

TQ4200 – ZONING GAS SAMPLING SYSTEM

OPERATING MANUAL

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1. INTRODUCTION

The **TQ4200 - ZONING 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 other refrigerant gases. (Please see TQ4300 for other sampling systems and gas types). The **TQ4200 - ZONING** 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 **TQ4200 - ZONING 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 **TQ4200 - ZONING** is restricted to no more than 24.

The **TQ4200 - ZONING** is capable of providing individual 'low' and 'high' alarms and individual alarm outputs for each sample channel with corresponding alarm relays. This can provide an interface with alarm management systems, remote mimic panels, and audible / visual warning devices.

The **TQ4200 - ZONING** 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 **TQ4200 - ZONING 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 **TQ4200 - ZONING sampling system** is divided into the following main components:

- ◆ Pneumatics
- ◆ Sensor
- ◆ 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

Infrared Sensor

The operation of the infrared sensor within the **TQ4200 - ZONING 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 GD137 unit within the **TQ4200 - ZONING** and provides a RS485 signal for their respective target gas concentrations. And is capable of having several calibration factors included for different refrigerant gases. This can be very useful when monitoring from different areas of the plant containing different refrigerants.

2.3. Control and Display Electronics

The **TQ4200 - ZONING** is controlled from one PCB, the Control Card. This is where the unit is set up from using the buttons and display.

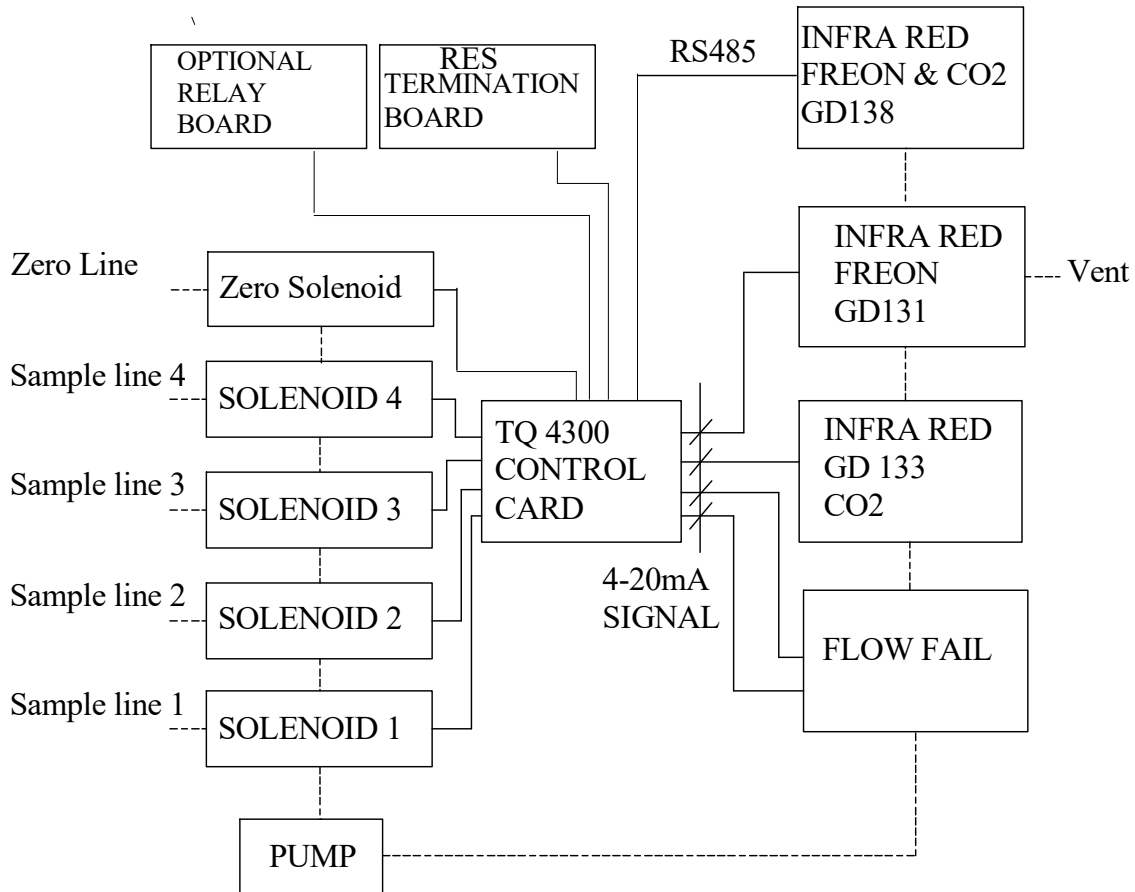


Fig. 1 Block diagram of System

2.3.1. The TQ4200 - ZONING Front Panel Display

The **TQ4200 - ZONING** Unit houses the 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).

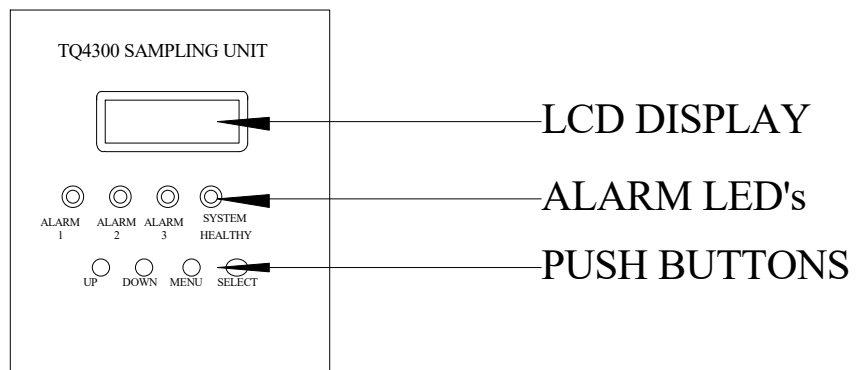


Fig 2 Front Display of TQ4200 - ZONING

2.4. Outputs

The **TQ4200 - ZONING** 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 TQ4200 - ZONING 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 TQ4200 - ZONING

The TQ4200 - ZONING 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					

Input Register (0x04)	Starting Address	Number of Registers	Number of Bytes		Discrete Inputs (0x02)	Starting Address
Zone 1 Conc.	30001	1	2		No Pressure	10001
Zone 2 Conc.	30002	1	2		Sensor Comms Fail	10002
Zone 3 Conc.	30003	1	2		TQ4200 Comms Fail	10003
Zone 4 Conc.	30004	1	2		TQ4200 NVRAM Fail	10004
Zone 5 Conc.	30005	1	2		Menu Activated	10005
Zone 6 Conc.	30006	1	2		N/A	10006
Zone 7 Conc.	30007	1	2		N/A	10007
Zone 8 Conc.	30008	1	2		N/A	10008
Zone 9 Conc.	30009	1	2		Alarm 1	10009
Zone 10 Conc.	30010	1	2		Alarm 2	10010
Zone 11 Conc.	30011	1	2		Alarm 3	10011
Zone 12 Conc.	30012	1	2		System Fault	10012
Zone 13 Conc.	30013	1	2		Flow Fail	10013
Zone 14 Conc.	30014	1	2		Zero Filter Blocked	10014
Zone 15 Conc.	30015	1	2		Sensor Fault	10015
Zone 16 Conc.	30016	1	2		Sensor Drift	10016
Zone 17 Conc.	30017	1	2			
Zone 18 Conc.	30018	1	2			
Zone 19 Conc.	30019	1	2			
Zone 20 Conc.	30020	1	2			
Zone 21 Conc.	30021	1	2			
Zone 22 Conc.	30022	1	2			
Zone 23 Conc.	30023	1	2			
Zone 24 Conc.	30024	1	2			

2.6. Technical Specification

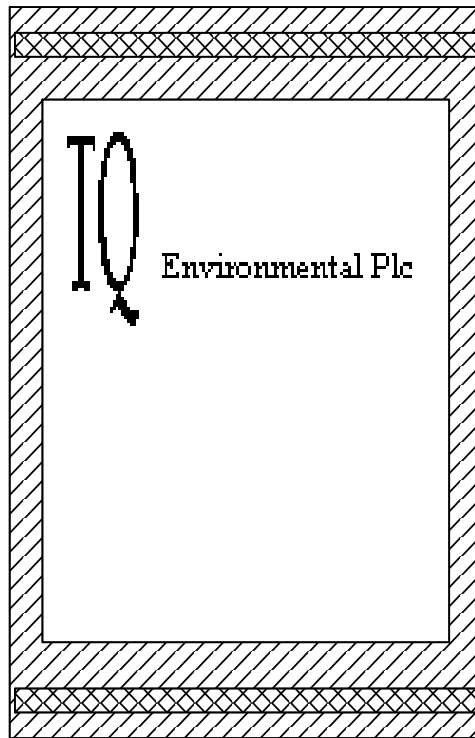
<i>Power</i>	110/240V 50/60Hz @ 4 Amps non inductive
<i>Internal D.C. power supplies</i>	1 x 24V DC (Sensors / Solenoids) (factory fitted dependent on sensor ratings and overall system requirement)
<i>Max no. of locations for sequential monitoring per Max no. of Sensor</i>	24 Locations for 5 Sensors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

3. OPERATION

This section explains in detail the **TQ4200 - ZONING** 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 **TQ4200 - ZONING** 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.

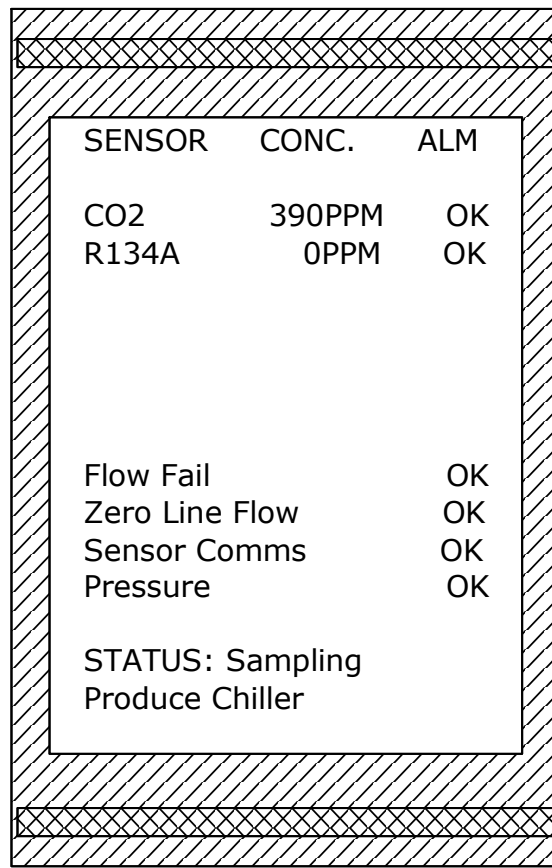
3.2. Pressure Test

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 image shows a rectangular LCD display with a hatched 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.

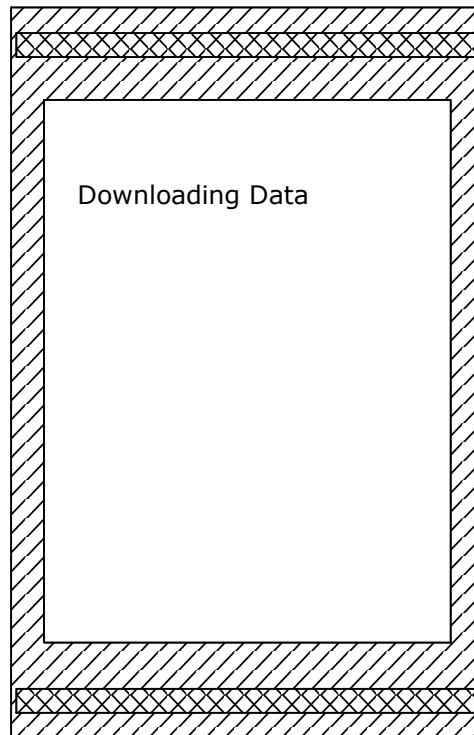
MENU- This button allows the user to enter the menu system.

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**

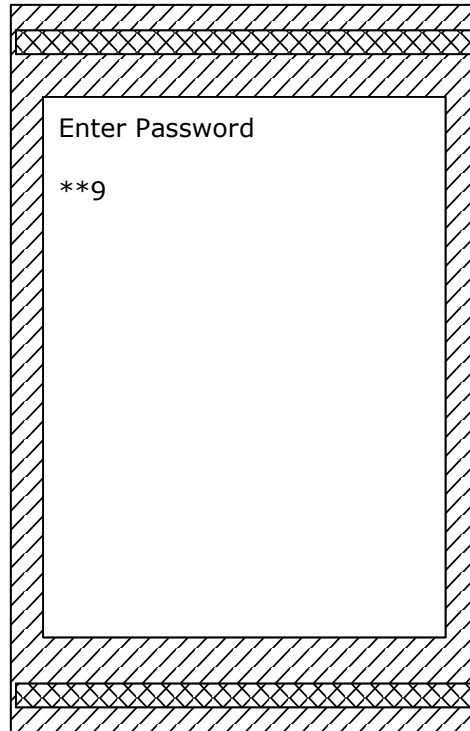
The operator must press the *UP*, *DOWN*, and *MENU* buttons simultaneously **when TO the title screen is displayed.** After the title screen is displayed, factory default data is transferred to the Non-Volatile RAM (NVRAM) and system memory.



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.

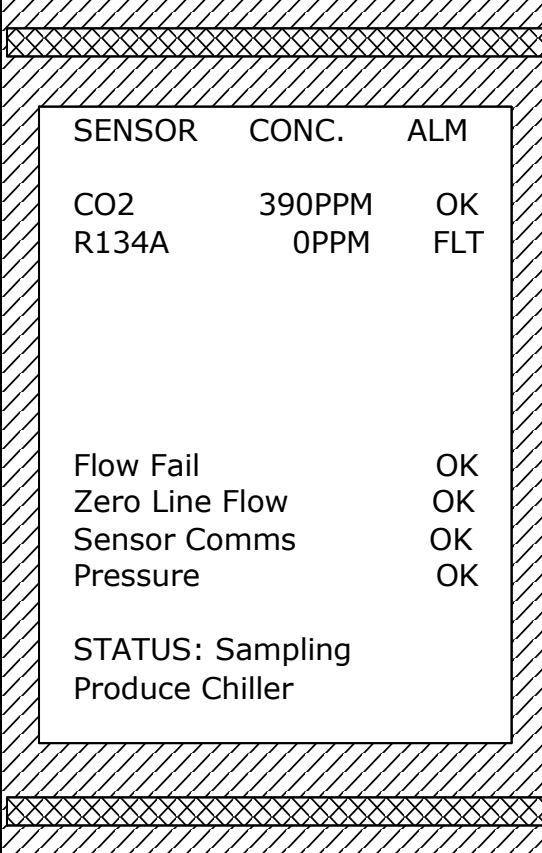
3.6. Alarm Conditions

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

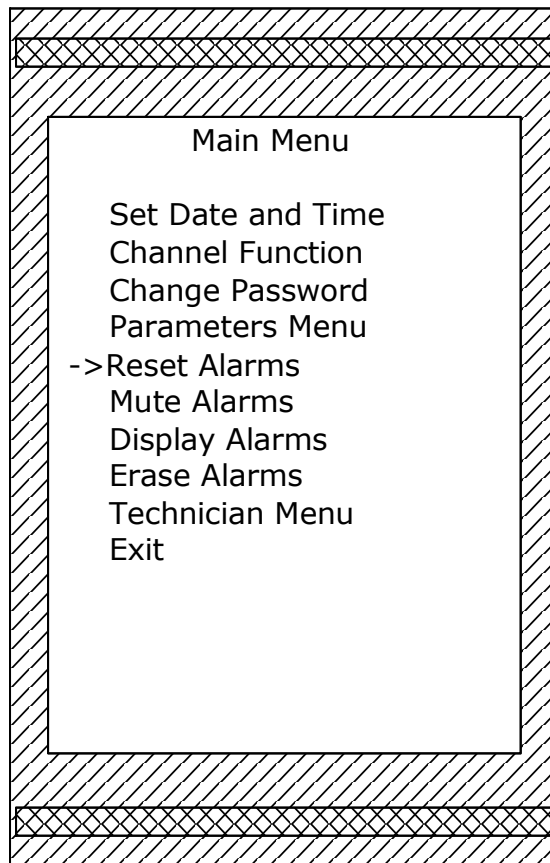
The sensor will be in fault if the milliamp value output of the sensor falls below a set value. When this occurs the LCD will display *FLT* in the appropriate alarm status field, the System Healthy LED will extinguish and the Fault relay and system buzzer will be activated.



The image shows a rectangular LCD display with a hatched border. The display content is as follows:

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		

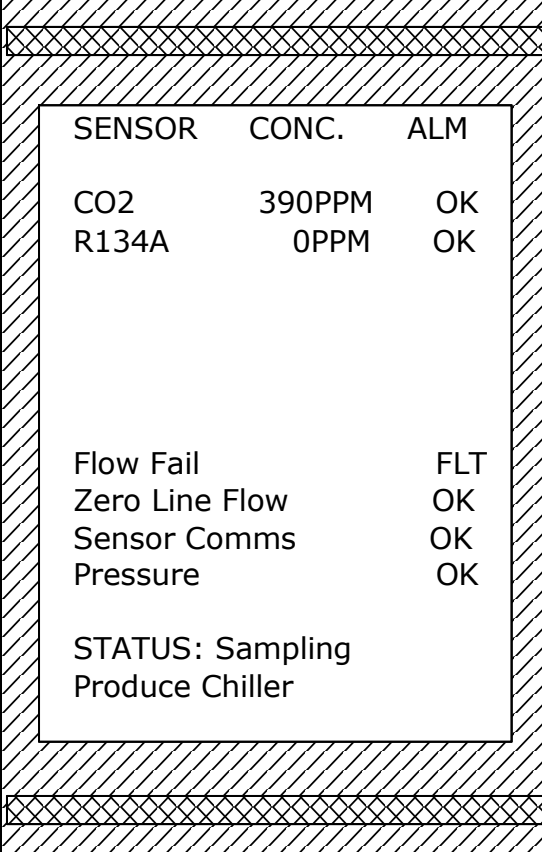
To clear the Fault condition repair or replace the sensor and enter the menu system. Press the *SELECT* button when the *Reset Alarms* option is highlighted with the 'Right Arrow' icon to the left of the menu options.



The 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 hatched border. The display is divided into several sections. At the top, there is a header with three columns: 'SENSOR', 'CONC.', and 'ALM'. Below this, there are two rows of sensor data: 'CO2' with '390PPM' and 'OK', and 'R134A' with '0PPM' and 'OK'. In the middle section, there is a list of alarm conditions and their corresponding status: 'Flow Fail' with 'FLT', 'Zero Line Flow' with 'OK', 'Sensor Comms' with 'OK', and 'Pressure' with 'OK'. At the bottom, there is a status line that reads 'STATUS: Sampling Produce Chiller'.

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 deactivated. The alarm will not clear until the system has flow again, it may be required to 'skip' the problem channel which is discussed later.

3.6.1.3. Communications Failure

A Communications Failure will occur when communications are interrupted for more than 2 minutes between the TQ4200 - ZONING system and the Infrared Sensor.

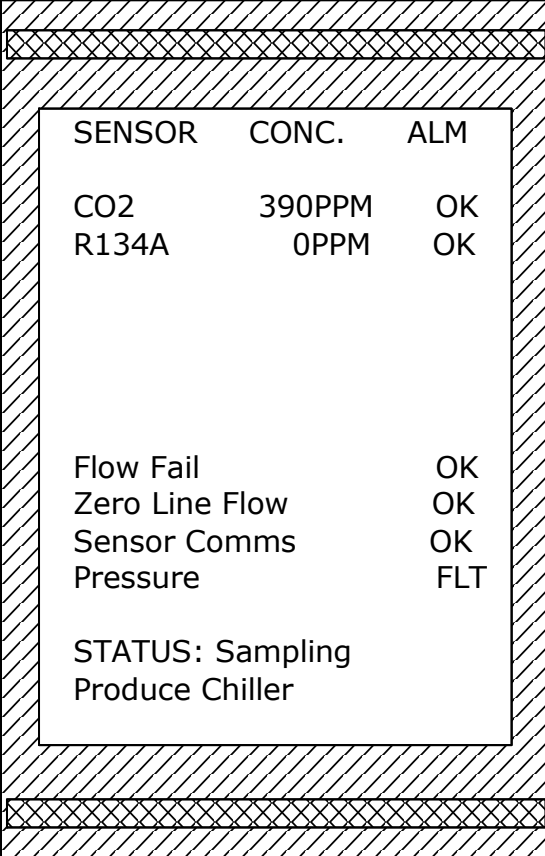
SENSOR	CONC.	ALM
CO2	390PPM	OK
R134A	0PPM	OK
Flow Fail		OK
Zero Line Flow		OK
Sensor Comms		FLT
Pressure		OK

STATUS: Sampling
Produce Chiller

This cannot be reset by the reset function in the menu system; the panel has to be opened and powered down and back up again. However it is preferred to do this from the power supply changeover unit.

3.6.1.4. Pressure Test Fault

A Pressure Fault will occur if the system does not pass the pressure test at start up. 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.



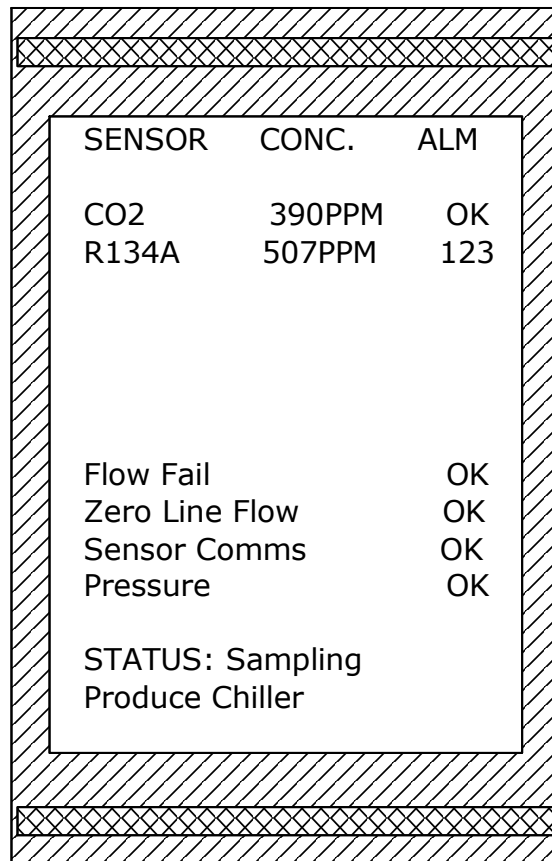
The image shows a rectangular LCD display with a hatched border. The display content is as follows:

SENSOR	CONC.	ALM
CO2	390PPM	OK
R134A	0PPM	OK
Flow Fail		OK
Zero Line Flow		OK
Sensor Comms		OK
Pressure		FLT

STATUS: Sampling
Produce Chiller

3.6.2. Concentration Alarms

There are three alarms on the TQ4200 - ZONING 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.



The image shows a rectangular LCD display with a hatched border. Inside the display, there is a table with three columns: SENSOR, CONC., and ALM. The table contains two rows of sensor data. Below the table, there are four status entries, each with an OK status. At the bottom, the status is 'Sampling Produce Chiller'.

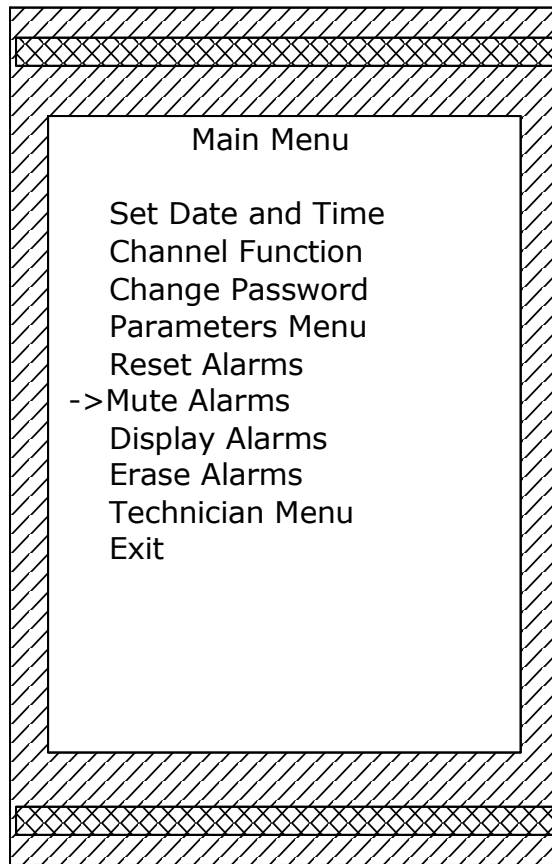
SENSOR	CONC.	ALM
CO2	390PPM	OK
R134A	507PPM	123

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.

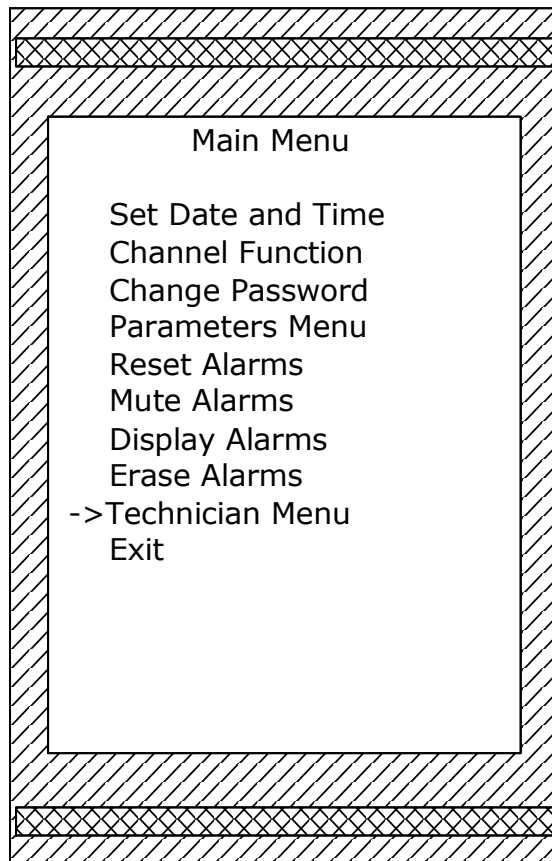


To de-activate the alarm relays the user must use the *RESET* function as described above.

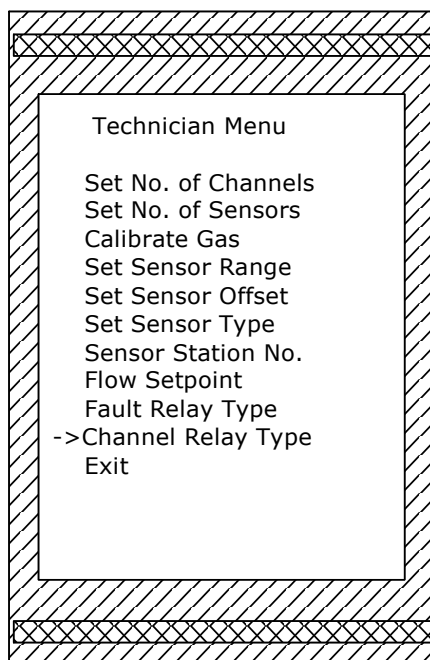
If the alarms are un-latched, then the system will automatically reset the alarms. When the gas concentration does not exceed the alarm set levels on the next samples of that particular channel location.

3.7. Relay Board

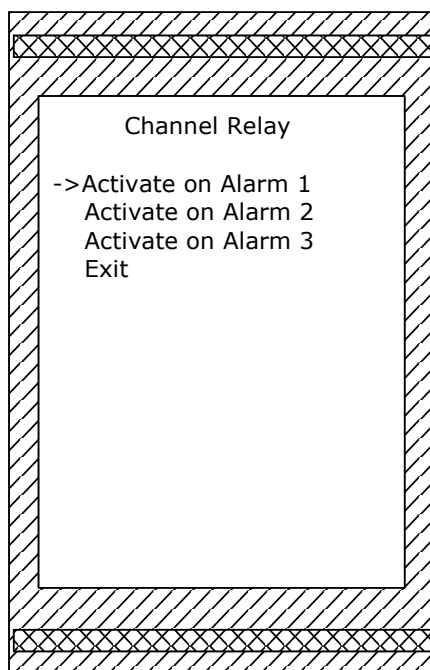
An optional relay board may be provided in the **TQ4200 - ZONING** system that contains 16 relays. Relay 1 will activate on the first sample location alarm, Relay 2 will activate on the second sample location alarm, Relay 3 will activate on the third sample location alarm and so on. The relays may be 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. Press the *SELECT* button when the *Technician Menu* option is highlighted with the 'Right Arrow' icon to the left of the menu options.



This will invoke the sub-menu *Technician Menu*. Use the Up/Down buttons to highlight the Channel Relay Type option.



The next screen will show the available options. Use the UP/DOWN buttons to navigate to the desired option and press the SELECT button to accept it.

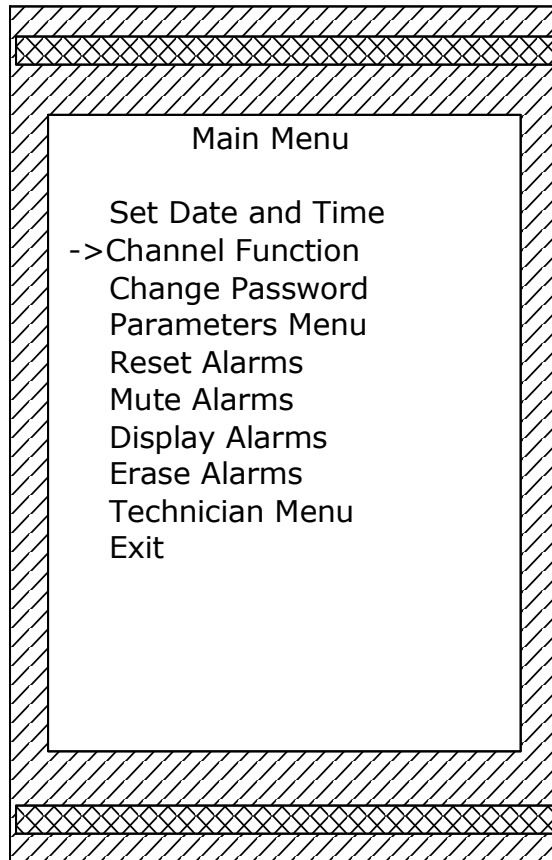


To exit the menu system, the user must navigate to the *Exit* function and press the *SELECT* button. This will take the user to the previous sub-menu and hence the same procedure is used to exit all the way out of the main menu.

The relays are reset when the system resets the alarms as described above.

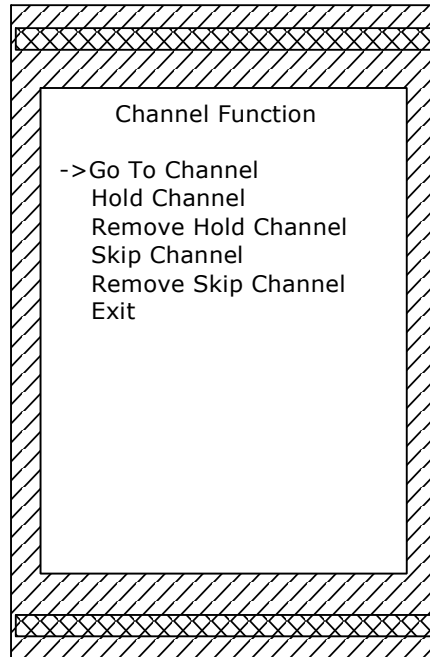
3.8. Channel Functions

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.

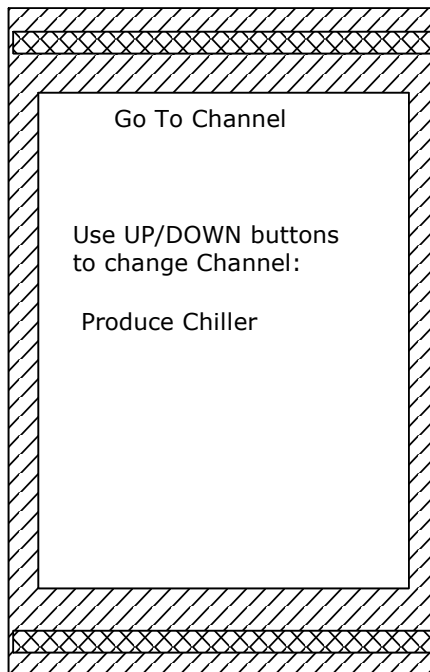


3.8.1. Goto Channel

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

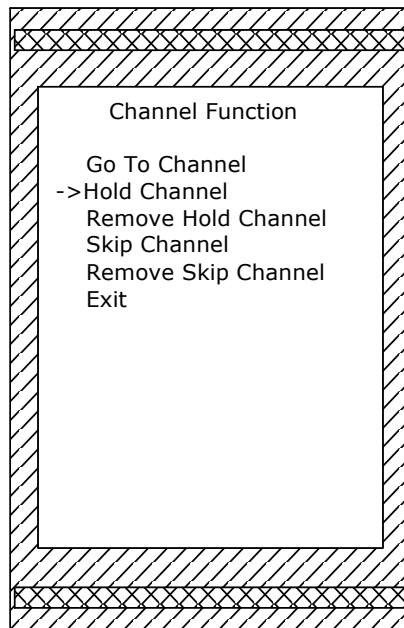


The next screen will prompt the user to select the desired channel location to move to. Press the *SELECT* button to accept the displayed location. The TQ4200 - ZONING will deactivate the current solenoid and move to the selected location and begin sampling, resuming normal system operation.

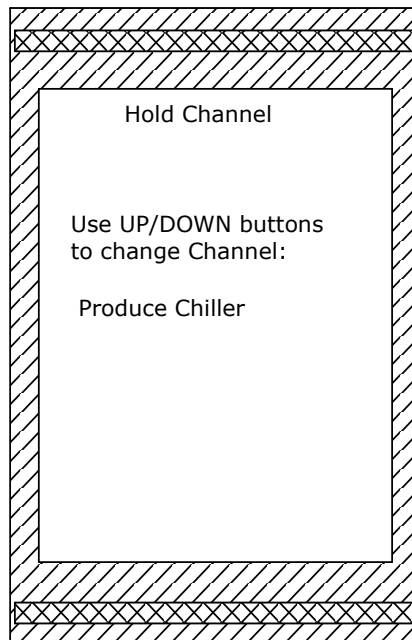


3.8.2. Hold Channel

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



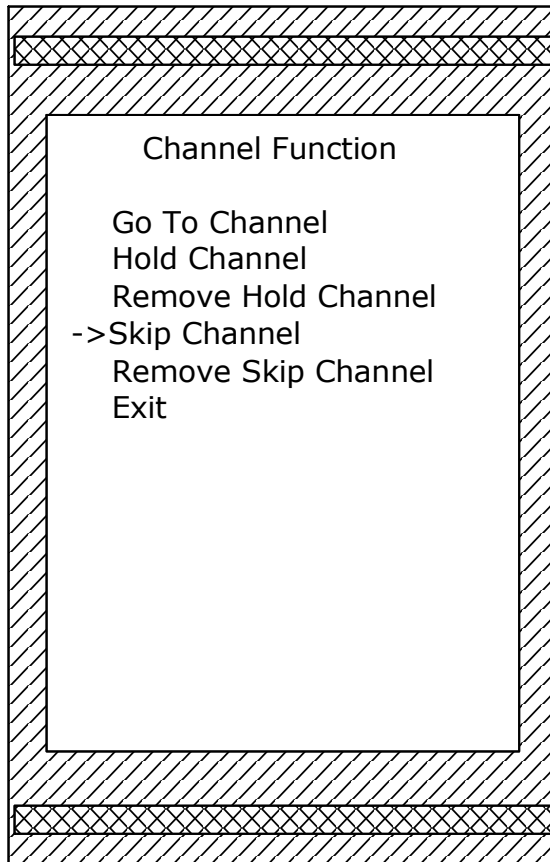
The next screen will prompt the user to select the desired channel location to move to. Press the *SELECT* button to accept the displayed location. The TQ4200 - ZONING will deactivate the current solenoid and move to the selected location and begin sampling. The current Channel location will be continuously sampled for a maximum period of 20 minutes after which time the system will revert to sequential sampling.



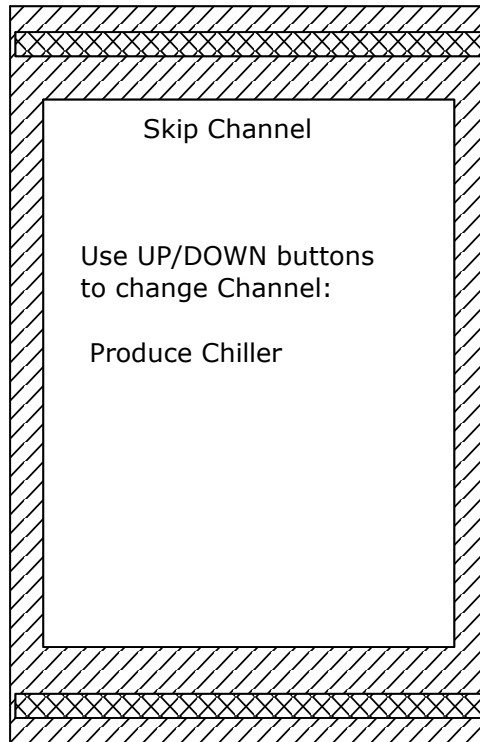
The user may remove the held channel at any time by invoking the *Remove Hold Channel* option. The system will then revert to sequential sampling.

3.8.3. Skip Channel

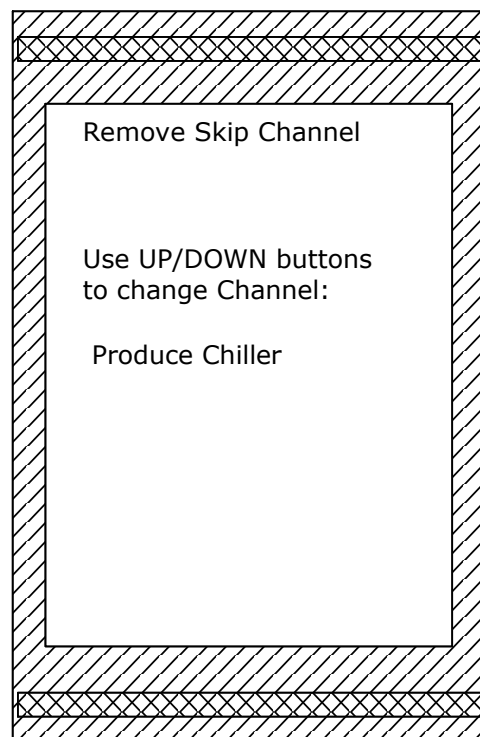
To Skip a particular channel the user must select the *Skip Channel* option. This will invoke the Skip Channel function.



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 TQ4200 - ZONING will skip this channel when it sequentially gets to it, activating the next non-skipped channel instead.

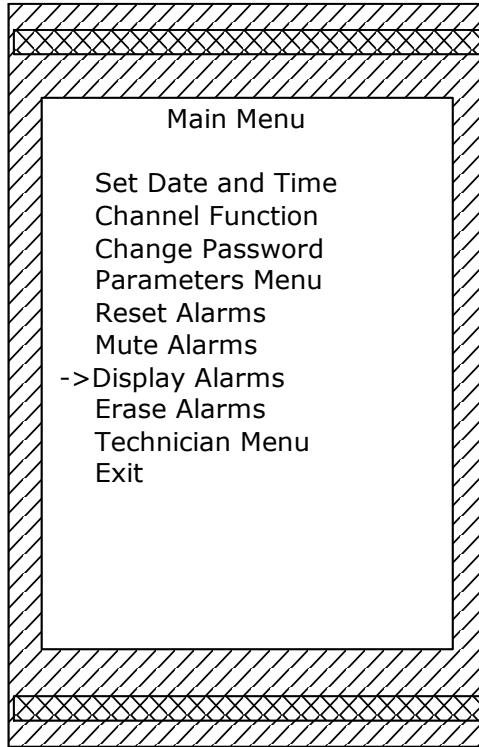


The user may remove the skipped channel at any time by invoking the *Remove Skip Channel* option. The system will then revert to sequential sampling.

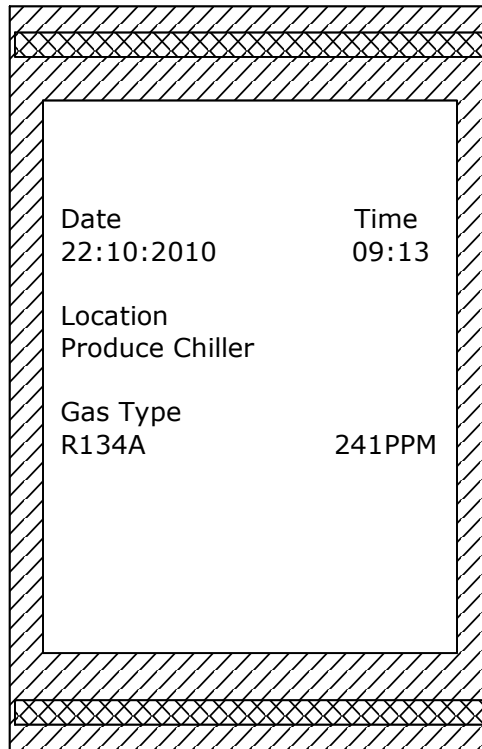


3.8.4. Display Alarms

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 TQ4200 - ZONING 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

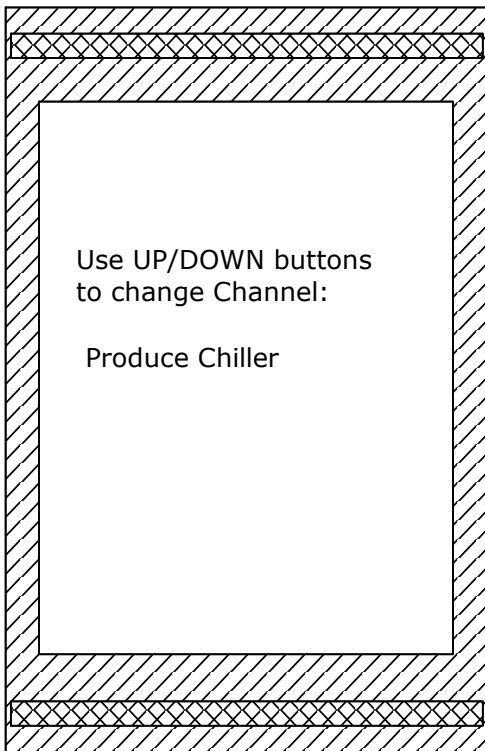
System parameters may be set and edited by entering the **PARAMETERS** menu option. Each parameter is set on a Location by Location basis, therefore what ever is set for channel 1 does not apply to channel 2, unless 'All Channels' option is selected. This option is only available for 'Set Gas Name'.

Detailed descriptions of the Parameters Sub Menu items now follow:

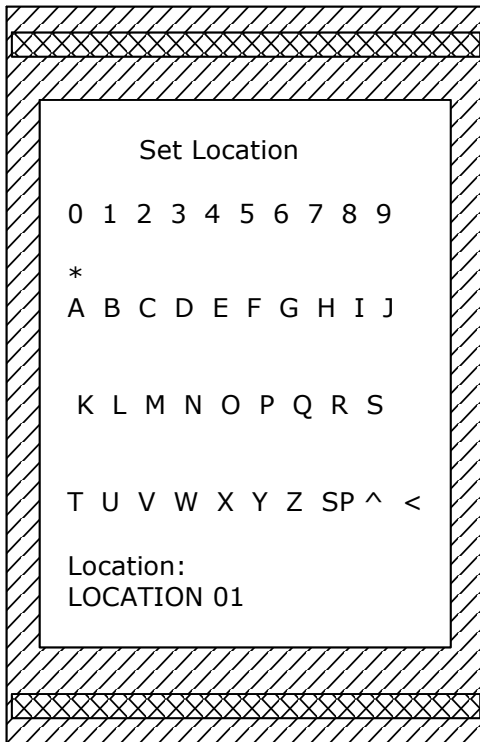
4.1.1. Parameters Sub Menu - Set Location

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.

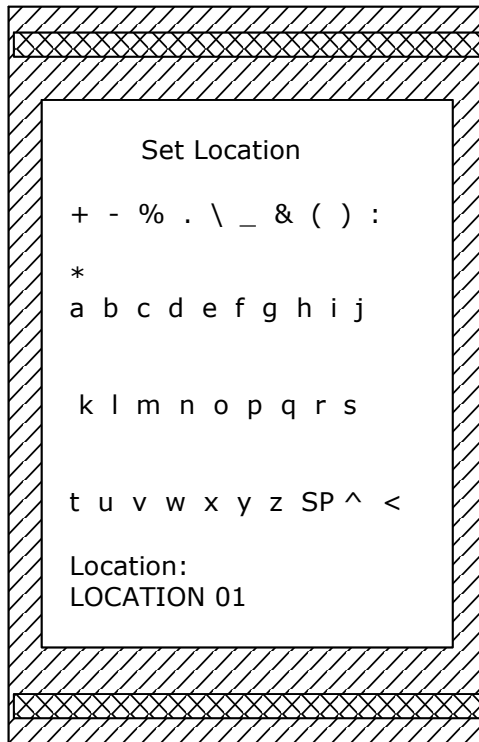
The user is prompted to select the channel to be altered.



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.



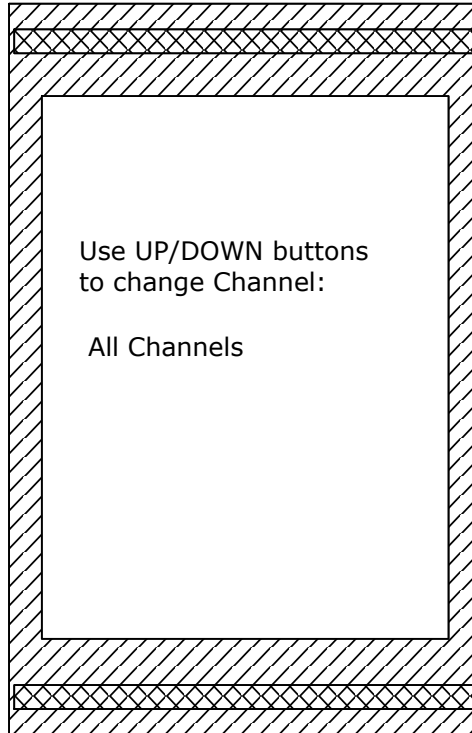
The ^ symbol will toggle between uppercase and lowercase letters and between numbers and general symbols. The < symbol will delete the previous characters.



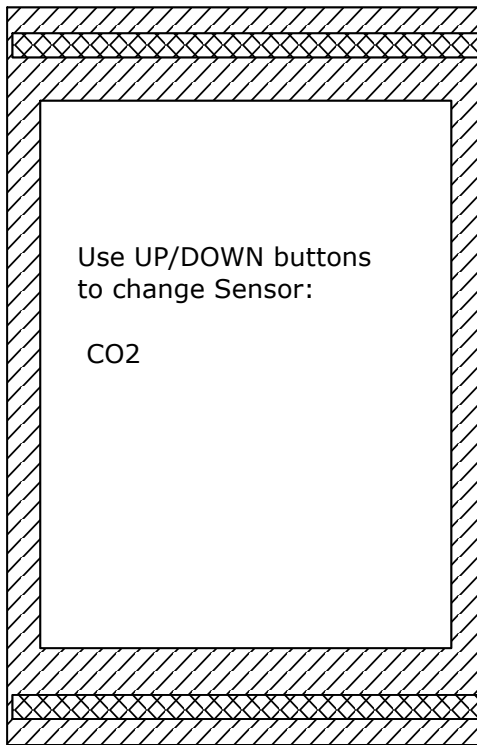
To accept the channel location description the user must press the *MENU* button.

4.1.2. Parameters Sub Menu - Set Gas Name

This option is used to set a particular gas to a particular channel location. The user is prompted to select a Channel location. 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.



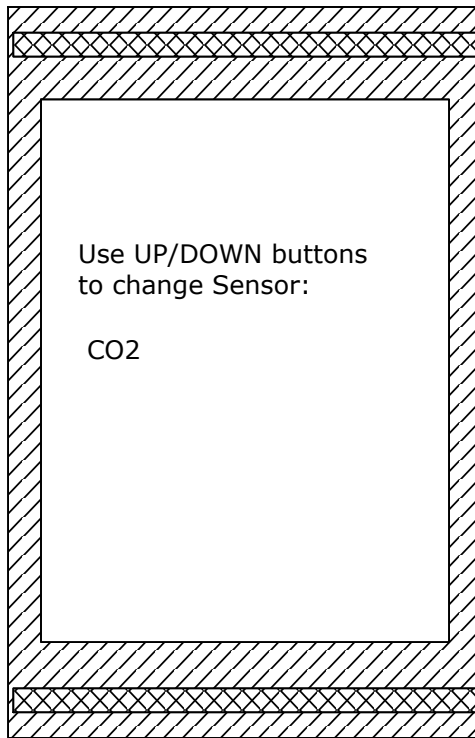
The user must use the *UP* and *DOWN* buttons to cycle through the available gases, pressing the *SELECT* button when the display shows the required gas.

To accept the Sensor name the user must press the *SELECT* button.

N.B. If the sensor is a 4-20mA Sensor then the user will be presented with the alphanumeric keyboard to enter the sensor name, e.g. Oxygen. This operates as described above in Set Location Name.

4.1.3. Parameters Sub Menu - Set Sensor Units

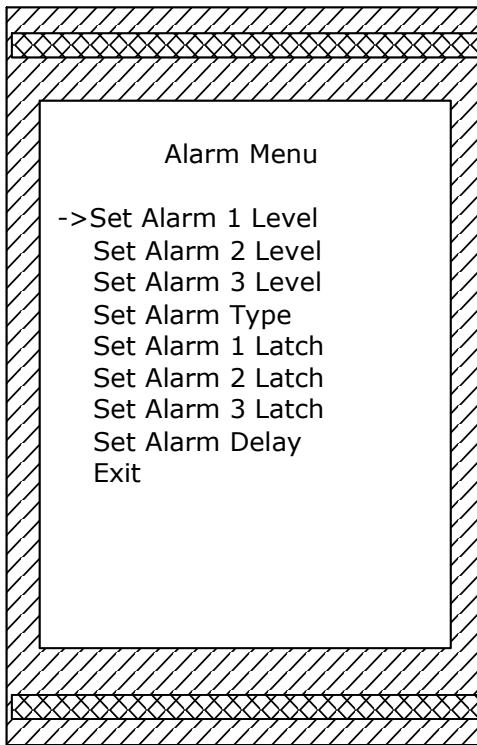
This option will allow the user to select the appropriate units corresponding to the gas type, e.g. PPM, %LEL, %VOL, and MGM. A maximum of four characters are reserved for the sensor units. The user is prompted to select the sensor whose units are to be changed.



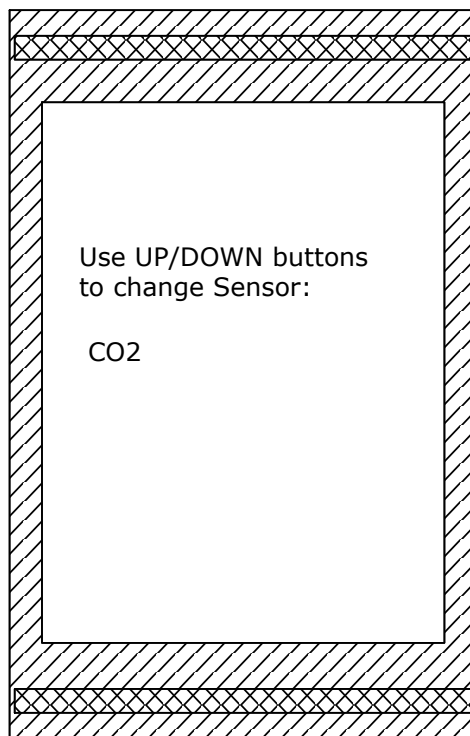
The user is then presented with the alphanumeric keyboard to enter the required sensor units.

4.1.4. Parameters Sub Menu - Set Alarms

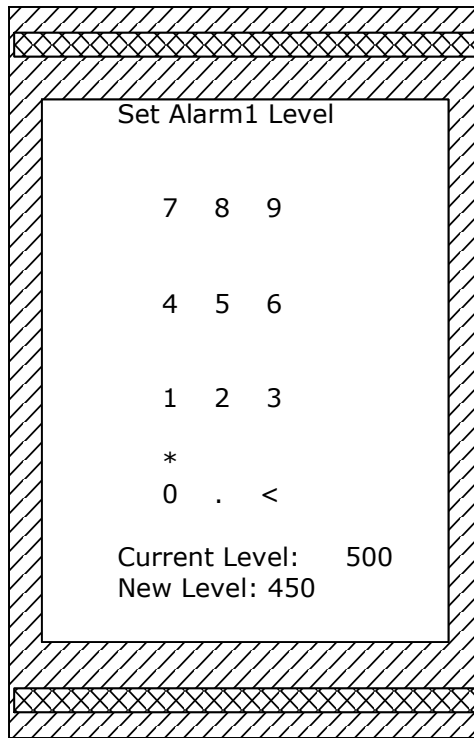
When selected, this option displays a Set Alarms sub menu which allows the user to Set Alarm 1 Level, Set Alarm 2 Level, Set Alarm 3 Level, Set Alarm Type (Rising or Falling), Latch state, Alarm Delay, or Exit Sub Menu. The following describes the typical for alarm 1 but the other alarm options work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



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



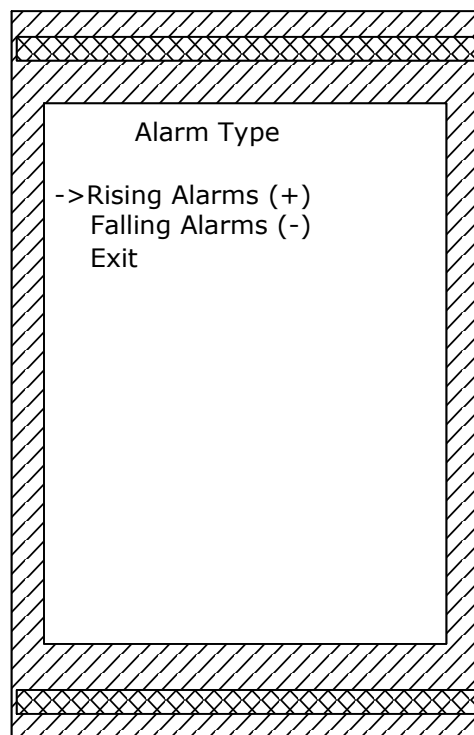
The user must then enter the alarm level using the numeric keypad pressing the *UP/DOWN* buttons to move the asterisk above the desired number.



Pressing the *MENU* button will accept the alarm level.

4.1.5. Parameters Sub Menu - Set Alarm Type

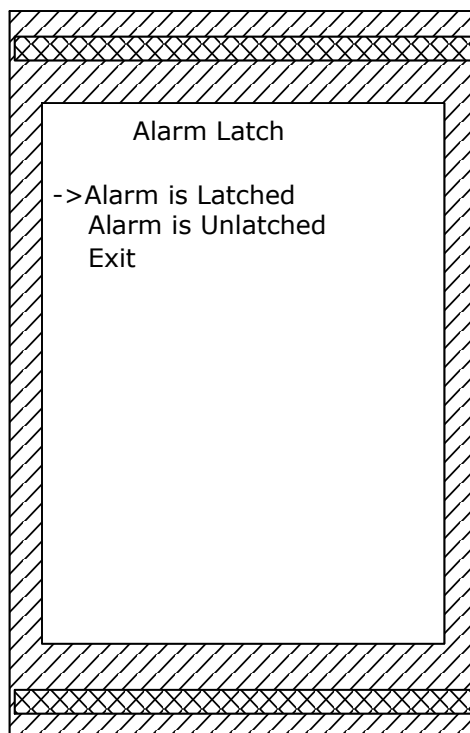
This option is used to select whether an alarm is generated when the concentration is rising (+) or falling (-) for the selected sensor.



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

4.1.6. Parameters Sub Menu - Set Alarm Latch

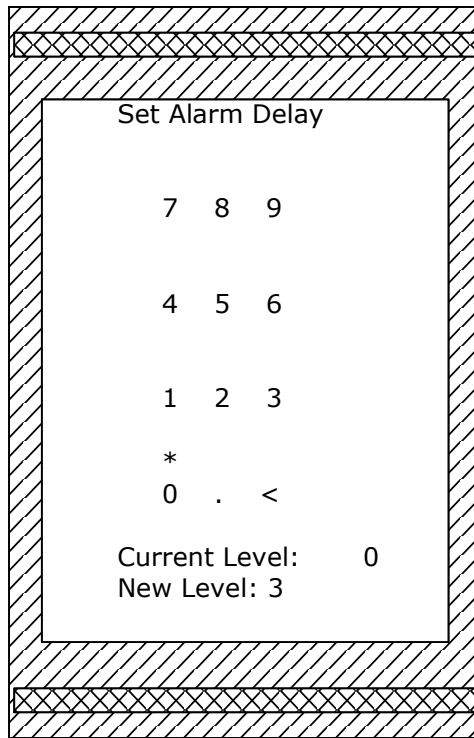
This option allows any gas concentration alarm to be automatically cancelled as soon as the concentration of gas has returned to a level not beyond its alarm set point (Unlatched). The default alarm state is latched alarms.



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

4.1.7. Parameters Sub Menu - Set Alarm Delay

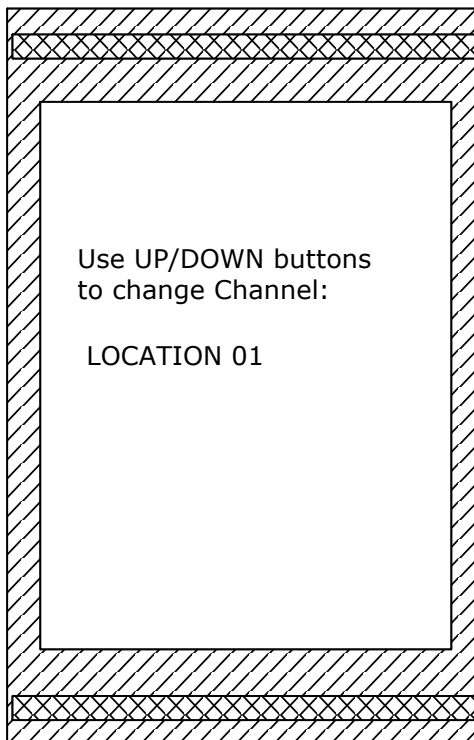
The user may specify a delay time (in seconds) for a particular sensor before an alarm is activated. The default value for this is zero seconds as the alarms are generally tested at the end of the Dwell Time for a sampling system.



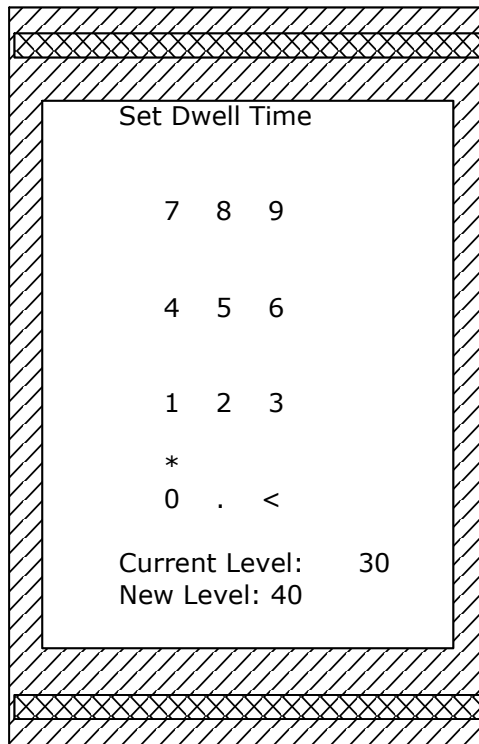
4.1.8. Parameters Sub Menu - Set Dwell Time

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.



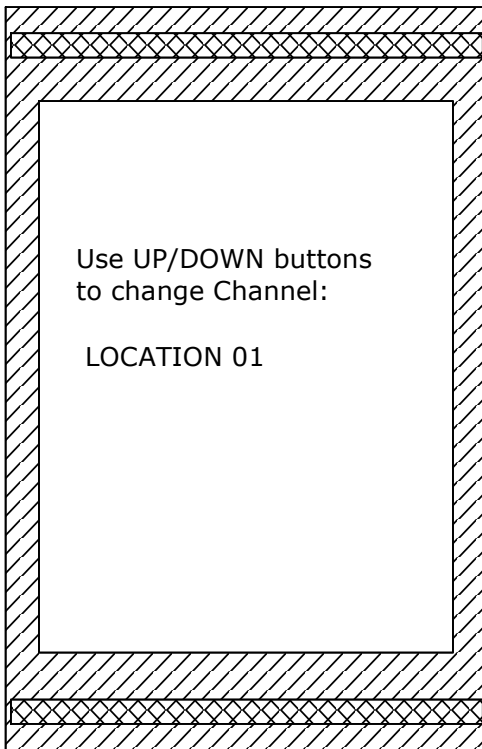
To change the dwell time for that particular channel the user must press the *UP* and *DOWN* buttons to set the required time and the *MENU* button when the desired dwell time is displayed.



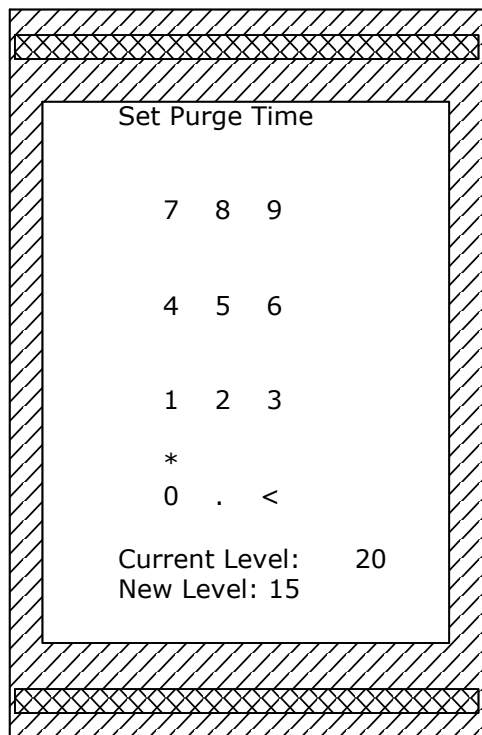
4.1.9. Parameters Sub Menu - Set Purge Time

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.



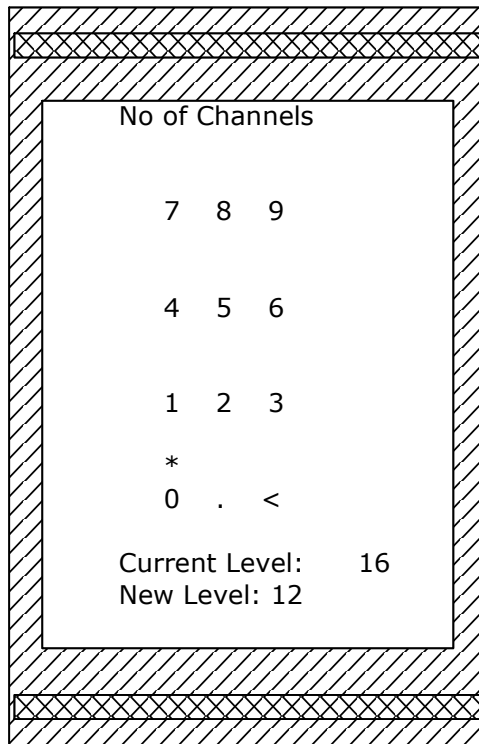
4.2. Technician Menu

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

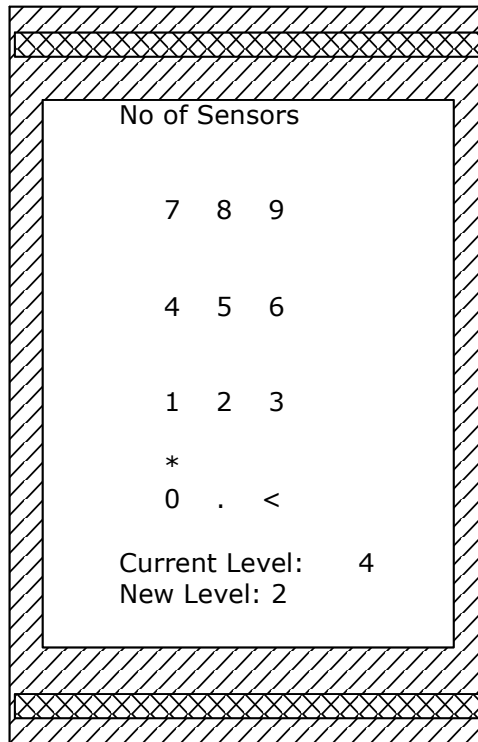
This option allows the user to select the desired number of channels.



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

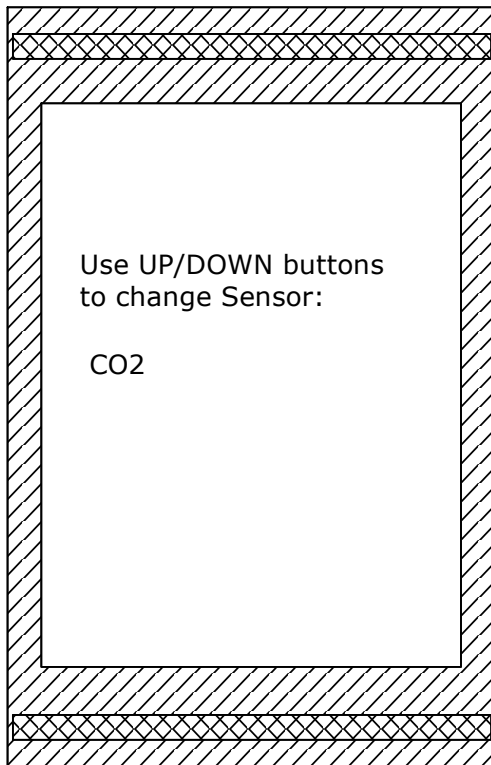
This option allows the user to select the desired number of Sensors.



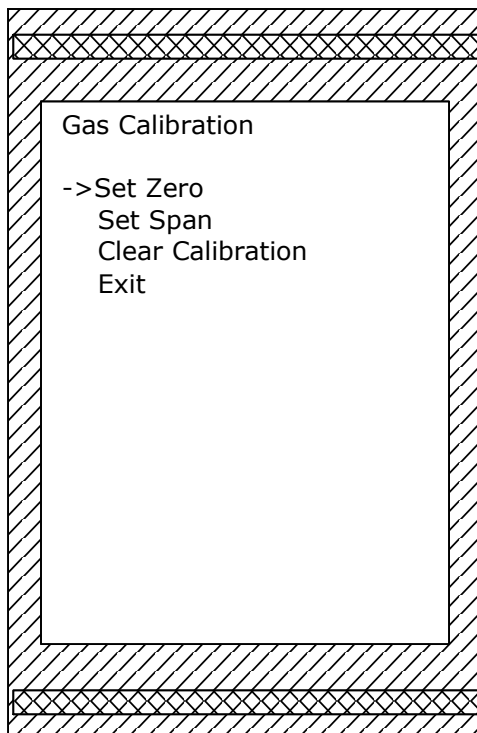
This is set by the *UP* or *DOWN* buttons. When the desired number of Sensors is displayed, the user must press the *MENU* button to accept the displayed value.

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.

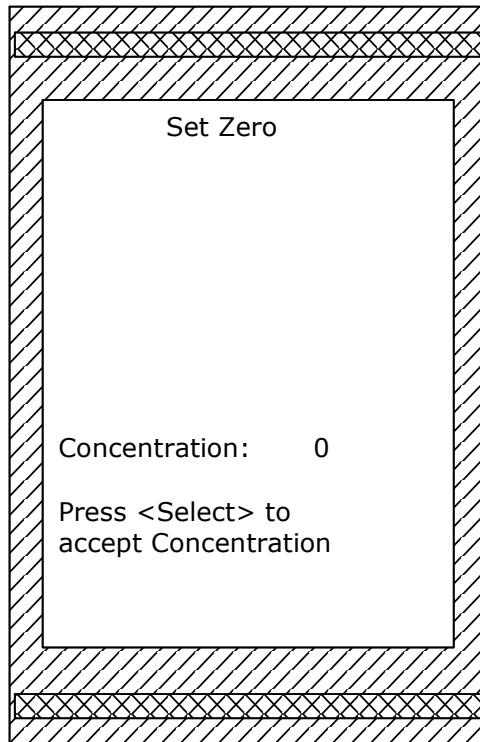


The display then shows the Gas Calibration sub menu which will allow the user to Zero and Span the selected sensor and also clear the calibration data to the factory default values.

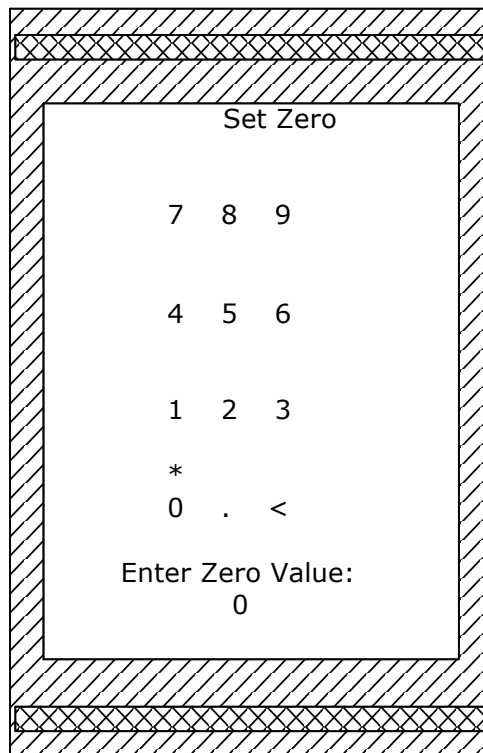


4.2.3.1. Set Zero

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.

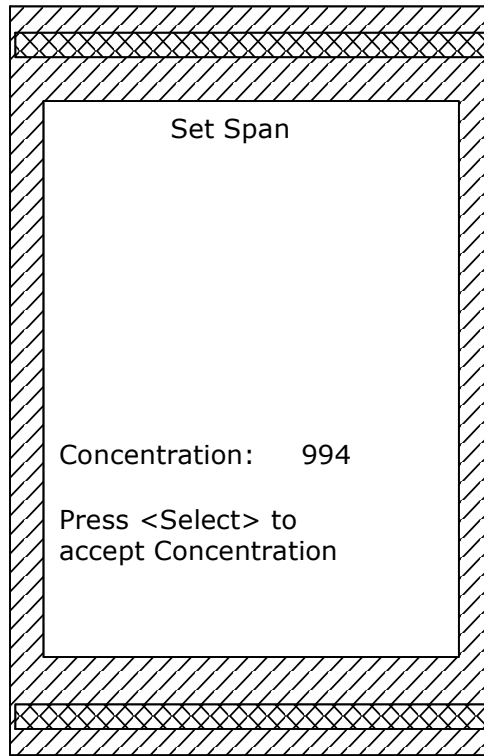


The user will then be prompted to enter the desired display reading, e.g. 0, via the LCD's numeric keypad. Once the desired value is displayed the user may press the *MENU* button to accept this zero level.

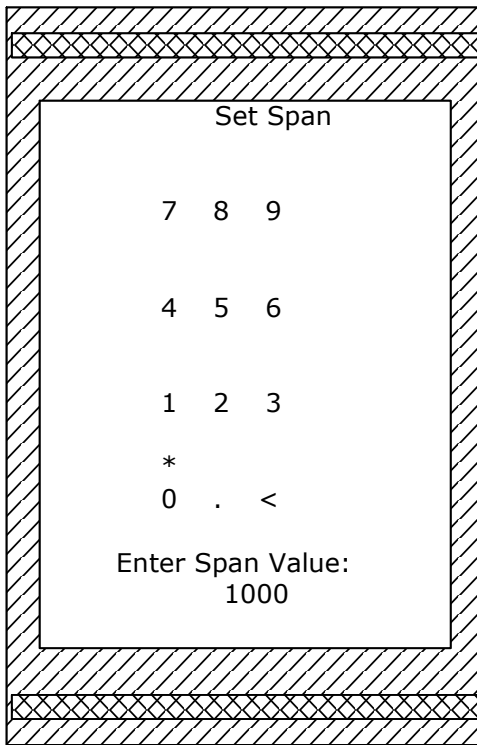


4.2.3.2. Set Span

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 number 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*.

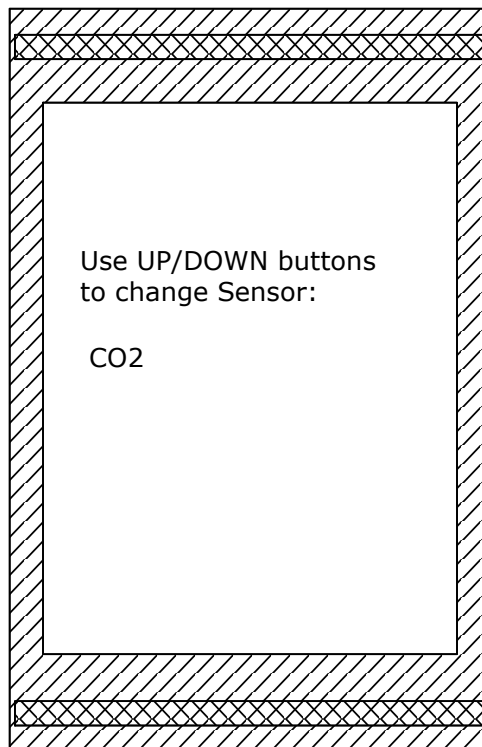
4.2.4. Technician Sub Menu – Set Sensor Range

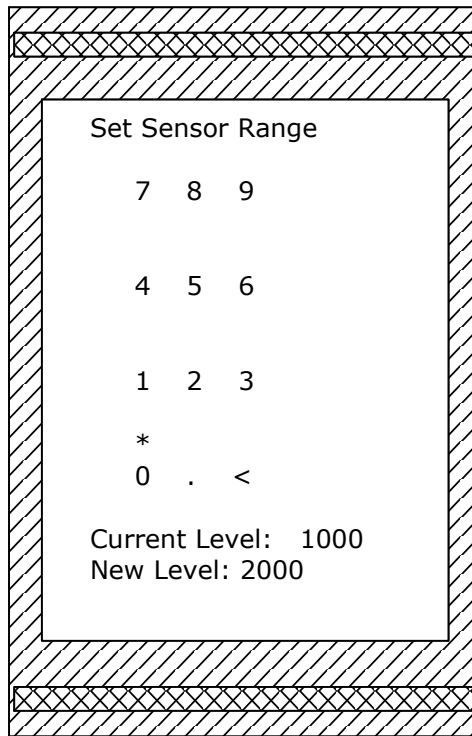
This option of the Technician Menu will allow the range of the selected sensor to be changed. The default range is factory set at 10000 ppm for a CO₂ Sensor and 1000 ppm for a HCFC sensor.

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.





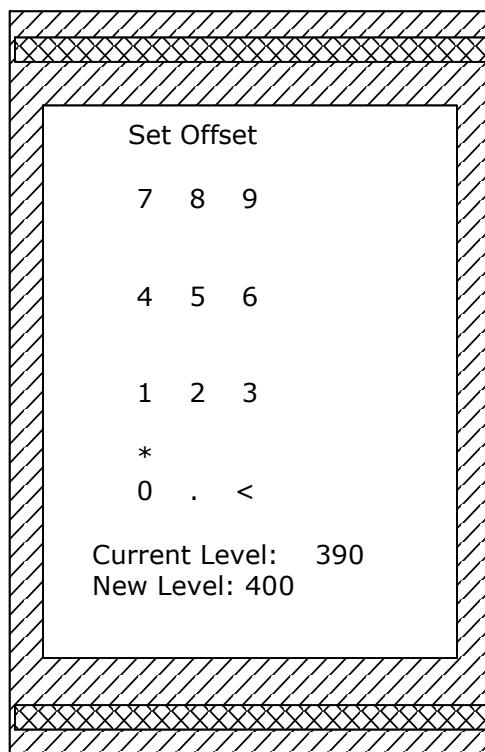
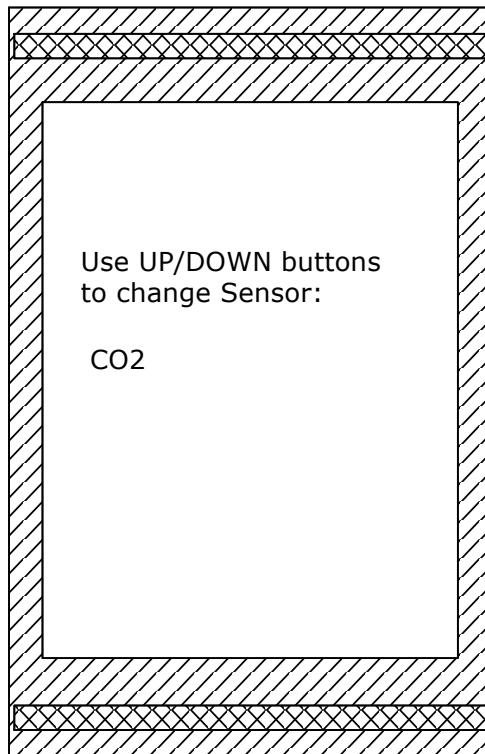
The user will then be prompted to enter the desired display reading, e.g. 2000, via the LCD's number keypad. Once the desired value is displayed the user may press the *MENU* button to accept this Sensor Range level.

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.

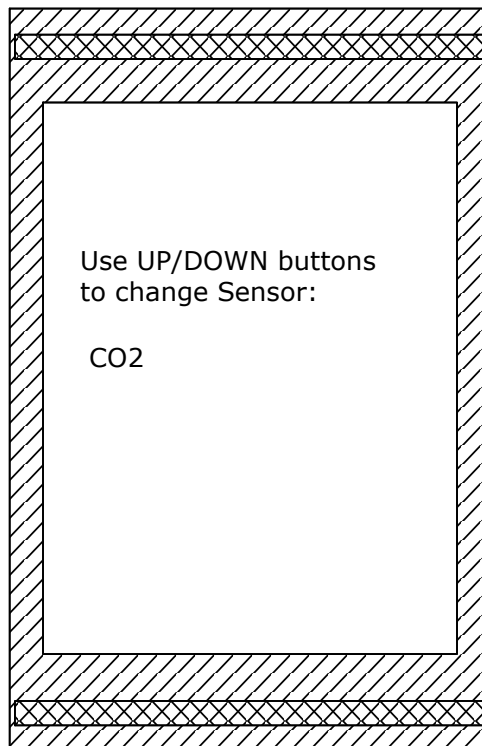
4.2.6. Technician Sub Menu – Set Sensor Type

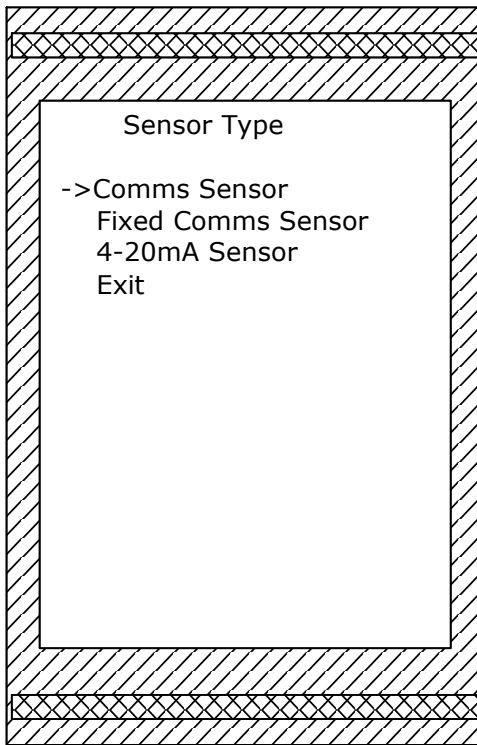
This option of the Technician Menu will allow the user to set the type of Sensor for the selected sensor. The three types of sensor are as follows:

- Comms Sensor
- Fixed Comms Sensor
- 4-20mA 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.



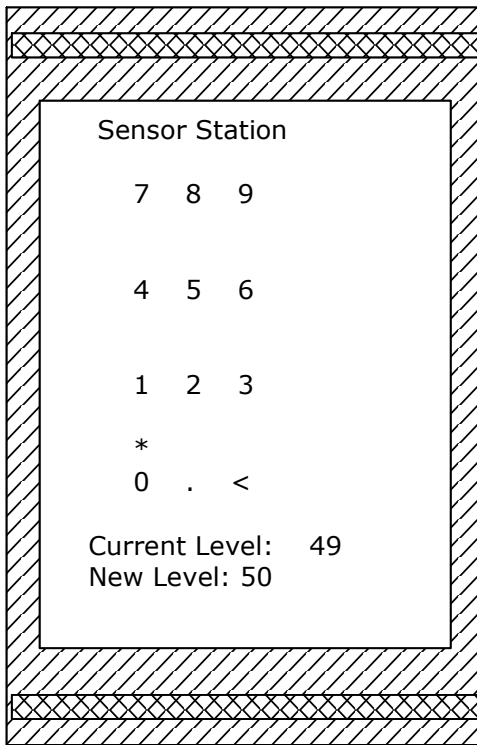


The user will then be prompted to select the desired sensor type.

4.2.7. Technician Sub Menu – Set Sensor Station Number

This option of the Technician Menu will allow the user to set the Sensor Station Number for the selected sensor.

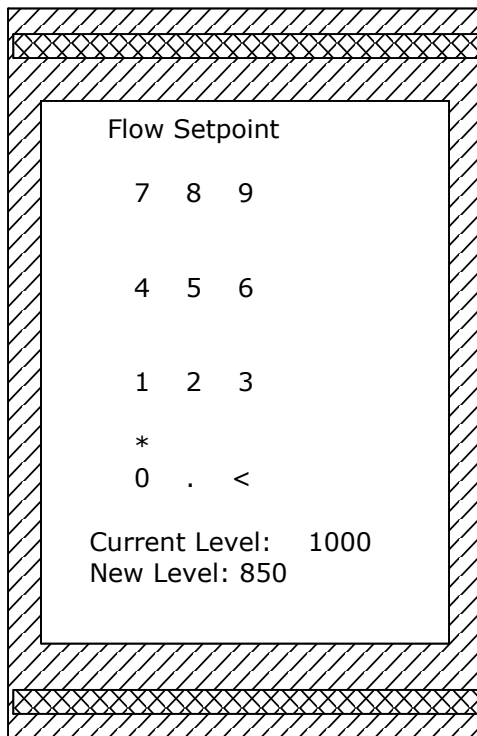
This is already factory set and should not be attempted by anyone other than TQ personnel.



4.2.8. Technician Sub Menu – Set Flow Set-point

This option of the Technician Menu will allow the user to set the Flow Set-point for the system flow fail unit.

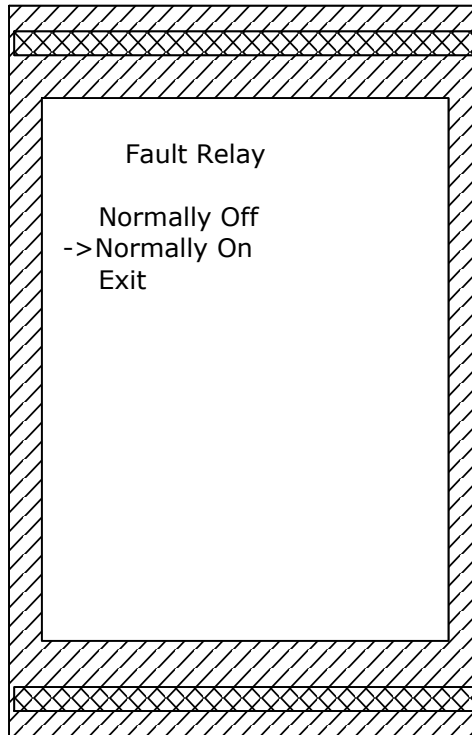
This is already factory set and should not be attempted by anyone other than TQ personnel.



4.2.9. Technician Sub Menu – Set Fault Relay Type

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

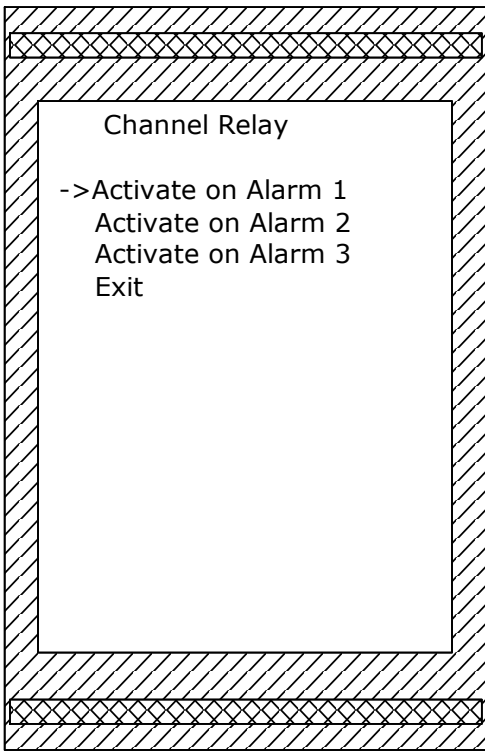
This is already factory set and should not be attempted by anyone other than TQ personnel.



4.2.10. Technician Sub Menu – Set Channel Relay Type

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.

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 **TQ4200 - ZONING sampling system**.

5.1. TQ4200 - ZONING Analysing Unit

The **TQ4200 - ZONING** 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.

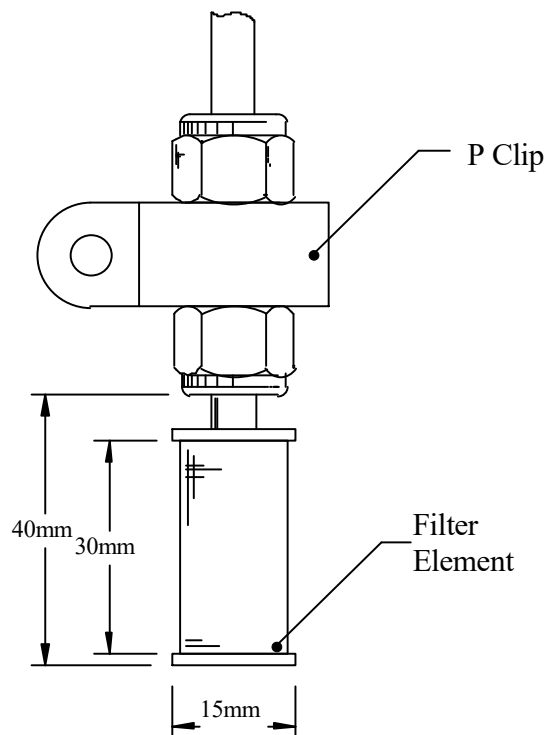


Fig.4 Diagram of an End of Line Filter

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.

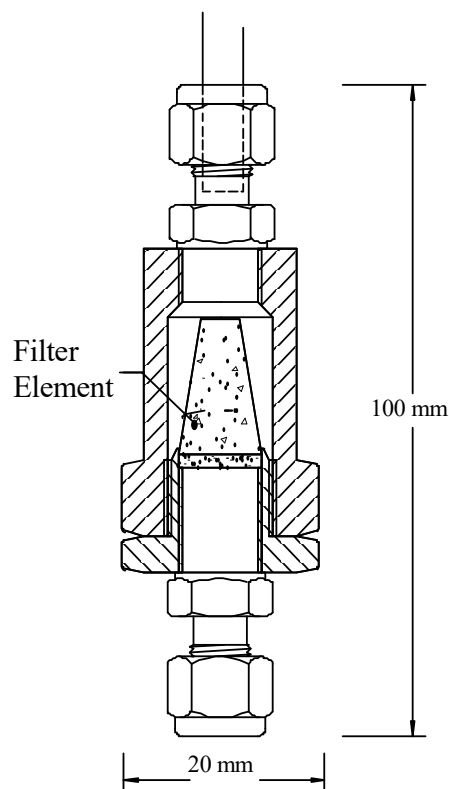


Fig.5 Diagram of an In Line Filter

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.

PARTS LIST

Description: TQ4200 - ZONING 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	137-001	GD137 Freon Detector	2	
11	905-008K	1A Quick Blow Glass Fuses (5x20)	1	
12	905-008H	2A 10 X 38 Fuses	5	