system. The system extracts a gas sample from a desired location, via transport lines to an analysing unit where the sample is monitored for 'Freons' and/or 'CO<sub>2</sub>' or Flammable gases. The **TQ4300** in its usual form uses fixed gas sensor heads to constantly monitor gases in conjunction with solenoids and a pump to make this into a cost effective sampling system.

The **TQ4300 sampling system** is primarily designed for gas detection and plant leak detection. Portable personal hand held devices are recommended as primary protection for personnel working continuously in confined spaces.

The number of locations for a **TQ4300** is restricted to no more than 24.

Typical explosive and toxic gas sensors (6 Max), which can be installed within the **TQ4300**, can be seen in table 1, (other gases are available on request.)

<u>Explosive</u>	<u>Toxic</u>
Methane 0-100% LEL	H <sub>2</sub> S Various ranges
Butane 0-100% LEL	CO Various ranges
Methane 0-100% VOL	CO <sub>2</sub> Various ranges
Butane 0-100% VOL	Oxygen 0-25% VOL
	Freon 0-2000PPM

**Table 1**

The **TQ4300** is capable of providing individual 'low' and 'high' alarm outputs for each gas sensor installed and corresponding alarm relays. This can provide an interface with alarm management systems, remote mimic panels, and audible / visual warning devices.

The **TQ4300** Unit is mounted within the cabinet. The operator interface is via four push buttons and a backlit LCD. During normal operation the LCD display will provide the 'gas type' and sample 'concentration' for each individual location. It will also display the current alarm status of the unit.

## 2. SYSTEM DESCRIPTION

The **TQ4300 sampling system** standard Analysing Unit is housed in a wall-mounted enclosure complete with front panel Display Unit. The enclosure contains all electrical, electronic and pneumatic equipment required to monitor, display, control and provide alarm outputs for the relevant locations.

The **TQ4300 sampling system** is divided into the following main components:

- ◆ Pneumatics
- ◆ Sensor(s)
- ◆ Control Unit
- ◆ Power Supply Change Over Unit
- ◆ Sample Line Accessories
- ◆ Outputs
- ◆ Technical Specification

### 2.1. Pneumatics

The typical Analysing Unit contains the following pneumatic devices:

- ◆ Solenoid Valves
- ◆ Particulate Filter
- ◆ Pump
- ◆ Flow Detector

**2.1.1. The Solenoid Valves** are mounted singularly on the back panel of the cabinet. Each solenoid is then individually plumbed to the gland plate where they are fitted with a suitable pipe fitting from which the sample line can be connected.

Each valve is complete with a 24V D.C. coil, and connection to each coil is via a 3 pole connector containing an LED and snubbing diode.

**2.1.2. The Particulate Filter** is fitted with a micro-fibre filter element, which cannot be cleaned and therefore must be replaced when it is suspected of reducing air flow. This unit is also fitted with a poly-carbonate bowl to allow visual inspection of the filter element. Spare filter elements can be supplied, refer to Section 8 for Part numbers.

**2.1.3. The Pump** is an Industrial type to ensure adequate flow rates for the larger installations. As an example on transport tube dimensions of 4.0mm I/D, flow rates in excess of 4 litres/min. are achievable for sample line lengths up to 300 metres. Based on these figures, sample times for a 300 metre sample line will be in the order of 1 minute, providing sharp bends and fittings are kept to a minimum. A Pump Service Kit can be supplied refer to Section 8 for Part numbers

**2.1.4. The Flow Detector** is fitted in the sample flow line to indicate airflow to the sensors and works in conjunction with the differential needle valve. The flow detector monitors for a pressure differential across the system. When the differential has balanced out it assumes a blockage and flag a flow fail alarm. When flow returns the difference in pressures will return and the signal to its control relay will revert to normal.

**2.1.5. Sample Line Equipment** is optionally available in several forms to suit the sample location.

- End of Line filters for 'Dry' areas,
- In-line filter (where an End of line filter is not practical).

There are two types of **End of Line Filters**. See section 5.2 & 5.3

- A fibre element type where the filter element has to be replaced periodically.
- A stainless steel type where the filter element can be cleaned.

Both of the above filters are supplied with dual compression fittings to suit pipe sizes 6 or 8mm O/D, in either brass or stainless steel. It is advisable to protect the Filter when installed in a location where damage may occur.

The **In-Line Filter** is a stainless steel unit that is suitable for attaching to a stop-valve when fitted in a stop valve box or can be fitted to the line in a serviceable location. It is advisable to remove the In-Line Filter complete for cleaning, as splitting the filter in situ may damage the threads.

## **2.2. Sensors**

There are two type of sensors, the infrared type, for Freons, CO<sub>2</sub> and flammable gases, or the electro-chemical type for Toxic and Oxygen gases. When a system comprises of more than one sensor, they are connected in series in the sample line which then is vented out from the enclosure.

### **2.2.1. Infrared Sensor (TQ 129, GD133, & GD131)**

The operation of the infrared sensor within the **TQ4300 sampling system** is to measure the absorption of infra red light by a target hydrocarbon gas and converting that absorption to an electronic signal.

The infrared sensor is now packaged as a TQ-129, GD-133 & GD-131 stand-alone unit within the **TQ4300** and provides a 4-20mA signal for their respective target gas concentrations.

### **2.2.2. Electro-chemical Type.**

These sensors typically monitor for Oxygen and Toxic gases and because of their properties have a life span of approximately 1-2 years depending on conditions.

The Electrochemical types, as with the Infrared sensor, provide a 4-20mA signal for their respective gas concentrations.

### 2.3. Control and Display Electronics

The **TQ4300** is controlled from one PCB, the Control Card. This is where the unit is set up from using the buttons and display.

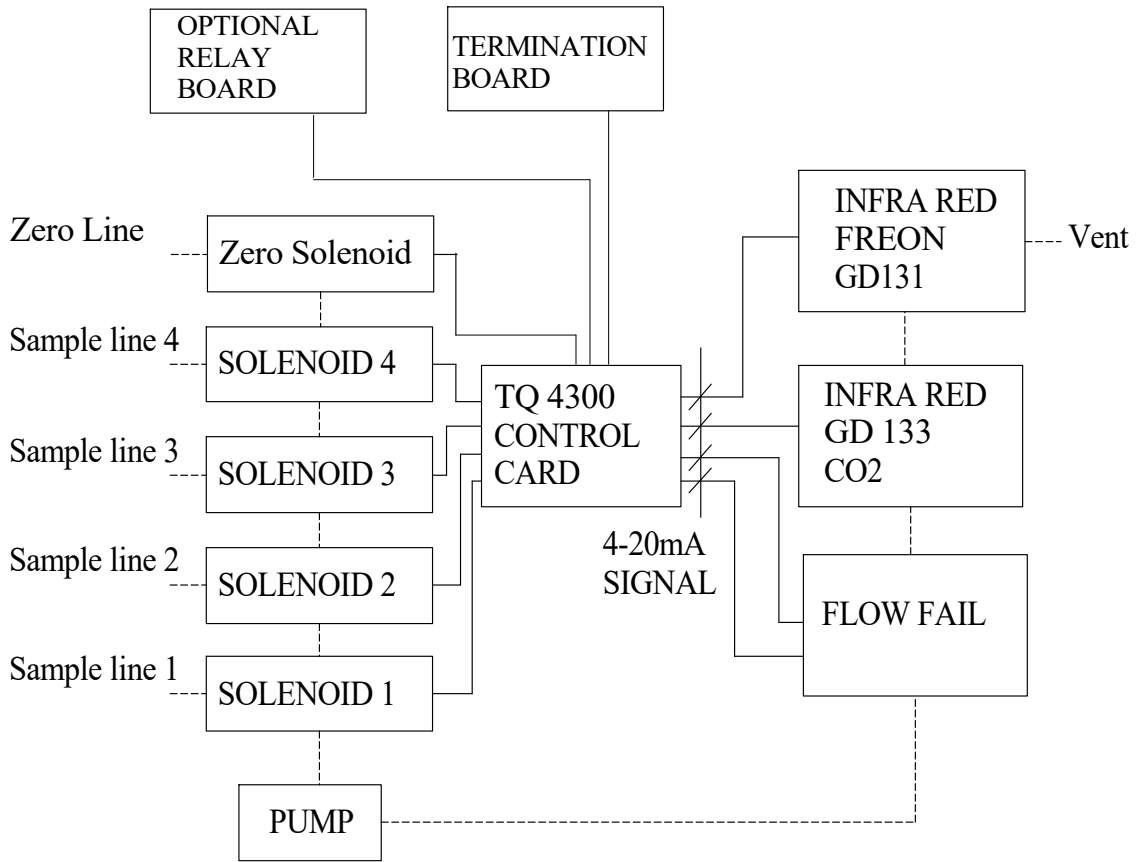


Fig. 1 Block diagram of System



### 2.3.1. The TQ4300 Front Panel Display

The Front Panel Display includes:

- Liquid Crystal Display.
- 4 Push buttons (Up, Down, Select and Menu function).
- 4 LED's (Alarm 1, Alarm 2, Alarm 3 and System Healthy).

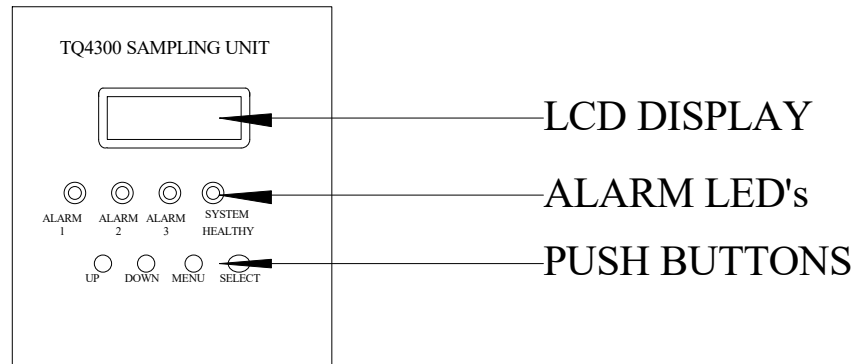


Fig 2 Front Display of TQ4300

### 2.4. Outputs

The TQ4300 standard outputs are in the form of:

- One sets of Volt Free Change-over relay contacts for Common Concentration Alarm Low.
- One sets of Volt Free Change-over relay contacts for Common Concentration Alarm High.
- One sets of Volt Free Change-over relay contacts for Common Concentration Alarm High High.
- One set of Volt Free Change-over relay contacts for System Fault Alarm.
- One 24VDC Output for Common Concentration Alarm Low. (Typically rated for beacon and sounder connection).
- One 24VDC Output for Common Concentration Alarm High. (Typically rated for beacon and sounder connection).
- One 24VDC Output for Common Concentration Alarm High High. (Typically rated for beacon and sounder connection).
- RS 485 MODBUS.
- One 4-20mA Output with respect to concentration (0-2000ppm) (sensor 1 only).
- One 4-20mA Output with respect to location (1mA per location).

## 2.5. MODBUS Communication

The **TQ4300** unit features single channel MODBUS communication over a RS485 serial line. The communication allows remote interrogation of the channel and sensor concentrations, as well as the status of the unit alarms and fault conditions. The MODBUS register addresses are detailed in the following tables:

### Modbus Register Addresses for TQ4300

The TQ4300 offers a RS485 MODBUS output, it has the following basic parameters.

Communications Protocol					
Baud Rate	Data Bits	Parity	Stop Bits	Transmission	Error Check
19200	8	Even	1	RTU	CRC-16
NB. Allow a minimum of 2 seconds for a Response					

#### Sensor 1

Input Register	Sensor 1 Address	Sensor 2 Address	Sensor 3 Address	Sensor 4 Address	Sensor 5 Address	Sensor 6 Address
Zone 1 Conc.	30001	30025	30049	30073	30097	30121
Zone 2 Conc.	30002	30026	30050	30074	30098	30122
Zone 3 Conc.	30003	30027	30051	30075	30099	30123
Zone 4 Conc.	30004	30028	30052	30076	30100	30124
Zone 5 Conc.	30005	30029	30053	30077	30101	30125
Zone 6 Conc.	30006	30030	30054	30078	30102	30126
Zone 7 Conc.	30007	30031	30055	30079	30103	30127
Zone 8 Conc.	30008	30032	30056	30080	30104	30128
Zone 9 Conc.	30009	30033	30057	30081	30105	30129
Zone 10 Conc.	30010	30034	30058	30082	30106	30130
Zone 11 Conc.	30011	30035	30059	30083	30107	30131
Zone 12 Conc.	30012	30036	30060	30084	30108	30132
Zone 13 Conc.	30013	30037	30061	30085	30109	30133
Zone 14 Conc.	30014	30038	30062	30086	30110	30134
Zone 15 Conc.	30015	30039	30063	30087	30111	30135
Zone 16 Conc.	30016	30040	30064	30088	30112	30136
Zone 17 Conc.	30017	30041	30065	30089	30113	30137
Zone 18 Conc.	30018	30042	30066	30090	30114	30138

Zone Conc.	19	30019	30043	30067	30091	30115	30139
Zone Conc.	20	30020	30044	30068	30092	30116	30140
Zone Conc.	21	30021	30045	30069	30093	30117	30141
Zone Conc.	22	30022	30046	30070	30094	30118	30142
Zone Conc.	23	30023	30047	30071	30095	30119	30143
Zone Conc.	24	30024	30048	30072	30096	30120	30144

### Alarms

	<b>Input Number</b>
Sensor 1 Alarm 1	10001
Sensor 1 Alarm 2	10002
Sensor 1 Alarm 3	10003
Sensor 2 Alarm 1	10004
Sensor 2 Alarm 2	10005
Sensor 2 Alarm 3	10006
Sensor 3 Alarm 1	10007
Sensor 3 Alarm 2	10008
Sensor 3 Alarm 3	10009
Sensor 4 Alarm 1	10010
Sensor 4 Alarm 2	10011
Sensor 4 Alarm 3	10012
Sensor 5 Alarm 1	10013
Sensor 5 Alarm 2	10014
Sensor 5 Alarm 3	10015
Sensor 6 Alarm 1	10016
Sensor 6 Alarm 2	10017
Sensor 6 Alarm 3	10018
System Fault	10019
Flow Fail	10020
Zero Blocked	10021
Sensor 1 Fault	10022
Sensor 2 Fault	10023
Sensor 3 Fault	10024
Sensor 4 Fault	10025
Sensor 5 Fault	10026
Sensor 6 Fault	10027
Comms Fault	10028
Menu Active	10029

## 2.6. Technical Specification

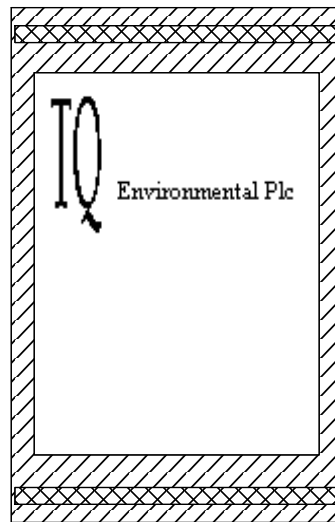
<b><i>Power</i></b>	110/240V 50/60Hz @ 4 Amps non inductive
<b><i>Internal D.C. power supplies</i></b>	1 x 24V DC (Sensors / Solenoids) (factory fitted dependent on sensor ratings and overall system requirement)
<b><i>Max no. of locations for sequential monitoring per Max no. of Sensor</i></b>	24 Locations for 5 Sensors
<b><i>Sensor types</i></b>	4-20mA current sources (2 or 3 wire)
<b><i>Pump Capacity</i></b>	11 Litres / Minute (open ended)
<b><i>Gas Concentration Alarm Outputs</i></b>	<b>Standard:</b> - 1 x Common Low / 1 x Common High Volt Free Contacts, @ 5Amps. Resistive. 1 x Common Low / 1 x Common High 24V DC @ 500mA <b>Custom:</b> - Up to 1 Individual Volt Free Contact per Sample Location Gas Alarm, 5A.
<b><i>Sample Lines</i></b>	Nylon OD 6mm - 8mm, ID 4mm - 6mm. Max length 300Metre @ 4.0mm I/D
<b><i>Fault Alarm Outputs</i></b>	1 x System Fault Volt Free Contact
<b><i>Data communications</i></b>	RS 485 MODBUS RTU
<b><i>Additional Outputs</i></b>	2 x 4-20mA o/p respective of location and concentration of sensor 1
<b><i>Operational temperature and humidity range</i></b>	0°C-40°C 0-90%RH non-condensing.

### 3. OPERATION

This section explains in detail the **TQ4300** system operation and typical alarm conditions.

#### 3.1. System Start-up

When power is applied to the system, the display will indicate the title screen, as below:



After the title screen the **TQ4300** system will enter a sensor warm-up period which will give the sensors sufficient time to stabilise. The system will stay in this mode for approximately 45 seconds.

#### 3.2. Pressure Test

After the 'start-up' delay the system will enter the pressure test mode. This will close all solenoids for approximately 10 seconds and test to ensure there is sufficient pressure in the 'closed' system.

#### 3.3. Auto-Zero Sensor

After the pressure test has been concluded the system will perform an auto-zero on the sensor. This will also be performed at the end of every cycle.

### 3.4. Normal Operation

The diagram shows a rectangular LCD display with a decorative border. The display content is as follows:

SENSOR	CONC.	ALM
CO2	390PPM	OK
R134A	0PPM	OK
Flow Fail		OK
Zero Line Flow		OK
Sensor Comms		OK
Pressure		OK
STATUS: Sampling		
Produce Chiller		

The top line of the display shows the headers for the sensor, concentration, and alarm status. The next lines of the display will show, for the number of sensors selected; the gas sensor name, concentration of the gas, and the units of the gas being analysed. In the next block of lines the LCD displays the System status, i.e. Flow fail, Zero Line Flow, Sensor Comms, and Pressure. The status of the system is then shown. This may be Sampling, Purging, Auto-Zero, Holding, or Skipped. The last line of the display is the current active Channel Location. The system will sequentially sample all of the channel locations, displaying the appropriate data on the LCD.

### 3.5. Panel Controls

The front panel consists of four pushbuttons. These are as follows:

*UP*- This button allows the user to navigate the menu system.

*DOWN*- This button allows the user to navigate the menu system.

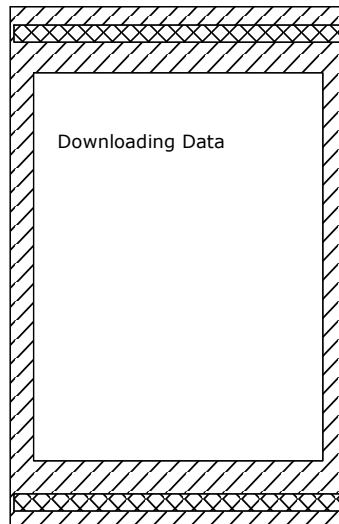
*MENU*- This button allows the user to enter the menu system.

*SELECT*- This button allows the user to navigate the menu system.

#### 3.5.1. Download Default Data

**\*\*This is only required when all settings are to be erased\*\*  
and when first powered up in the factory**

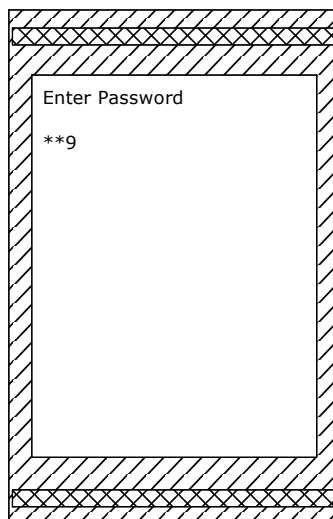
The operator must press the *UP*, *DOWN*, and *MENU* buttons simultaneously **when the TQ title screen is displayed**. After the title screen is displayed, factory default data is transferred to the Non-Volatile RAM (NVRAM) and system memory.



### 3.5.2. Enter Password

At any time during the normal operating mode, the user has the option to enter the menu system and this is invoked by pressing down the *MENU* push button.

To access the menu system the user is prompted to enter a password.



The password is a 4-digit number which may be incremented/decremented using the *UP/Down* buttons respectively. When the correct digit is displayed the user may press the *SELECT* button to accept it. The digit will be 'hidden' and the next digit to change will be displayed. NB. The system default password is '**6197**' but this may be changed to a more suitable number via the Change Password menu option as discussed later.



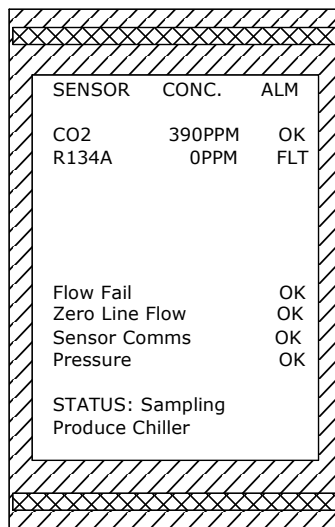
### 3.6. Alarm Conditions

#### 3.6.1. Fault Conditions

There are several possible fault conditions: *Sensor Fault, Flow Fail, Comms Error, and Pressure Test Fault.*

##### 3.6.1.1. Sensor Fault

The sensor will be in fault if the milliamp value output of the sensor falls below a set value. When this occurs the LCD will display *FLT* in the appropriate alarm status field, the System Healthy LED will extinguish and the Fault relay and system buzzer will be activated.



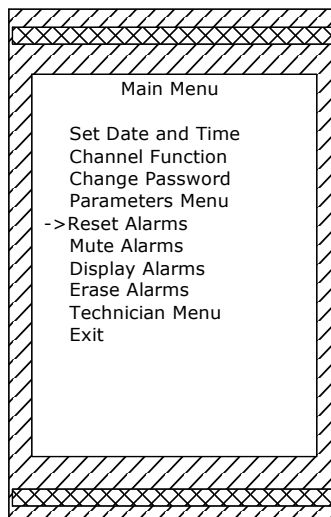
The LCD display shows a table with three columns: SENSOR, CONC., and ALM. The first two rows show CO2 and R134A sensor data. Below the table, there are four alarm status entries: Flow Fail, Zero Line Flow, Sensor Comms, and Pressure, each with an OK status. At the bottom, the status is shown as 'Sampling Produce Chiller'.

SENSOR	CONC.	ALM
CO2	390PPM	OK
R134A	0PPM	FLT

Flow Fail OK  
Zero Line Flow OK  
Sensor Comms OK  
Pressure OK

STATUS: Sampling  
Produce Chiller

To clear the Fault condition repair or replace the sensor and enter the menu system. Press the *SELECT* button when the *Reset Alarms* option is highlighted with the 'Right Arrow' icon to the left of the menu options.



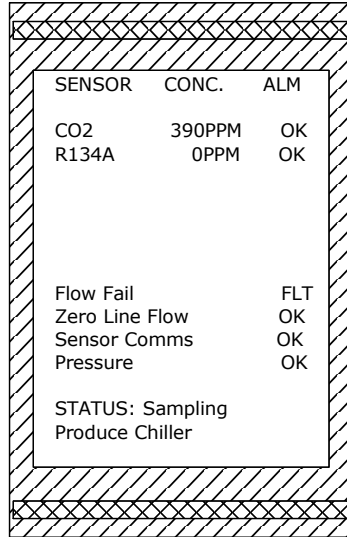
The LCD display shows the 'Main Menu' with the following options: Set Date and Time, Channel Function, Change Password, Parameters Menu, ->Reset Alarms (highlighted), Mute Alarms, Display Alarms, Erase Alarms, Technician Menu, and Exit.

Main Menu
Set Date and Time
Channel Function
Change Password
Parameters Menu
->Reset Alarms
Mute Alarms
Display Alarms
Erase Alarms
Technician Menu
Exit

The display will flash *RESET ALARMS*. At the same time, the System Healthy LED will illuminate and the Fault relay and system buzzer will be de-activated.

### 3.6.1.2. Flow Fail

The Flow Fail will occur if the pressure through the system drops to a set value. When this occurs the LCD will display *FLT* in the appropriate alarm status field, the System Healthy LED will extinguish and the Fault relay and system buzzer will be activated.



The image shows a rectangular LCD display with a decorative border. The display is divided into several sections. At the top, there is a table with three columns: SENSOR, CONC., and ALM. Below this table, there are two rows of sensor data. Further down, there is a list of alarm conditions and their corresponding status. At the bottom, there is a status line.

SENSOR	CONC.	ALM
CO2	390PPM	OK
R134A	0PPM	OK

Flow Fail	FLT
Zero Line Flow	OK
Sensor Comms	OK
Pressure	OK

STATUS: Sampling  
Produce Chiller

To clear the Fault condition, resolve the flow fail and enter the menu system. Press the *SELECT* button when the *Reset Alarms* option is highlighted with the 'Right Arrow' icon to the left of the menu options.

At the same time, the System Healthy led will illuminate and the Fault relay will be de-activated. The alarm will not clear until the system has flow again, it may be required to 'skip' the problem channel which is discussed later.

### 3.6.1. Concentration Alarms

There are three alarms on the TQ4300 system, *ALARM 1*, *ALARM2*, and *ALARM 3*. When the gas concentration exceeds the set levels, the appropriate alarms will be activated, and operate the appropriate LED's, system buzzer, and alarm relays. The LCD will display in the appropriate alarm status field, 1, 2, and/or 3 to indicate which alarm level has been exceeded by the particular sensor. The system will continue to sample the channels sequentially.

SENSOR	CONC.	ALM
CO2	390PPM	OK
R134A	507PPM	123
Flow Fail		OK
Zero Line Flow		OK
Sensor Comms		OK
Pressure		OK
STATUS: Sampling		
Produce Chiller		

If the alarms are latched the user may reset the alarmed channels by entering the menu system. Press the *SELECT* button when the *Reset Alarms* option is highlighted with the 'Right Arrow' icon to the left of the menu options. At which point the alarms for all channels will be cleared. The appropriate alarm LED's and relays will also be cleared upon a reset.

The user may acknowledge the alarms to clear the audible buzzer (if fitted). This may be achieved by entering the menu system. Press the *SELECT* button when the *Mute Alarms* option is highlighted with the 'Right Arrow' icon to the left of the menu options.

Main Menu	
	Set Date and Time
	Channel Function
	Change Password
	Parameters Menu
	Reset Alarms
->	Mute Alarms
	Display Alarms
	Erase Alarms
	Technician Menu
	Exit

To de-activate the alarm relays the user must use the *RESET* function as described above.

If the alarms are un-latched, then the system will automatically reset the alarms. When the gas concentration does not exceed the alarm set levels on the next samples of that particular channel location.

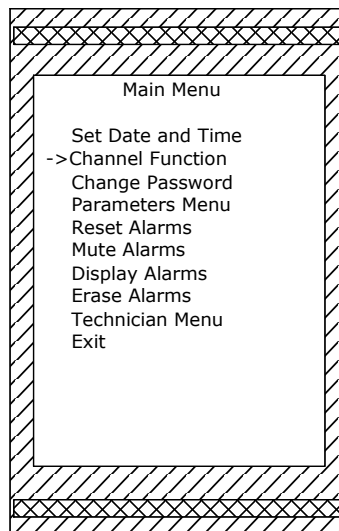
### 3.7. Relay Board

An optional relay board may be provided in the **TQ4300** system that contains 16 relays. Relay 1 will activate on the first sample location alarm, Relay 2 will activate on the second sample location alarm, Relay 3 will activate on the third sample location alarm and so on. The relays may be configured to activate on either the Alarm 1, Alarm 2, or Alarm 3 levels. The default level is the Alarm 1 level but may be changed by invoking the menu system.

Please see section 4.2 Technician menu for further relay options.

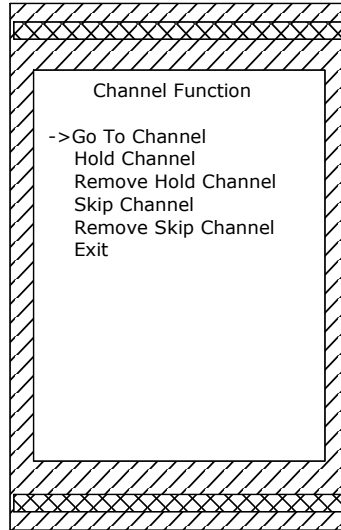
### 3.8. Channel Functions

During Normal operation the user may perform several channel functions such as Goto a channel, Holding a channel, removing a held channel, skipping a channel, removing a skipped channel, and displaying the stored alarms. To access these Channel functions the user must enter the menu system as described above. Press the *SELECT* button when the *Channel Function* option is highlighted with the 'Right Arrow' icon to the left of the menu options.

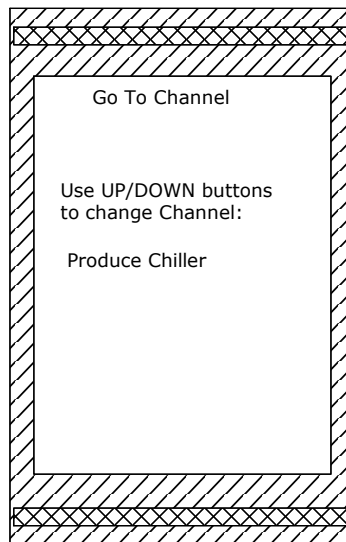


### 3.8.1. Goto Channel

To go to a particular channel the user must select the *Go To Channel* option. This will invoke the Goto Channel function.

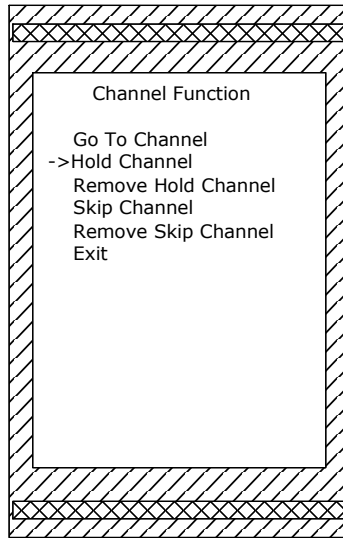


The next screen will prompt the user to select the desired channel location to move to. Press the *SELECT* button to accept the displayed location. The TQ4300 will deactivate the current solenoid and move to the selected location and begin sampling, resuming normal system operation.

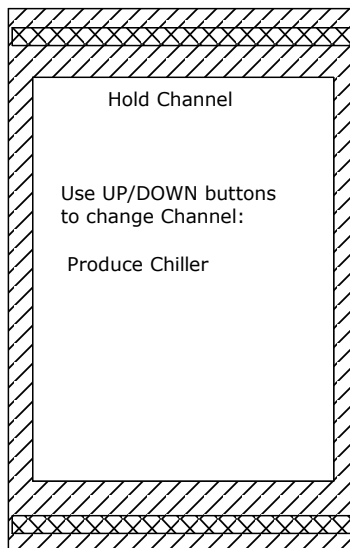


### 3.8.2. Hold Channel

To Hold a particular channel the user must select the *Hold Channel* option. This will invoke the Hold Channel function.



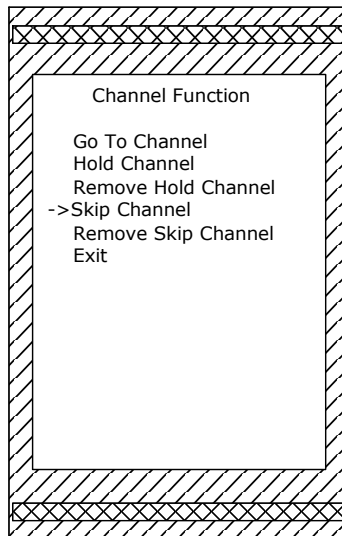
The next screen will prompt the user to select the desired channel location to move to. Press the *SELECT* button to accept the displayed location. The TQ4300 will deactivate the current solenoid and move to the selected location and begin sampling. The current Channel location will be continuously sampled for a maximum period of 20 minutes after which time the system will revert to sequential sampling.



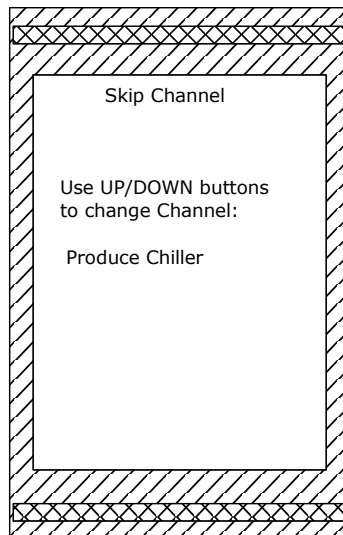
The user may remove the held channel at any time by invoking the *Remove Hold Channel* option. The system will then revert to sequential sampling.

### 3.8.3. Skip Channel

To Skip a particular channel the user must select the *Skip Channel* option. This will invoke the Skip Channel function.

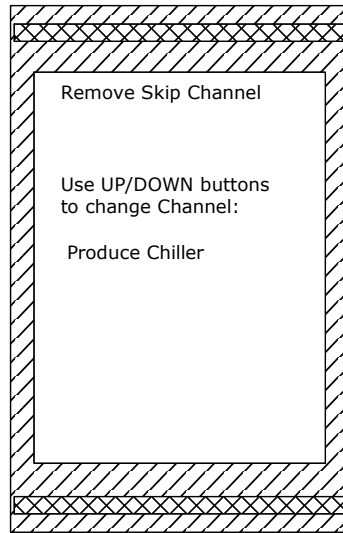


The next screen will prompt the user to select the desired channel location to Skip. Press the *SELECT* button to accept the displayed location. The TQ4300 will skip this channel when it sequentially gets to it, activating the next non-skipped channel instead.



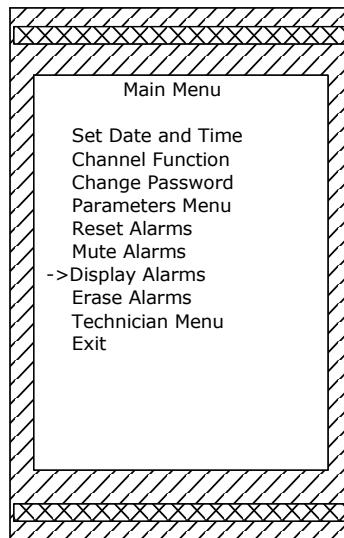
The user may remove the skipped channel at any time by invoking the *Remove Skip Channel* option. The system will then revert to sequential sampling.

## TQ Environmental



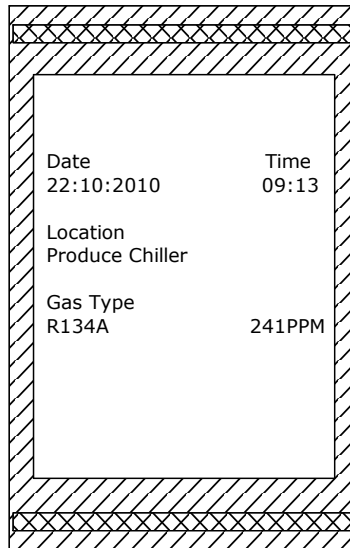
### 3.8.4. Display Alarms

The user has the option to display the Alarm Status. The *Display Alarms* function will show the stored alarm status of each channel in alarm. This function may be invoked by pressing the SELECT button when the *Display Alarms* option is highlighted in the main menu.



The display will show the most recent alarm first, and pressing the SELECT button will cycle through all the stored alarms before exiting to normal system operation. The information shown will include the date and time of the alarm, location of the alarm, the sensor that was in alarm and the gas concentration that triggered the alarm.





The TQ4300 system will store a maximum of 20 most recent alarms. If there are no alarm conditions on any channel location, the display will read NO ALARM PRESENT before resuming normal system operation.

### 3.8.5. Erase Alarms

The user has the option to erase all the stored alarms. The *Erase Alarms* function will erase all the stored alarm status of each channel in alarm. This function may be invoked by pressing the SELECT button when the *Erase Alarms* option is highlighted in the main menu.

## 4. SYSTEM SETTINGS

If any parameter requires changing within the system, and if the sensor requires a calibration check, then the Technician and Parameters Menu will need to be accessed.

Parameters Include: - Location Names, Sensor Names, Sensor Units, Alarm Levels, Dwell Times, and Purge Times.

Technician Parts Include: - No. of channels, No. of Sensors, Calibration, Sensor Range, Sensor Offset, Sensor Type, Sensor Station No., Flow Setpoint, Fault Relay Type, and Channel Relay Type.

\*- NOTE it is also advised that all menus have been completely exited, to ensure new settings are saved. -\*

### 4.1. Parameters Menu

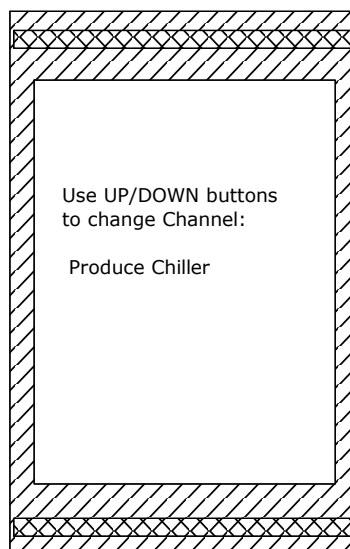
System parameters may be set and edited by entering the **PARAMETERS** menu option. Each parameter is set on a Location by Location basis, therefore what ever is set for channel 1 does not apply to channel 2, unless 'All Channels' option is selected. This option is only available for 'Set Gas Name'.

Detailed descriptions of the Parameters Sub Menu items now follow:

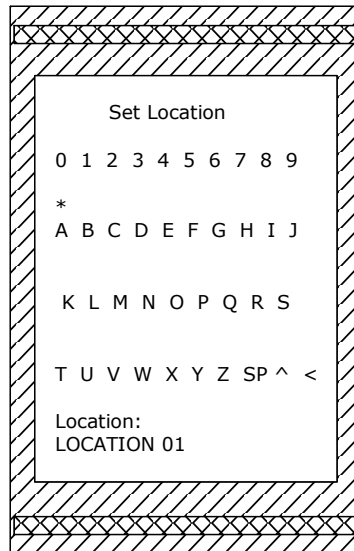
#### 4.1.1. Parameters Sub Menu - Set Location

The channel locations are set by default to "LOCATION 1", "LOCATION 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.

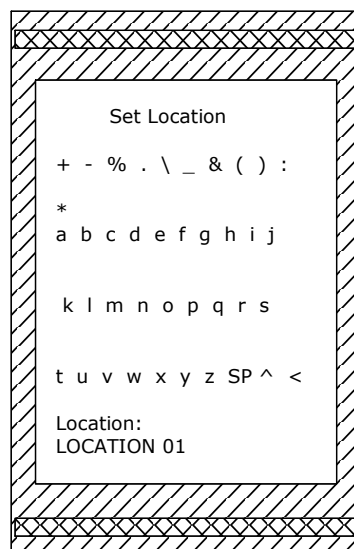
The user is prompted to select the channel to be altered.



The user must use the *UP* and *DOWN* buttons to move the asterisk above the desired alphanumeric characters on the alphanumeric keyboard, pressing the *SELECT* button when the display shows the required character. To leave spaces, select the <SP> character and press the *SELECT* button. When the *SELECT* button has been pressed the next digit on the right will be displayed.



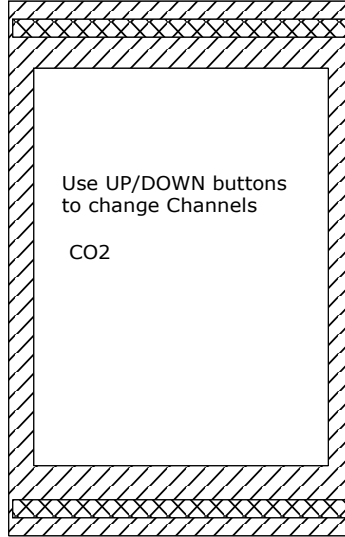
The ^ symbol will toggle between uppercase and lowercase letters and between numbers and general symbols. The < symbol will delete the previous characters.



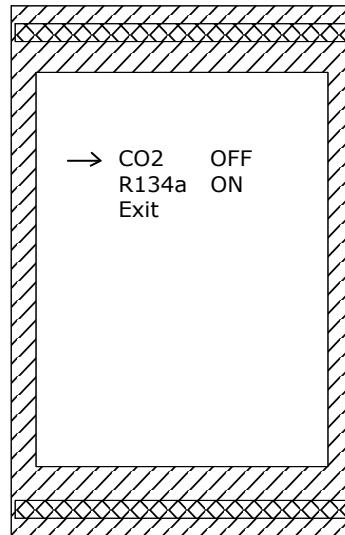
To accept the channel location description the user must press the *MENU* button.

### 4.1.2. Parameters Sub Menu – Allocate Sensor

If more than one sensor is fitted, this option allows the user to select which sensors are used when monitoring individual channels. The user is prompted to select a Channel Location. Individual channels can be selected using the UP /DOWN buttons. If the sensor is to be the same for all location points then the “ALL Channel” option should be selected.

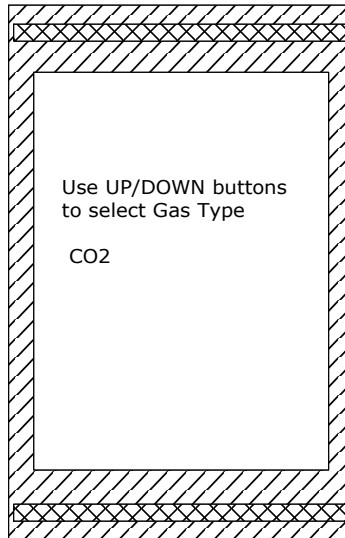


To set a particular gas the user must press the UP and DOWN button to cycle through the available sensors. The SELECT button will toggle the sensor On or Off

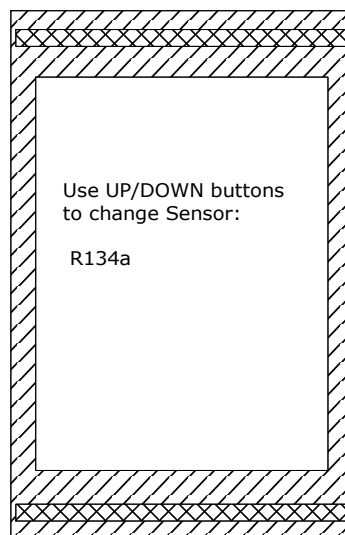


### 4.1.3. Parameters Sub Menu - Set Gas Name

This option is used to set the default gas names of a fitted sensor. The user is prompted to select a Gas Type. If the sensor is to be the same on all location points then the 'All Channels' option should be selected.



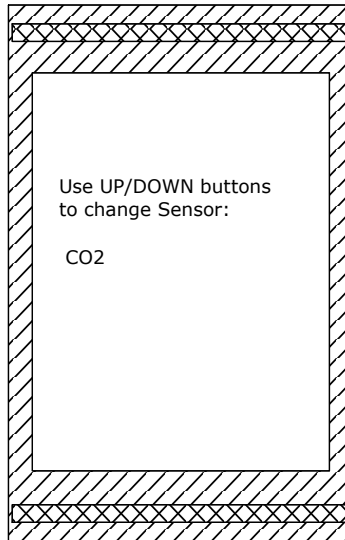
To set a particular gas the user must press the *UP* and *DOWN* buttons to cycle through the available gasses. This option will allow the user to change the name of the sensor gas type to a more meaningful description up to 10 characters in length, including the <SPACE> character.



When a sensor is selected the user will be presented with an alphanumeric keyboard to enter the sensor name, e.g. R449a or other gas type. This operation is described previously in Set Location Name.

#### **4.1.4. Parameters Sub Menu - Set Sensor Units**

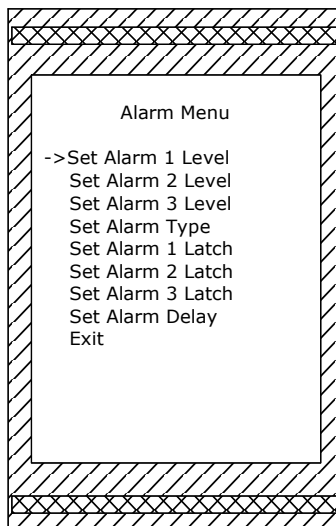
This option will allow the user to select the appropriate units corresponding to the gas type, e.g. PPM, %LEL, %VOL, and MGM. A maximum of four characters are reserved for the sensor units. The user is prompted to select the sensor whose units are to be changed.



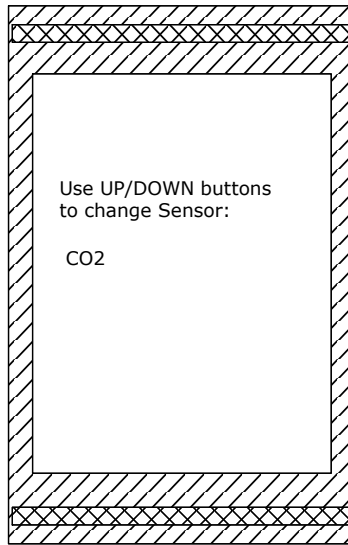
The user is then presented with the alphanumeric keyboard to enter the required sensor units.

#### **4.1.5. Parameters Sub Menu - Set Alarms**

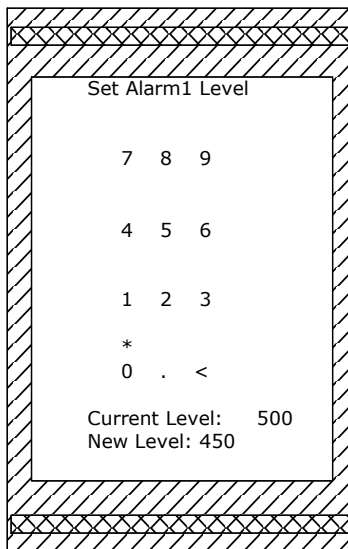
When selected, this option displays a Set Alarms sub menu which allows the user to Set Alarm 1 Level, Set Alarm 2 Level, Set Alarm 3 Level, Set Alarm Type (Rising or Falling), Latch state, Alarm Delay, or Exit Sub Menu. The following describes the typical for alarm 1 but the other alarm options work in exactly the same way.



When selected, the user is prompted to select the required sensor.

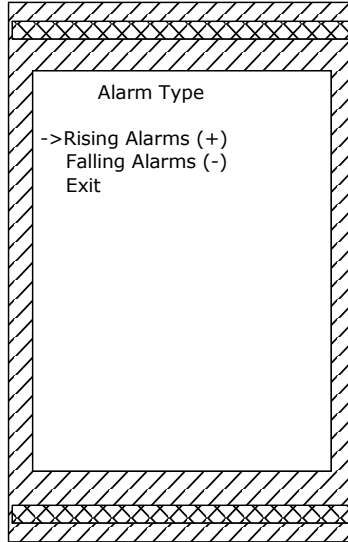


The user must then enter the alarm level using the numeric keypad pressing the *UP/DOWN* buttons to move the asterisk above the desired number.



#### **4.1.6. Parameters Sub Menu - Set Alarm Type**

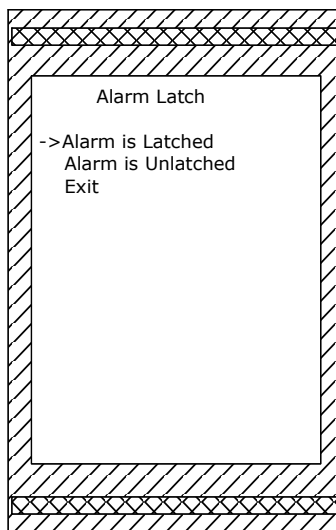
This option is used to select whether an alarm is generated when the concentration is rising (+) or falling (-) for the selected sensor.



Press *UP* or *DOWN* to select between a rising alarm (+) or a falling alarm (-). Then press *SELECT* on required alarm type.

#### **4.1.7. Parameters Sub Menu - Set Alarm Latch**

This option allows any gas concentration alarm to be automatically cancelled as soon as the concentration of gas has returned to a level not beyond its alarm set point (Unlatched). The default alarm state is latched alarms.

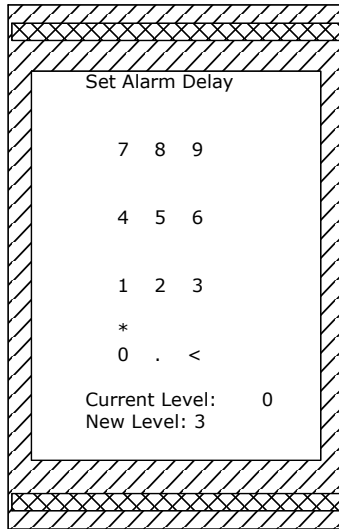




Press *UP* or *DOWN* to select between latched or unlatched alarms. Then press *SELECT* on required alarm state.

#### 4.1.8. Parameters Sub Menu - Set Alarm Delay

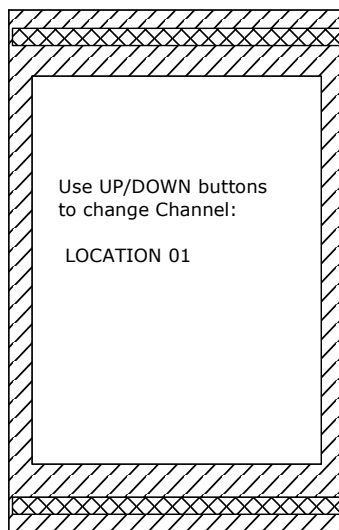
The user may specify a delay time (in seconds) for a particular sensor before an alarm is activated. The default value for this is zero seconds as the alarms are generally tested at the end of the Dwell Time for a sampling system.



#### 4.1.9. Parameters Sub Menu - Set Dwell Time

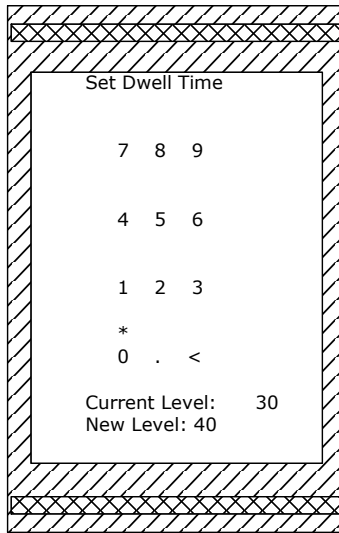
This option allows the user to specify the time in seconds that the system will remain in a particular channel location before sequentially incrementing to the next channel location. The dwell time is variable in the range from 0 to 300 seconds.

The user must first select the required channel location.



### *TQ Environmental*

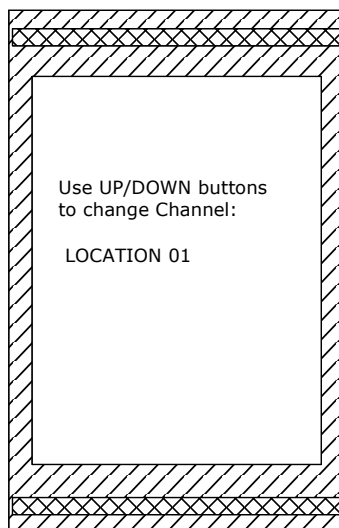
To change the dwell time for that particular channel the user must press the *UP* and *DOWN* buttons to set the required time and the *MENU* button when the desired dwell time is displayed.



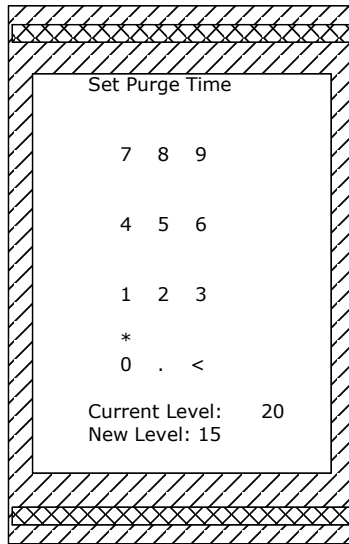
#### **4.1.10. Parameters Sub Menu - Set Purge Time**

This option allows the user to specify the time in seconds that the system will remain purging the system before sequentially incrementing to the next channel location. The Purge Time is variable in the range from 0 to 300 seconds.

The user must first select the required channel location.



To change the purge time for that particular channel the user must press the *UP* and *DOWN* buttons to set the required time and the *MENU* button when the desired purge time is displayed.



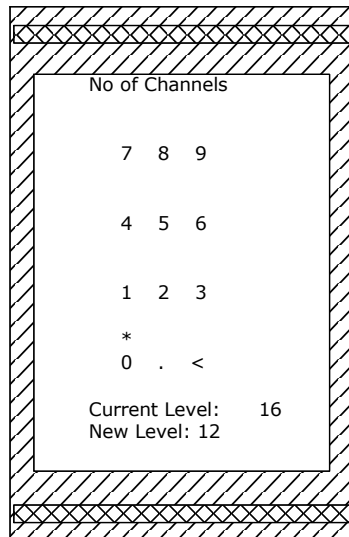
## 4.2. Technician Menu

System parameters may be set and edited by entering the **TECHNICIAN** menu option. Each parameter is set on a system level basis

Detailed descriptions of the Technician Sub Menu items now follow:

### 4.2.1. Technician Sub Menu - Set Number of Channels

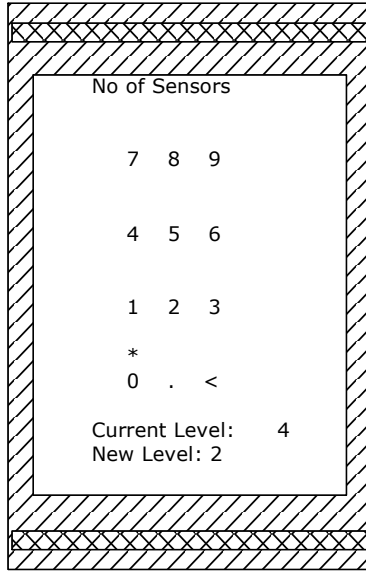
This option allows the user to select the desired number of channels.



This is set by the *UP* or *DOWN* buttons. When the desired number of channels is displayed, the user must press the *MENU* button to accept the displayed value.

#### 4.2.2. Technician Sub Menu - Set Number of Sensors

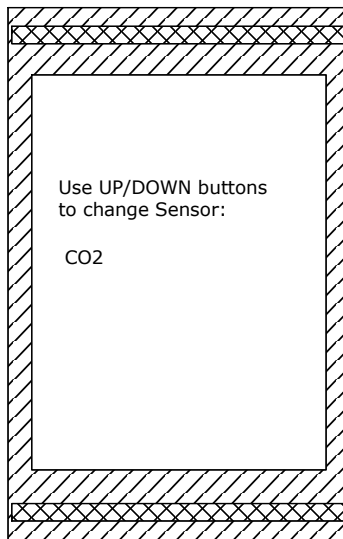
This option allows the user to select the desired number of Sensors.



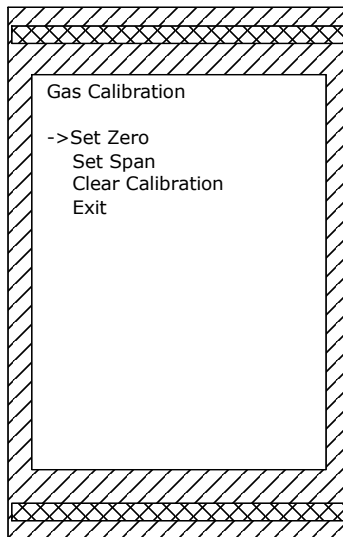
This is set by the *UP* or *DOWN* buttons. When the desired number of Sensors is displayed, the user must press the *MENU* button to accept the displayed value.

#### 4.2.3. Technician Sub Menu – Calibrate Gas

This option will allow the user to calibrate a particular sensor. Once entered, the display will prompt the user to select a desired sensor for calibration. The user must press the *UP* and *DOWN* buttons to display the required sensor and then press the *SELECT* button to accept that sensor.

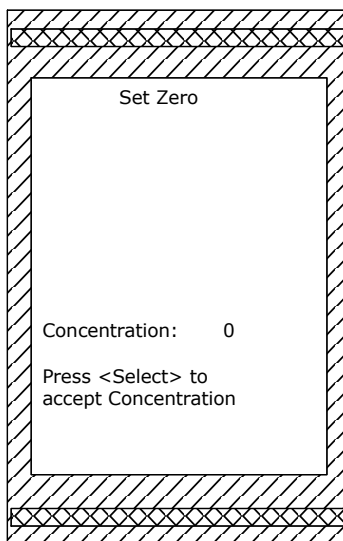


The display then shows the Gas Calibration sub menu which will allow the user to Zero and Span the selected sensor and also clear the calibration data to the factory default values.

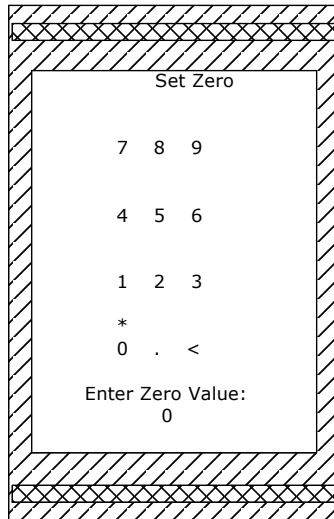


#### 4.2.3.1. Set Zero

The user must apply zero gas to the sensor and the value of the gas concentration will be displayed on the LCD. When the value on the LCD has stabilised, the user must press the Select button to accept that value.

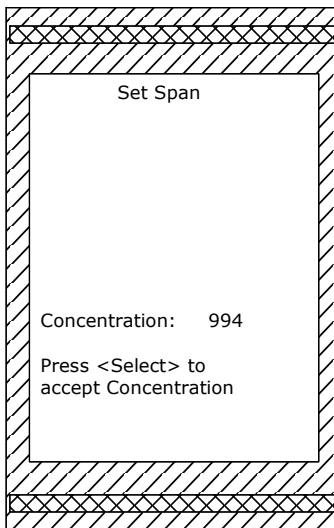


The user will then be prompted to enter the desired display reading, e.g. 0, via the LCD's numeric keypad. Once the desired value is displayed the user may press the *MENU* button to accept this zero level.

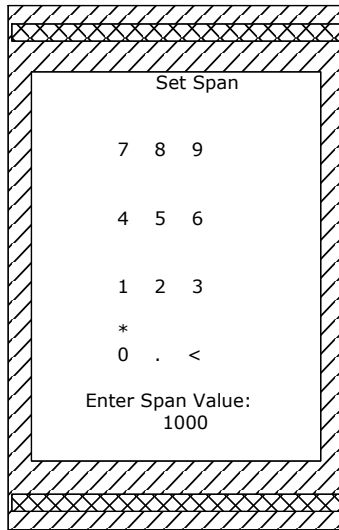


#### 4.2.3.2. Set Span

The user must apply span gas to the sensor and the value of the gas concentration will be displayed on the LCD. When the value on the LCD has stabilised, the user must press the Select button to accept that value.



The user will then be prompted to enter the desired display reading, e.g. 1000, via the LCD's numeric keypad. Once the desired value is displayed the user may press the *MENU* button to accept this span level.



#### 4.2.3.3. Clear Calibration

All existing calibration data for the selected sensor may be cleared and reset to the system factory default values. This may be achieved by selecting the Clear Calibration Data option on the LCD. This option may be useful if previous system calibration attempts have proved unsuccessful for whatever reason.

#### 4.2.3.4. Exit Sub Menu

Pressing the *SELECT* button will exit from the *Gas Calibration* sub menu and return the user to the main *Technician Menu*.

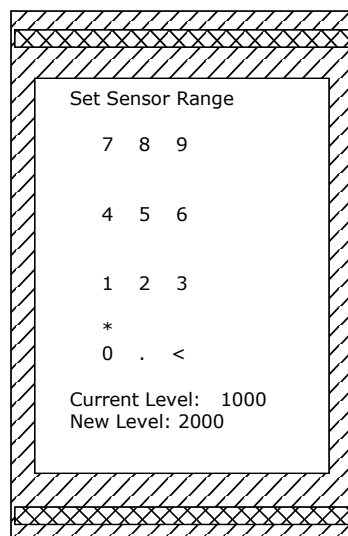
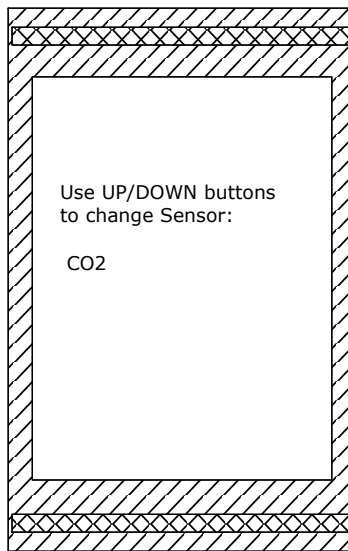
#### 4.2.4. Technician Sub Menu – Set Sensor Range

This option of the Technician Menu will allow the range of the selected sensor to be changed. The default range is factory set at 20,000 ppm for a CO<sub>2</sub> Sensor and 2000 ppm for a HCFC sensor.

**This is already factory set and should not be attempted by anyone other than TQ personnel.**

\*-NOTE – This figure does not correspond to the gas calibration level required -\*

First, the user must select the required sensor.



The user will then be prompted to enter the desired display reading, e.g. 2000, via the LCD's number keypad. Once the desired value is displayed the user may press the *MENU* button to accept this Sensor Range level.

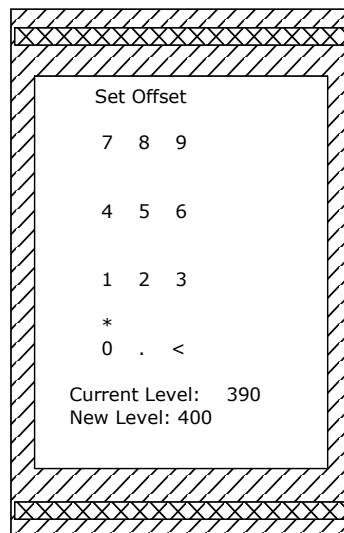
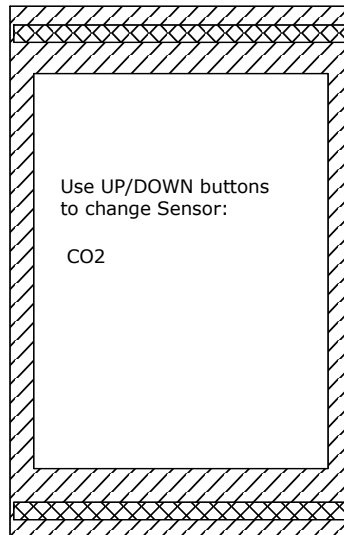


#### 4.2.5. Technician Sub Menu – Set Sensor Offset

This option of the Technician Menu allows the user to offset the sensor value by a specified value for the selected sensor.

**This is already factory set and should not be attempted by anyone other than TQ personnel.**

First, the user must select the required sensor.

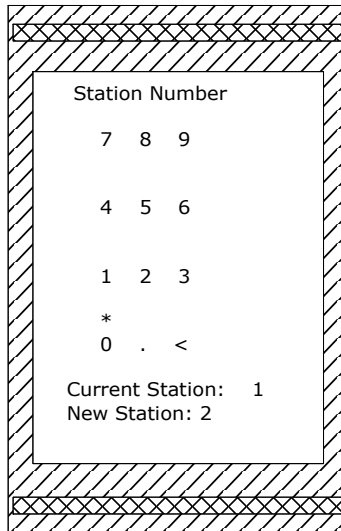


The user must press the *UP* and *DOWN* buttons to change the value of the offset. The default value is zero and would not under normal circumstances require changing. Once the desired value is displayed the user may press the *MENU* button to accept this sensor offset level.

#### 4.2.6. Technician Sub Menu – Set Modbus Address (Station Number)

This option of the Technician Menu will allow the user to set the Station Number for the detection panel.

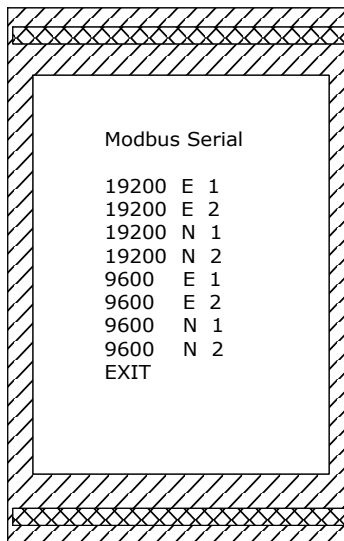
**This is already factory set and should not be attempted by anyone other than TQ personnel.**



#### 4.2.7. Technician Sub Menu – Set Serial Configuration

This option of the Technician Menu will allow the user to set the serial configuration for the system

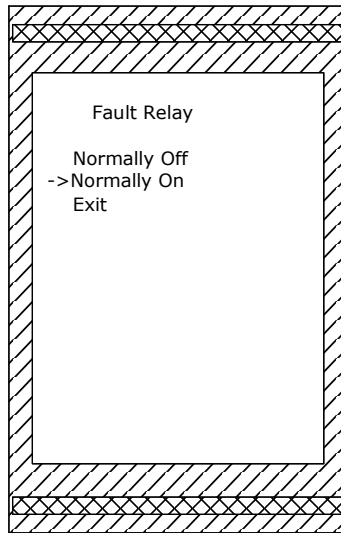
**This is already factory set and should not be attempted by anyone other than TQ personnel.**



#### 4.2.8. Technician Sub Menu – Set Fault Relay Type

This option of the Technician Menu will allow the user to set the Fault Relay Type.

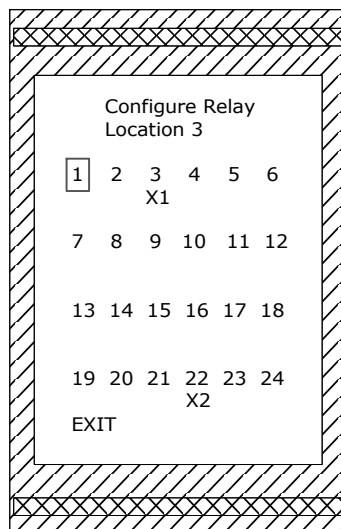
**This is already factory set and should not be attempted by anyone other than TQ personnel.**



#### 4.2.9. Technician Sub Menu – Set Channel Relays

This option of the Technician Menu allows the user to select whether the Channel Relays are activated on Alarm 1, Alarm 2 or Alarm 3. UP/DOWN buttons allow the user to select individual relays. SELECT button will toggle the relay On or Off. Pressing the MENU button will set the alarm trigger level for Alarm 1 (X1), Alarm 2 (X2) and Alarm 3 (X3)

**This is already factory set and should not be attempted by anyone other than TQ personnel.**



## 5. INSTALLATION

**NOTE:** TQ Environmental Ltd gives the recommendations in this section with respect to the correct installation of the **TQ4300 sampling system**.

### 5.1. TQ4300 Analysing Unit

The **TQ4300** Analysing Unit is designed to be fixed to a rigid bulkhead via 4 x 8mm mounting brackets on the rear of the enclosure.

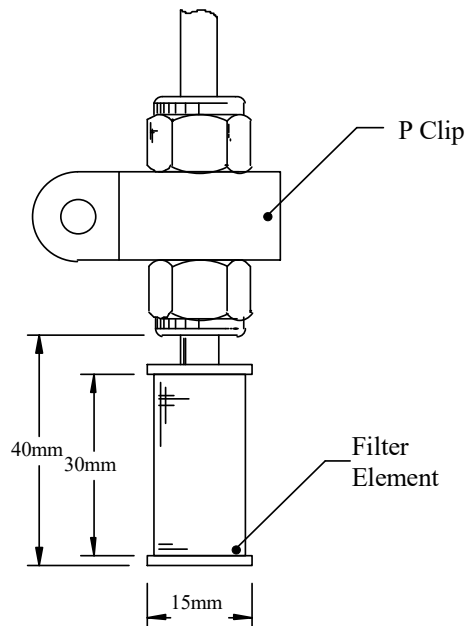
As this unit contains sensitive electronics and instrumentation it is recommended that the unit is installed in a relatively stable environment, where vibration is at a minimum and must not be installed near high voltage equipment.

### 5.2. End of Line filters

When sample lines are installed in void spaces it is recommended that end of line particulate filters are fitted to prevent dust particles/debris from being sucked into the system.

The filter assembly can be supplied by TQ Environmental Ltd as an optional extra and is very light weight approximately 0.05 kg and can hence be satisfactorily supported by the P clip arrangement shown in Fig. 4, when attached to a suitable bracket via an M5 screw.

Please note end of line filters are only suitable for use in dry areas and must be installed in an accessible position for ease of service.



**Fig.4 Diagram of an End of Line Filter**

### 5.3. In-Line Filters

When sample lines are installed in void spaces and the end of the sample line is not readily accessible it is recommended that an in-line filter be used.

This has the same function as the end of line filter, i.e. to remove dust/debris. However, this filter is installed directly in the sample line by means of two compression fittings, which match the size of the sample lines used, refer to fig 5.

Again as with end of line filters in-line filters are only suitable for use in dry areas and must be installed in accessible position for ease of service.

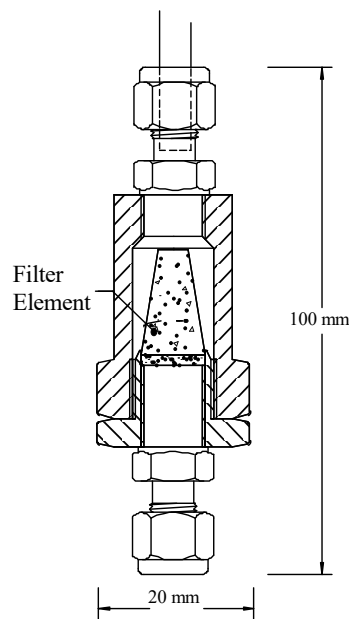


Fig.5 Diagram of an In Line Filter

### 5.4. Sample Lines

Sample lines from point of connection at the analysing unit to point of sample should be as straight as possible and U-bends should be kept to a minimum.

Ensure that all Sample Lines are connected to the Analysing Unit on the correct ports, in order to eliminate the possibility of 'crossed lines'.

## 6. COMMISSIONING

*It is strongly advised that a TQ Environmental Approved Engineer carries out the commissioning. The system is fully tested and known to be operational when it leaves the factory, however the ultimate performance of the system in the field depends heavily on the final commissioning. If persons not approved by TQ Environmental carry out the commissioning incorrectly, TQ Environmental cannot and will not accept any responsibility for the system's performance in the field.*

To aid commissioning it is essential to have a good understanding of how the system operates, therefore please read all sections of this manual before commencing.

This section repeatedly references the 'system drawings'; these drawings are project specific and no two sets are the same. Please ensure that the correct drawings are available.

### 6.1. Installation.

**Ensure that all points detailed in section 5 are completed**

*Only when section 5 has been completed can the commissioning proceed.*

### 6.2. System Power Up

- Check all system wiring is as per the system drawings.
- Check that the voltage to the system corresponds to the voltage stated in the system drawings.
- The system can be 'Powered up' for testing only when the two above points have been completed.
- Check with the site staff that the areas to be sampled are clear of any usual vapours that can trigger an alarm.
- Apply power to the system via the power supply change over unit. Fault alarms may occur after system boot up, this is due to the time taken by some sensors to 'warm up'.

### **6.3. Setting the Flow Rate**

The flow rate has been factory set to its maximum potential, however if the flow indicator has stopped rotating then the calibration valve is set to the wrong position.

### **6.4. Sample Location Set-Up Test**

This section gives details on how to set the individual sample locations 'dwell time', this is the time taken to transport a sample gas from a sample location and analyse it accurately.

Whilst this test is carried out, it is possible to test the sample lines for blockages or leaks.

One person is required to be present at the sample location to be tested with the gas lighter, and one at the control panel. Both persons are to be in contact with each other at all times.

Apply gas to the sample line and record how long it takes for the system to display a gas concentration on the LCD. Log this time in the Dwell Time column.

Block the sample line off, as the flow decreases a flow fail alarm will be activated, if this is not the case a leak in the line may be apparent - amend and repeat the test. Log the result.

Enter the Dwell Time for each location into the corresponding Timer. See section 4.5.3.

### **6.5. Testing Gas Concentration Alarms**

Follow Task 1 detailed within the Scheduled Maintenance in section 7.

## **7. SCHEDULED MAINTENANCE**

### **7.1. System Confidence Test Sequential Sampling Part**

**Frequency:** 6 Months

**Equipment Needed:** Calibration Gas suitable for the sequential sensors.

Ensure that the concentration of gas used is greater than that of the highest alarm set point.

**Description:**

When sample locations are grouped into zones, and different zones activate different alarms, ensure that all 'zone alarm configurations' are known so that alarms can be checked.

Activate a flow fail alarm; this can be achieved by blocking the current sample line. Once the alarm is activated, acknowledge the alarm, refer to section 3.4.1.2.

Connect the test gas to the end of line and turn the gas on at a rate of 1 litre / minute.

The system will now generate a gas alarm on the current sample location. Ensure all relevant alarms are activated.

Ensure also that the display reads the same concentration as that of the calibration gas used, i.e. 1000PPM if 1000PPM calibration gas is used.

It must be noted however that all calibration gases have a tolerance that must be taken in to account.

Repeat for all locations that activate different alarms.

### **7.2. Filter Check**

**Frequency:** 6 Months / when required.

**Equipment Needed:** Replacement Filter Elements.

**Description:** Check that all Particulate; End of Line and In-Line are in good condition and clean/ replace if necessary.



### 7.3. System Calibration (All Sensors)

**Frequency:** 12 months.

**Equipment Needed:** Calibration Gas suitable for the sensors being calibrated i.e.: use 1000PPM gas (or similar) for a 0-2000PPM sensor.

**Description:** Refer to section 13.1 for applying test gas. Repeat for all Sensors. N.B. if the calibration for any of the sensors requires altering, the setup box may be used to achieve this.

### 7.4. Pump Service

**Frequency:** 12 months.

**Equipment Needed:** Pump Service Kit.

**Description:** Replace the pump diaphragm and valves.

## 8. PARTS LIST

**Description:** TQ4300 Sampling System. Typical Major Components

Item	Part No:	Description	Qty	Name
1	920-030	Air Comp/Vacuum Pump 24VDC 0.75A	1	
2	920-031	Pump service Kit	1	
3	420-006	Particulate Filter Element	1	
4	420-028	Particulate Filter housing	1	
5	420-024	End of Line Filter housing	1	
6	420-006	End of Line Filter element (paper)	1	
7	42-006A	End of Line Filter element (ST/ST)	1	
8	611-022	In-Line filter (Complete)	1	
9	611-022B	In line filter Element	1	
10	340-060	GD 133 0-2000PPM CO <sub>2</sub> IR Sensor	1	
11	131-001	GD131 Freon Detector	2	
12	138-000	GD138 Freon & CO <sub>2</sub> sensor	1	
13	123-531	Non Cert O <sub>2</sub> Sensor	1	
14	123-251	Non Cert H <sub>2</sub> S Sensor	1	
15	905-008K	1A Quick Blow Glass Fuses (5x20)	1	
16	905-008H	2A 10 X 38 Fuses	5	