*TQ 8000*

*8 CHANNEL MONITORING SYSTEM*

*OPERATING MANUAL*



*TQ Environmental Ltd*

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**WARNINGS, CAUTIONS AND NOTES**

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

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

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

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

**SAFETY WARNINGS**

1. **FOR SAFETY REASONS, THE TQ8000 MUST BE INSTALLED, OPERATED AND SERVICED BY QUALIFIED PERSONNEL ONLY. READ AND UNDERSTAND THIS INSTRUCTION MANUAL COMPLETELY BEFORE OPERATING THE TQ8000**
2. **THE OPERATION DESCRIBED IN THIS DOCUMENT IS THE INTENDED USE OF THE TQ8000. TQ ENVIRONMENTAL LTD CANNOT BE HELD RESPONSIBLE IF THE TQ8000 IS USED FOR ANY OTHER PURPOSE OTHER THAN THAT STATED. ANY OTHER USE OF THE TQ8000 WILL RENDER ANY CERTIFICATES ISSUED INAPPLICABLE.**

**1. INTRODUCTION**

The TQ8000 is a Monitoring System capable of accepting 8 inputs as a standard version or up to 48 as a bespoke version from either three wire, or two wire 4-20mA detectors and transducers.

This tried and tested processor based control system allows each connected sensor to have its units and level displayed sequentially on the front panel display. The system also allows each sensor to monitor each level with respect to pre-set alarm trip points.

Two alarm trip points are available for each input. These alarms can be configured to operate relay outputs in the form of volt free contacts for connection to other systems, or 24v dc outputs to operate a local audible / visual device.

The TQ8000 may be interfaced to PC’s, BMS’s, LTD’s, Data Loggers etc. using the 4-20mA outputs available for each channel.

It can be controlled and monitored remotely via an RS485 Modbus communications network.

A dedicated ‘fault’ relay also provides a ‘fail-safe’ volt free, or 24v dc output.

Three operator controls are available on the TQ8000 front panel to allow for ‘Reset’, ‘Mute’, and ‘Hold’ functions. Internal password protected push buttons allow the user to calibrate, or re-configure each input.

The TQ8000 in its native form provides a neat, “flush to wall” installation by utilising the three internal mounting points.



**1.1 Specification**

|  |  |
| --- | --- |
| **Inputs:** | Std 8 x 2/3 wire 4-20mA source, or 3 wire Pellistor type. Expandable up to 48 inputs |
| **Outputs:** | 16 SPCO relays, rating: 24 vdc/280V ac @ 12A resistive local in Panel  32 SPCO relays, rating: 24 vdc/280V ac @ 12A resistive local or external to panel  1 x 4-20mA source per input. (non isolated) |
| **Communications:** | Dual RS485 MODBUS protocol. Baud rate of 9600bps. |
| Alarms: | 2 alarm levels per channel, adjustable to any point within the fsd. |
| **Power Supply:** | Universal; 85 to 254 volts ac 50/60Hz (24v dc on request) @  65VA - 8 channel,  150VA - 16 channel,  225VA - 24 channel,  300VA - 32 channel.  375VA - 40 channel.  450VA - 48 channel |
| **Rating:** | IP54 |
| **Enclosure:** | Folded sheet steel, hammer coated polyester finish |
| **Cable entry:** | Bottom gland plate. |
| **Front Panel Controls:** | ‘Reset’, ‘Hold’, & ‘Mute’ |
| **Front Panel Indicators:** | ‘Power ’ green LED  ‘Alarm 1’ & ‘Alarm 2’ red LED  ‘Fault’ amber LED  ‘Inhibit’ amber LED |
| **Display:** | 4 x 40 character alphanumeric Liquid Crystal. |
| **Internal Audible:** | 80dB |
| **Dimensions:** | This depends on the number of channels and client requirements. Below are some typical dimensions:  8-channel: 341mm high x 326mm wide x 160mm deep  16-channel: 600mm high x 600mm wide x 250 mm deep  24-32 channel: 1000.0mm high x 600.0 mm wide x 250.0 mm deep |

1. **DESCRIPTION**

The TQ8000 is based around a Control Board communicating with four other electronic units to monitor each of the eight channels, and provide the display and alarm functions.

These units are:

* + Adaptor PCB
  + Display
  + LED PCB
  + Relay PCB

Standard 8 x sensor TQ8000 layout

The typical system configuration is shown below:



* 1. **Adaptor Board:**

The Adaptor Board terminates each sensor input, and is configurable to accept either 2 or 3 wire 4-20mA or Pellistor type sensors. Links are provided to select the 4-20mA sensor, and an ‘input card’ is fitted to provide the bridge voltage and zero function for the Pellistor sensor.

The Adaptor Board sends the sensor input data to the Control Board, which in turn sends back the control for the 4-20mA outputs.

Also included on the Adaptor Board are LED’s and fuses for the +5 and +24 volt dc power supplies.

* 1. **Control Board:**

The Control PCB is a microprocessor based unit which; accepts the data from each input sequentially, monitors the sensor levels for alarm and malfunction and sends this information to the Display.

In an Alarm or Fault condition the Control PCB also sends data to the Relay PCB, any fitted remote relay PCB’s and signals to the LED’s on the front panel switch PCB.

The TQ8000 configuration data is stored on this PCB in a non volatile memory, and can be re-configured using the on display menu and the programme push buttons.

* 1. **Display:**

This is a 4 line x 40 character alphanumeric LCD device, which sequentially displays the monitored location on the top line, and the current status of each channel on the bottom two lines.

The third row provides a curser to indicate which input that the top line is displaying.

**2.4 Switch PCB:**

This PCB is situated on the rear of the front door, providing common ‘Alarm 1’, ‘Alarm 2’ & ‘Fault’ LED’s and operator ‘Mute’, ‘Hold’ and ‘Reset’ pushbuttons.

Situated on the rear of this board are five PCB mounted pushbuttons:

* + Up
  + Down
  + Enter
  + Menu
  + Inhibit

These pushbuttons are used during calibration and configuration of the TQ8000.

* 1. **Relay Board (local):**

This PCB has 16 relay SPCO outputs, and is fitted under the Adaptor board.

Relay 1 is always configured as the ‘Fault’ relay, whereas the remaining relays are configurable to operate for any level of alarm on any of the eight channels.

At present the TQ8000 does not provide for relay voting configuration.

The TQ8000 provides a ‘Latched’ and ‘Non-Latched’ configuration for individual relays.

A ‘Latched’ relay will require a ‘Reset’ function, whereas the ‘Non-Latched’ relay will reset automatically only when the input alarm trip level has cleared.

Also relays can be mutable, which means that once a sensor has gone beyond the alarm level the relays can be reset so that they will not switch on again until the sensor goes out of alarm and then goes back in to alarm.

* 1. **Remote Relay Board (if fitted):**

This PCB is available with 16 relay SPCO outputs. It may be fitted in within the TQ8000 enclosure or within an enclosure separate from the rest of the TQ8000.

All relays function as alarm relays only and are configurable to operate for any level of alarm on any of the 48 channels.

As regards voting, latching and muting the comments for local relays apply here.

The board is controlled using RS485 MODBUS communications

* 1. **Power Supply:**

The Power Supply fitted in the TQ8000 will accept the mains input via the fused input terminal block.

The power supply provides a 24V dc output which is fed to the PCB’s and a dc/dc converter. This converter provides a 5volt dc output for the Control Board, Adaptor Board, and Relay PCB electronics.

On the 8 channel version three dc fuses are fitted to the left hand side of the Power supply tray;

* + F2 +5 V dc to Electronics
  + F3 +24 V dc to Electronics
  + F4 +24 V dc for Auxiliary Outputs

The 24V dc auxiliary supply, through Fuse F4, can be utilised to drive two local audible & visual alarm devices via the relay contacts. It is capable of supplying 330mA for each device, with F4 rated at a maximum of 3.0Amps.

For fuses on other channel configurations please refer to drawing at back of manual for fuse configuration

**3. OPERATION**

* 1. **Normal Operation**

For normal operating conditions the TQ8000 will show an illuminated green ‘Healthy’ on the front panel, and the display will indicate the system status. A typical display is shown below:

01 GAS ZONE 1 alarm1 acknowledged

01 02 03 04 05 06 07 08

AL1 OK OK AL1 OK OK OK OK

BOILER ROOM 04 METHANE 10 %LEL

01 02 03 04 05 06 07 08

OK OK OK AL1 FLT OK OK OK

* 1. **Gas/input Alarms**

The TQ8000 provides for two trip levels per channel. These are either ‘rising’ or ‘falling’ and can be configured in any combination for each channel.

In a low alarm condition, the TQ8000 display will show an ‘AL1’ on the bottom row under the respective input channel, and operate the internal sounder, and cause the front panel ‘Alarm 1’ red LED indicator to flash. It will also energise any relays that have been pre-configured for that alarm.

The top line of the display will show details of the location in alarm and the warning “ACKNOWLEDGE ALARM1”. Any high alarm will operate the same as for ‘Alarm 1’ above, but will indicate an ‘Alarm 2’ condition.

* 1. **Fault**

Any sensor fault will cause the TQ8000 to put a ‘FLT’ indication on the fourth line of the display corresponding to the channel input, flash the ‘Fault’ LED, operate the internal sounder, and de-energise relay 1.

An alarm is also generated if the TQ8000 has ceased to communicate with another communications device or Remote Relays. Relays cannot be activated by communications errors. These alarms can be disabled in the SETUP COMMUNICATIONS menu.

The display will also request an “ACKNOWLEDGE FAULT” message.

The ‘Fault’ alarm is acknowledged by pressing the “Mute” button. This will silence the internal sounder, put the ‘Fault’ LED into a steady state, and the display will then show “Fault Acknowledged”.

When the fault has been rectified, the ‘Fault’ indication will be removed from the display. The TQ8000 can be returned to its normal operation condition by pressing the front panel ‘Reset’ pushbutton.

**3.4 Over range Fault**

The range of each sensor is established during the TQ8000 configuration procedure. If the displayed concentration exceeds this range then an Over Range Fault is fault is generated. The over range fault will be displayed as ‘OVR’ on the bottom row of the display under the respective input channel, will sound the buzzer and, in the case of a pellistor based sensor, will interrupt power to the sensor.

**WARNING**

**An Over Range Fault is an indicator that concentrations of flammable gas or vapour near, at or above the lower explosive limit have been detected in the area where the sensor has been sited.**

**It is important that the source of the gas or vapour is located and the leak repaired before power is reapplied to a pellistor sensor. A pellistor sensor will be damaged and may generate erroneous results when exposed to concentrations of flammable gases or vapours above the LEL whilst power is applied.**

Resetting an over range fault is a 2 stage operation:-

* Clear the OVR indicator by selecting “Reset over range faults only” option from the menu and enter the appropriate password when requested.
* Press the black reset button at the bottom right hand corner of the large pcb on the door of the instrument. See the TQ8000 internal layout drawing above.

It may also be necessary to reset any concentration and fault alarms, see below.

* 1. **Acknowledge**

Pressing the front panel ‘Mute’ pushbutton will silence the internal sounder, cause the front panel LED to stay on steady and indicate ‘ALARM ACKNOWLEDGED’ on the top line of the display.

Relays can be configured for non-latching operation which will automatically reset only when the alarm levels have returned to normal condition. If the relays have been configured for latching operation then the alarm must be reset before the onscreen warning and relays are removed.

* 1. **Reset**

When the respective channel has returned to its’ normal operation from an ‘Alarm’ or ‘Fault’ condition, the ‘Reset’ pushbutton will return the TQ8000 display, front panel LED’s and relays to normal. **Please note alarms have to be acknowledged before they can be reset.**

* 1. **Hold**

Operating the ‘Hold’ button on the front panel will allow the display to remain on a desired location for monitoring purposes. The cursor on line three will then freeze above the number of the input channel that relates to the location that is being monitored.

To return to normal indication re-press the ‘Hold’ button.

In the event of another channel going into an ‘Alarm’ condition, the ‘Hold’ will be removed and the ‘Alarm’ channel displayed.

* 1. **Inhibit**

The TQ 8000 allows a sensor to be excluded from being monitored by using the ‘Inhibit’ function.

To invoke this function, allow the display to scroll to the sensor to be excluded and press the ‘Inhibit’ button located on the rear of the front panel. The display will show ‘OFF’ on the bottom line underneath the channel number that has been selected.

In this condition the current sensor reading will still be displayed but alarms will not be generated. The ‘Fault’ relay will operate and the front panel ‘Fault’ LED will light.

The sensor may be reactivated by repeating the above procedure, and the ‘OFF’ indication will disappear from the display to confirm this action.

* 1. **Power Failure**

In the event of a power failure the TQ8000 will shutdown and the ‘Fault’ relay will de-energise.

When power is resumed the TQ8000 will carry out a self check routine for a period of 80 seconds, after which time the display will indicate the system status as normal.

In the event that a sensor connected to the TQ8000 has its own self checking routine which exceeds the 80 seconds, it will be necessary to ‘Reset’ the unit to clear the fault indication.

**3.10 Lamp & Buzzer Test**

The LEDs and buzzer may be tested be pressing the “Mute” button. Whilst the button is depressed the all LEDs will illuminate and the buzzer will sound.

**4. INSTALLATION**

It is recommended that the unit be situated away from equipment, and high current carrying cables, which may emit electro magnetic interference

**4.1 Mechanical**

Remembering that the TQ8000 is bottom entry, choose a suitable flat, vertical surface, mark the hole centres, and secure the unit using the 3 off 6.5mm internal fixing holes provided.

After fixing ensure that internally the TQ8000 is free from swarf and debris.

Remove the gland plate and drill out the required number of entries.

**4.2 Electrical:**

**4.2.1 Mains Supply:**

Mains power supply to the TQ8000 should be from a suitable ‘Fused Isolator’ rated at a minimum of 6.0 Amps and fitted adjacent to the TQ8000. Connection to the 8 channel TQ8000 will be to the fused terminal block on the power supply tray for 16-48 channel unit it will be t a rail mount fuse isolator on termination rail.

Mains earth is to be connected to the brass ‘Earth’ terminal adjacent to the fused terminal block.



**4.2.2 Sensor Inputs:**

Ensure that the sensor(s) to be connected to the TQ8000 will operate from a 24V dc supply, and are 2 or 3 wire 4-20mA source type. Ensure that the sensor current for each input does not exceed 5.0W, approximately 200mA.

**NB** This does not apply to Pellistor sensors, as a separate ‘Input Module’ is provided for these devices. The instrument will have been prepared at the factory to accept the appropriate mixture of Pellistor and 4-20mA sensors. The ‘Input Module’ associated with a Pellistor sensor CANNOT be used in channel previously reserved for a 4-20mA sensor, and vice versa.

Field wiring for ALL sensors must have an “over-all” screen.

**NB** The screen of the sensor wiring must not be connected to earth at the sensor, as it must be connected to the ‘Earth’ stud provided within the TQ8000 on the bottom left hand side of the unit.

If practical, any exposed screening at the sensor is to be insulated with heat-shrink material or similar.

Where the TQ8000 has been configured prior to despatch, particular attention must be given to the connection of the correct sensor to its respective input.



Input termination & typical sensor circuits

Note, Sensor connection for 09 to 48 channel units are provided as terminals in the bottom of the panel, please refer to drawing at back of manual for termination.

* + 1. **Relay Outputs**

These are available as ‘Volt-Free, Single Pole Change-Over’ type and terminated on the 16 way ‘Relay board’ supplied.

Relay 1 is always the ‘Fault’ output leaving the remainder as configurable Alarm outputs. Each relay has a ‘Red LED’ across its’ coil to aid in system functional checks.

The TQ8000 8 channel unit has an auxiliary 24v dc supply on ‘TB3’ which can be connected to the relay contacts thus providing 24v dc powered outputs.

The total output current must not exceed 1.0Amp resistive, or 660mA inductive.

Additional relays may be added using a “remote relay PCB as described in 2.6. Additionally output current will increase depending on application

* + 1. **4-20mA Outputs**

A 4-20mA non-isolated, current source output is provided for each individual channels, with their terminals situated next to the sensor inputs on the Adaptor Board.

The maximum circuit resistance for this loop is 680R.

**5 COMMISSIONING**

* 1. **Pre Checks**

Prior to the start of any commissioning work ensure that:

* + All wires and screens, including earth wires, are correctly terminated and secure.
  + All sensors are connected to their respective channel inputs as per the TQ8000 configuration sheet.
  + Ensure that all links and Input Modules, are fitted correctly in accordance with the requirements of the sensor connected.

**5.1.1 INPUT CARD & LINK SET UP**

The TQ8000 adaptor Card has several link positions to determine what the sensor input signal, what is supply voltage to the sensor.

**5.1.1.1 4-20mA input Sensors.**

When using a 4-20mA input 3 wire or 2 wire sensor e.g TQ GD129IR Flammable or TQ122-001 Oxygen, then an input card is **not** required for the ten way header marked CONN 16 – CONN 23 on the Adaptor Card .

The links for this type of channel should be set up as follows:-



**5.1.1.2 Pellistor / Catalytic input Sensors.**

When using a Wheatstone Bridge input 3 wire sensor e.g TQ122-210 Flammable, then an input card is required for the ten way header marked CONN 16 – CONN 23 on the Adaptor Card. In safety critical applications the input card Part no. is 370-656

The Links for the respective channel should be set up as follows:-



**5.1.1.3 4-20mA Output.**

If a 4-20mA output is required at each channel, irrespective of what sensor is connected then the links ‘LKAD2’ and LKAD3 will need inserting as shown below.

**NOTE** This is set differently for channel 9-16, 17-24 and 25-32 on each adaptor card.

 Channels 1-8  Channels 9-16

 Channels 17-24 Channels 25-32

* 1. **Power Up**

The systematic procedure for applying power to the TQ8000 is as follows:

* + Remove the input fuse from the TQ8000, close the mains ‘Fused

Isolator’ and check the supply voltage at the TQ8000 input terminals.

* + Open the ‘Fused Isolator’ and replace the TQ8000 input fuse.
  + Close the ‘Fused Isolator’ and observe the display on the TQ8000 front panel, which will show the self check routine for 80 seconds.
  + Check that the +5 & +24 volt LED’s on the Adaptor Board and Relay Board are lit.

Sensors that have an internal self check routine could exceed the 90 seconds time period for the TQ8000, and will therefore show a fault. Consult the sensor manufacturers’ data sheet, and perform a system ‘Reset’ after its’ respective self check period.

If the ‘Fault’ indication still persists measure the voltage between ‘S’ and ‘0v’ on the Adaptor Board input terminals, the reading should be 0.88V for a 4.0mA input current.

A low ‘milli-volt’ reading indicates a fault on the sensor or associated wiring, this must be rectified before calibration.

Channels connected to Pellistor type sensors could also show a ‘Fault’ after the TQ8000 has timed out. These sensors operate on the ‘Wheatstone Bridge’ principle and therefore require the ‘bridge voltage’ & ‘bridge balance’ setting up prior to calibration.

Upon power up the TQ 8000 will wait 90 seconds to allow the attached sensors to complete their self test. This can be bypassed by pressing the “mute” button. However this may cause sensors to go into fault unnecessarily. The remaining warm up time is displayed on the screen.

**5.3 Pellistor Sensor Set-up**

The ‘Input Card’ for a Pellistor type flammable sensors, e.g. TQ122-210, cards must be ‘set-up’ with the sensor connected to it. This compensates for voltage loss along the cable used.

**Note:** This procedure is to be carried out at installation/commissioning, and also when Pellistor sensors are replaced.



**5.3.1 Pellistor Bridge Voltage**

The ‘bridge voltage’ is set by measuring the dc voltage across ‘+V’ and ‘0v’ at the junction box associated with the pellistor whilst adjusting the appropriate trimpot on the Input Card (see above diagram). The bridge voltage setpoint is that specified by the pellistor manufacturer. For TQ pellistors the setpoints are 2.0, 2.5 & 2.0 volts for the 122-210, 122-211 & 122-212 respectively.

**5.3.2 Bridge Balance Voltage**

After setting the bridge voltage it is important to allow the pellistor to stabilise thermally before the bridge is balanced. This normally takes about 1 hour.

To ‘balance’ the Pellistor sensor bridge, connect the ‘negative’ lead of a calibrated voltmeter to ‘S’ on the ‘Adaptor Board’ input terminals and the ‘positive’ lead to appropriate test point on the Input Card (marked TP1 in the drawing above). Set to read +1.0mv on the meter by adjusting the appropriate ‘trimpot’ on the Input Card.

To clear any channel ‘Fault’ indications, press the TQ8000 front panel ‘Reset’ button.

1. **System Menus**

The sensor details, alarm levels and configuration are preset within the software on order, however if any changes are required then it can be done so via the system menus below.

These parameters of the TQ8000 are user configurable by using the ‘Menu’ driven set-up on the front door display, and the ‘Up’, ‘Down’, ‘Enter’, & ‘Menu’ pushbuttons on the rear of the front door.

To enter the ‘Main Menu’ press the ‘Menu’ pushbutton, and follow the ‘Prompts’ that appear on the bottom line of the display.

The ‘Up’ & ‘Down’ buttons will scroll through the options available:

- Test System

* + Calibration
  + Set Alarms
  + Configure
  + Reset Over Range Fault
  + Exit menu

Selecting the first three of the options by pressing ‘Enter’ will require a 5 digit Password for each option. Refer to **6.1** below for Password entry details.

**6.1 Password Entry**

When the required option is shown on the display and the ‘Enter’ button pressed, a ‘Password’ will be requested, and the left hand character will flash. By using the ‘Up’ & ‘Down’ buttons and the display bottom line instructions, the selected option will be entered.

Entering a false ‘Password’ will indicate ‘Not Valid’, and return the display to the ‘Main Menu’.

**6.2 System Test**

**NB:** This test must **not** be carried out on a **live** installation where there is a risk of operating warning devices and shutting down equipment which can result in injury to personnel, and damage to plant. Therefore this test is to be restricted to factory testing only.

Following the on screen instructions the ‘System Test’ will sequentially operate the following devices:

* + LED’s
  + Push Buttons
  + Relay’s
  + 4-20 mA outputs
  + Display

These are carried out automatically, except for the ‘Push buttons’ which will require an operator action when requested.

A test lead is made up to connect communications ports together, these then may be in turn tested for functionality. Contact TQ for details of test lead.

* 1. **Calibration Menu**

The Calibration Option includes the following sub-menus:

* + Calibrate Single Sensor
  + Auto Calibrate sensors
    1. **Calibrate Single Sensor**

This Calibration Option includes the following sub-menus:

* + Set-up Zero
  + Set-up Span
  + Set-up 4-20mA Zero
  + Set-up 4-20mA Span
    - 1. **Zero Setup**

‘Zero Setup’ defines the minimum point of the range which individual sensors monitor. The ranges may be defined in terms Pressure; Temperature; Flow; Gas concentration; etc.

From the Menu options select ‘Setup Zero’ for the channel required. The display will show:

SETUP ZERO

011.0 % LEL 00180

Enter + up key increases fast, menu exits

Ensure that the sensor under calibration is exposed to its Zero conditions, and allow the transfer value on the right hand side of the second line of the display to stabilise. Adjust the left hand value to the ‘Zero’ required by using the ‘Up’ & ‘Down’ buttons. Confirm and save the value by pressing ‘Menu’.

The ‘Prompt Line’ at the bottom of the display will give assistance.

* + - 1. **Setup Span**

As with the ‘Zero’ set-up, to cater for the numerous sensor types that can be used with the TQ8000, ‘Span’ setup will be for a value at the higher end of the sensor range.

Ensure that the sensor under calibration is exposed to its span conditions, and allow the transfer value on the right hand side of the display second line to stabilise. Adjust the left hand value to the selected range value of the sensor by using the ‘Up’ & ‘Down’ buttons. Confirm and save the value by pressing ‘Menu’.

The ‘Prompt Line’ at the bottom of the display will give assistance.

* + - 1. **Setup 4-20mA Zero**

Connect a calibrated meter, set it to read milliamps, across the appropriate output terminals, and enter the ‘Setup 4-20ma zero’ routine.

It is not necessary for the sensor to provide a zero output for this operation.

Set the respective channels’ output to 4.0mA on the milli-ammeter using the ‘Up’ & ‘Down’ buttons. A corresponding reading will be shown on the right hand side of the display where 0 = 0 volts, and 256 = 5.0 volts.

Confirm the settings by pressing ‘Menu’.

The ‘Help’ line of the display will give assistance.

* + - 1. **Setup 4-20mA Span**

Connect a calibrated meter, set it to read milliamps, across the appropriate output terminals, and enter the ‘Setup 4-20ma span’ routine.

It is not necessary for the sensor to provide an output for this operation.

In setting the 4-20mA output it is important to calculate the mA output equivalent to the range displayed on the left hand side of the display, eg 85% lel. The correct mA to be established is derived from the equation:-

mA output = (Tr x 0.16) + 4;

where Tr is the range displayed above, ie 85 in the example.

Set the respective channels’ output to the derived value on the milli-ammeter using the ‘Up’ & ‘Down’ buttons. A corresponding reading will be shown on the right hand side of the display where 0 = 0 volts, and 256 = 5.0 volts.

Confirm the settings by pressing ‘Menu’.

**6.3.2 Auto Calibrate Sensors**

The menu lets the user calibrate the TQ8000 without returning to the panel to adjust each sensor.

**NOTE: This should only be performed by trained personnel.**

The principle of operation is that the TQ8000 is set to record a number of readings at a certain frequency when the gas level has gone over a set threshold.

For example 8 x sensors are to be calibrated at 50% LEL and say each sensor say will be gassed for about 30 seconds. Therefore to capture the maximum recorded level we can say record a reading every 5 seconds when the gas level is above 35% and take 6 recordings. The TQ8000 will now wait until the reading now reaches above 35% threshold on any sensor and will log each reading every five seconds for up to 6 times. The highest level recorded can then be used as a new calibration set point.

When the user returns to the panel and finds 46% to be the highest reading on sensor 1, then this can be selected and the trimmed to 50%

This Calibration Option includes the following sub-menus:

* + Set Time between recordings
  + Set number of recordings
  + Set threshold concentration
  + Record Zeros
  + Record Spans
  + Select Zero
  + Select Span
    - 1. **Set Time between Recordings**

‘Set time between recordings’ defines the time interval that the TQ8000 takes a Gas measurement reading that is above the ‘threshold concentration’ for Span calibration or below the ‘threshold concentration’ for zero calibration.

This time is defined upon how long the sensor usually takes to reach its maximum level. A pellistor type sensor can usually take about 30 seconds. So every 5 seconds would be good enough to record its upper level.

* + - 1. **Set Number of Recordings**

‘Set time number recordings’ defines the number of gas measurement readings the TQ8000 will take of the concentration above the ‘set concentration level for Span calibration or below the threshold concentration level for zero calibration.

This number is defined upon how many records of concentration are required during the period the user is applying gas the sensor

* + - 1. **Set Threshold Level**

‘Set threshold Level’ defines the level of gas before the TQ8000 triggers itself to start recording the Gas readings. It should be high enough as to not start recording levels from any background gas condition and not too high as to be not triggered at all by an older sensor.

A regularly calibrated unit can assume a threshold 10% below the calibration gas bottle level .

* + - 1. **Record Zeros**

‘Record Zeros’ when activated will make the TQ8000 record the concentrations below the ‘threshold concentrations’ for the ‘set number of recordings’. **FOR INHIBITED SENSORS ONLY**

During this process the display will show how many records it has for what sensors

* + - 1. **Record Spans**

‘Record Span’ when activated will make the TQ8000 record the concentrations above the ‘threshold concentrations’ for the ‘set number of recordings’. **FOR INHIBITED SENSORS ONLY**

During this process the display will show how many records it has for what sensors

* + - 1. **Select Zero**

‘Select Zero’ allow the lowest recorded value of each sensor to be selected and used to calibrate against.

Sensor 2 can be selected and the TQ8000 will display the lowest recorded figure and allow it to be trimmed with the ‘up’ or ‘down‘ buttons to suit.

If no records are present then the display will say, and the recording threshold may require changing to capture results next time.

* + - 1. **Select Span**

‘Select Span’ allow the Highest recorded value of each sensor to be selected and used to calibrate against.

Sensor 2 can be selected and the TQ8000 will display the highest recorded figure and allow it to be trimmed with the ‘up’ or ‘down‘ buttons to suit.

If no records are present then the display will say, and the recording threshold may require changing to capture results next time.

* 1. **Set Alarms**

This routine alters the two concentration alarm ‘Setpoints’, Gas ‘units’ and the over range threshold alarm for each channel on the TQ8000.

Enter the ‘SET ALARMS’ menu and select the channel to be altered using the “UP” or “DOWN” buttons followed by “ENTER”. The user may return to the main menu by pressing the “MENU” button.

* + 1. **Set Alarms, units**

Two options; ‘Level 1’ or ‘Level 2’ are displayed after the channel number has been selected. The appropriate option is selected using the “UP”, “DOWN” and “ENTER” buttons.

A typical display is shown below.

CHANNEL 06 Level 1

r 01000 ppm

Rising or

Falling alarm

Concentration

Units

Three parameters are associated with the alarm ‘Setpoints’;

- Rising/Falling trigger level.(r or f).

- Trip Level.

- Trip Level units.

The cursor is moved between the three options using the “UP” or “DOWN” buttons and selected by pressing “ENTER”. The appropriate parameter is then highlighted by the cursor and the “UP” and “DOWN” buttons used to highlight the required option.

The revised parameter is confirmed by pressing the “MENU” button.

The “MENU” button allows the parameters for the second level to be set up, or return to the channel selection display.

* + 1. **Alter Over Range**

This option adjust the level the TQ8000 alerts of an over range fault. This as described in section 3.4 warns of a potential sensor ‘burn out’ and that calibration will need to be checked as soon as possible.

This will be typically set to 120% as any value above that becomes unreliable.

* 1. **Configuration**

The ‘Configure’ Sub-Menu allows general configuration of the TQ8000 and provides the following 13 options.

|  |  |
| --- | --- |
| **Option** | **Description** |
| Set Sensor Gas | Selects the name of the Gas the sensor is monitoring. |
| Set relays | Assigns relays to Alarms levels, and their ‘Latch’; ‘Non-latched’ operation. |
| Add/Remove channel | Adds/removes channels to be monitored |
| Set location | Assigns sensor locations. |
| Set lower limit | Sets the sensor lower range. |
| Set Alarm 1 dwell | Sets the sensor monitoring time for 1st threshold. |
| Set Alarm 2 dwell | Sets the sensor monitoring time for 2nd threshold. |
| Set range | Sets the sensor upper range. |
| Copy sensor | Allows all Sensor parameters to be copied to another channel. |
| Critical Safety | Allows the failsafe features to be disabled |
| Copy Setting | Show how any setting may be copied |
| Enable Repeater | Enables the RS485 port to connect to a repeater |
| Set up Modbus | Assigns the channel 4-20mA output. |

**HINT!** If all channels have the same parameters, configuration and alarms, then set up channel 1 and proceed to section 6.5.9 Copy Sensor. Here each channel’s variables can be copied from one to another.

**6.5.1 Set Sensor Gas**

This assigns the Gas name parameter of a Sensor to the respective monitoring channel.

a) Use the ‘UP’ & ‘DOWN’ buttons to select to the required channel, press ‘ENTER’ or ‘MENU’ to exit.

b) Use the ‘UP’ & ‘DOWN’ buttons to select the parameter being measured, press ‘MENU’ to accept and exit.

c) Repeat above for all other channel as required, or press ‘MENU’ to exit.

**6.5.2 Set Relays**

This allows ‘Alarm 1’ & ‘Alarm 2’ on each channel to be assigned to specific relays local or the remote PCB if fitted, and also select the relay function as ‘Latched’ or ‘Non-latched’.

a) Use the ‘UP’ & ‘DOWN’ buttons to the required menu, either local relay (0-15), remote (if fitted) or the latching status for each relay setting local or remote, and press ‘ENTER’ or ‘MENU’ to exit.

b) Use the ‘UP’ & ‘DOWN’ buttons to the required channel, and press ‘ENTER’ or ‘MENU’ to exit.

b) Use the ‘UP’ & ‘DOWN’ buttons to select the relay(s) to be assigned for the alarm, and press ‘ENTER’ to confirm. An ‘X’ will be put underneath the selected relay.

c) Use ‘Up’ & ‘Down’ buttons to select other relays, and repeat until all the required relays have been assigned.

Note: Re-selecting a relay already assigned will remove that relay from the assignment table.

1. Press ‘MENU’ to exit.

e) Repeat steps a) to d) for ‘Alarm 2’.

**6.5.2.1 Set Relay Latching**

This allows for selected relays to operate as ‘Latched’ or ‘Non-latched’.

a) Use the ‘UP’ & ‘DOWN’ buttons to select the relay to ‘Latch’, and press ‘ENTER’ to confirm. An ‘L’ should now be placed underneath the selected relay.

b) Repeat as necessary for other relays and remote relays (if fitted)

Re-selecting a relay already set as ‘Latched’ will convert that relay to ‘Unlatched’.

c) Press ‘MENU’ to exit.

**6.5.3 Add/Remove Channel**

This option selects ‘Channels’ that are not required for monitoring, and also re-instates ‘Channels’ for monitoring.

a) Use the ‘UP’ & ‘DOWN’ buttons to scroll to the channel, and press ‘ENTER’ to select or ‘MENU’ to exit.

b) Re-pressing ‘ENTER’ adds or removes the channel

c) Press ‘MENU’ to exit.

**6.5.4 Set Location**

This option allows ‘Location’ names to be allocated to the channels in place of the channel number.

a) Use the ‘UP’ & ‘DOWN’ buttons to select the channel, and press ‘ENTER’ to select or ‘MENU’ to exit.

b) Use the ‘UP’ & ‘DOWN’ buttons to select the current channel and press ‘ENTER’.

c) Use the ‘UP’ & ‘DOWN’ buttons to select the desired letter, and press ‘MENU’ to accept.

d) Repeat steps b) & c) for all the letters, and press ‘MENU’ to exit.

**6.5.5 Set Lower Limit**

This sets the lowest point of the measurement range for a sensor.

a) Use the ‘UP’ & ‘DOWN’ buttons to select the channel, and press ‘ENTER’ to select or ‘MENU’ to exit.

1. Use the ‘UP’ & ‘DOWN’ buttons to the required value, and press ‘MENU’.

**6.5.6 Set Alarm 1 Dwell**

The ‘Dwell Time’ is the time to analyse a particular sensor before triggering the alarm which may be set for up to a maximum of 120 seconds.. This can be helpful to avoid nuisance alarms

1. Use the ‘UP’ & ‘DOWN’ buttons to select the channel, and press ‘ENTER’ to select or ‘MENU’ to exit.
2. Use the ‘UP’ & ‘DOWN’ buttons to show the required value in seconds, and press ‘MENU’.

**6.5.7 Set Alarm 2 Dwell**

As Section 6.5.6 but for the 2nd threshold alarm

**6.5.8 Set Range**

This sets each channel to the high point of a Sensor’s measurement range. (FSD)

a) Use the “UP’ & DOWN’ buttons to select the channel, and press ‘ENTER’ to select or ‘MENU’ to exit.

b) Use the ‘UP’ & ‘DOWN’ buttons to the required value, and press ‘MENU’.

**6.5.9 Copy Sensor**

The operating parameters already assigned to a sensor or channel may be copied to another channel.

1. Use the ‘UP’ & ‘DOWN’ buttons to select the channel to copy ‘from’, and press ‘ENTER’ to select or ‘MENU’ to exit.
2. Use the ‘UP’ & DOWN’ buttons to scroll to the channel to copy ‘to’, and press ‘ENTER’.
3. The copying action will be displayed.

**6.5.10 Critical Safety**

This option toggles the critical safety features of the TQ8000 when disabled the following features will not be active

1. The fault LED and relay will not activate when a sensor is inhibited or calibrated.
2. Overange faults can only be reset from the ‘Resst over range fault’ menu
3. Over range shutdown cards are forced to power up if TQ8000 reboots or powers up

To change ‘Critical Safety enabled’ to disabled press enter when option appears. The same applies to change Critical Safety disabled’ to enabled

**6.5.11 Copy Setting**

This in the menu is purly an instruction and does not allow any interface. However the ‘Copy setting’ is possible throughout all on the sensor setting in the previous menus and alarm settings.

During the change of any setting, press inhibit and then a prompt will appear to copy the current setting to any other channel on the TQ8000.

This is similar to the ‘Copy Sensor’ but as an individual setting rather than complete sensor.

**6.5.12 Enable Repeater**

This allows the connection of a RS485 repeater unit to the TQ8000. Enabling it in this menu activate the port ‘COM 1’ on PCB on back of door.

The repeater may not be allowed to enable if the MODBUS comms to Master is enabled.

To change ‘Repeater enabled’ to disabled press enter when option appears. The same applies to change ‘Repeater disabled’ to enabled

**6.5.13 Set Up MODBUS communication**

This allows the MODBUS to be configured to suit most MODBUS master requirements. Also it permits port testing and the enabling of additional relay boards for extra volt free contacts.

**6.5.13.1 Enable Remote Relays 17 -32**

This allows 1 extra Relay card to be added the system giving an extra16 volt free contacts.

To change ‘Remote relays 17-32 enabled’ to disabled press enter when option appears. The same applies to change ‘Remote relays 17-32 disabled’ to enabled

* + - 1. **Enable Remote Relays 33 -48**

This allows another extra Relay card to be added the system giving an another16 volt free contacts.

To change ‘Remote relays 33-48 enabled’ to disabled press enter when option appears. The same applies to change ‘Remote relays 33-48 disabled’ to enabled

* + - 1. **Enable Comms to Master**

This allows the connection of a RS485 MODBUS Communication to the TQ8000. Enabling it in this menu activate the port ‘COM 1’ and ‘COM 2’ (dual redundancy) on PCB on back of door.

The ‘Comms’ may not be allowed to enable if the ‘Repeater’ is enabled.

To change ‘Comms to Master enabled’ to disabled press enter when option appears. The same applies to change ‘Comms to Master disabled’ to enabled

* + - 1. **Set Up Transmit Mode**

This allows the change of the transmission mode to either RTU or ASCII

1. Press Enter to toggle between ‘RTU’ or ‘ASCII’
2. Press Menu to exit
   * + 1. **Set Station Number**

This allows the change of the TQ8000 slave station number to suit the MODBUS master requirements

1. Use the ‘UP’ & ‘DOWN’ buttons to select the required station number, anything up to 247.
2. Press Menu to exit
   * + 1. **Set up DCS time out**

This allows the TQ8000 to flag a fault alarm if it has not received any communication activity with a set time. This will depend on how many slaves are connected and how much information is transmitted from other slaves. To Set time:

1. Use the ‘UP’ & ‘DOWN’ buttons to select the required station number, anything up to 600 seconds.
2. Press Menu to exit
   * + 1. **Set up time out for relays 17-48**

This allows the TQ8000 to flag a fault alarm if it has not received any communication back from the additional relay card within a set time. To set time:

1. Use the ‘UP’ & ‘DOWN’ buttons to select the required station number, anything up to 600 seconds.
2. Press Menu to exit
   * + 1. **Select Channel to test**

This allows the TQ8000 to send out typical MODBUS data to test any MODBUS Master is receiving data and receiving the correct data, without the need to generate an alarm.

Messages available are:

* Request all sensor readings
* Request all sensor statuses
* Request all sensor precisions
* Reset all relays
* Acknowledge all sensor alarms
* Cancel all alarms
* Acknowledge sensor alarms 2& 3 only
* Cancel sensor alarms 1 to 8
* Acknowledge comms fault only
* Acknowledge all alarms
* Switch on remote relays 17-20

1. Use the ‘UP’ & ‘DOWN’ buttons to select the COMM port to transmit from, and press ‘ENTER’ to select or ‘MENU’ to exit.
2. Use the ‘UP’ & DOWN’ buttons to scroll to the message to transmit, and press ‘ENTER’.
3. The transmission action will be displayed.
   * + 1. **Look at messages received on Comm1,2 or 3**

This allows the display to show what messages are being received on comm. 1, 2 or 3. Again this can be used to see if a MODBUS master is responsive to the TQ8000.

Press ENTER to start TQ8000 listening, MENU exits.

**6.5.14 Set Units**

This sets the sensors Gas units. This can only be set in Section 6.4; ‘Set Alarms’

**6.5.15 Set Precision**

Each channel can be selected to have its concentration printed to 0, 1, 2, or 3 decimal places.

1. Use the ‘UP’ & ‘DOWN’ buttons to scroll to the required channel, and press ‘ENTER’ to select or ‘MENU’ to exit.
2. Press the UP or DOWN buttons to alter the precision. Then press ‘MENU’ to exit.
   1. **Reset Over Range Fault.**

TQ 8000 will monitor for a fault situation where a sensor goes over Range. This is where a sensor is exposed to a concentration of gas higher than the recommended range of that sensor. This is provided to warn the user the sensor is possibly damaged due to saturation and may need calibration to verify functionality.

Selecting the ‘Reset over Range Fault’ of the options by pressing ‘Enter’ when displayed. This will require a 5 digit Password.

Once this is entered the Over Range fault will clear.

1. **MODBUS**
   1. **Introduction**

This Section specifies the MODBUS output of the TQ8000. It details the protocol used and information that is made available over the protocol.

* 1. **Communications**

In MODBUS communications there is a Master Device and a number of Slave Devices. The Master is usually a central store with one or more slaves on a network containing data that the Master must have access to. **The TQ8000 will be one of these slaves**. The network will be based on 2 x RS485 communications lines. If two lines are present then the system will operate on a dual channel basis. However, communication with the TQ8000 will be over one line at a time and it will be up to the MODBUS master to allocate the line it uses to communicate with the TQ8000.

Communication primarily will be over RS485 COM 1 but the PIU will keep the required registers for both RS485 COM 1 and RS485 COM 2 identical. It is up to the Modbus master to detect if communications has failed on RS485 COM 1 and therefore must use RS485 COM 2 or vice versa.

The slave number will have been set at the factory to 1 but may be set from within the menu system see section 6.5.13.5.

**7.2.1 Communication Specification**

The operating parameters already assigned to a sensor or channel may be copied to another

|  |  |
| --- | --- |
| **Interface:** | 3 wire RS485 (2 Wire and Ground) |
| **Transmission Mode:** | Half Duplex |
| **Transmission Protocol:** | MODBUS ASCII or RTU |
| **Modbus document base:** | PI-MBUS-300 Rev J[[1]](#footnote-1) |
| **Error Check:** | LRC or CRC |
| **Transmission Speed:** | 9600 |
| **Data Format:**  **Data bits**  **Start bits**  **Stop bits**  **Parity bit** | 8 bits  1 bit  1 bit  None |
| **Time Out Timer:** | 3 Seconds \* |
| **No Of Retries:** | 3 \* |
| **Time Between Polls:** | 5 Seconds \* |

\* These values may be changed at commissioning.

**The following tables assume that the MODBUS addresses start at 00000.**

**Be aware some systems the MODBUS addresses start at 00001.**

**7.2.2 Information Exchanged**

**7.2.2.1 Alarm State**

The following table shows the MODBUS addresses for the alarm status of the TQ8200:-

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **Channel** | **Sensor**  **Exists** | **Ack’d**  **Alarm 1**  **(3)** | **Unack’d**  **Alarm 1**  **(4)** | **Ac’d**  **Alarm 2**  **(5)** | **Unack’d**  **Alarm 2**  **(6)** | **Ack’d**  **Fault**  **(7)** | **Unack’d**  **Fault**  **(8)** | **Sensor**  **Inhibited**  **(9)** |
| 1 | 00936 | 00600 | 00648 | 00696 | 00744 | 00792 | 00840 | 00888 |
| 2 | 00937 | 00601 | 00649 | 00697 | 00745 | 00793 | 00841 | 00889 |
| 3 | 00938 | 00602 | 00650 | 00698 | 00746 | 00794 | 00842 | 00890 |
| 4 | 00939 | 00603 | 00651 | 00699 | 00747 | 00795 | 00843 | 00891 |
| 5 | 00940 | 00604 | 00652 | 00700 | 00748 | 00796 | 00844 | 00892 |
| 6 | 00941 | 00605 | 00653 | 00701 | 00749 | 00797 | 00845 | 00893 |
| 7 | 00942 | 00606 | 00654 | 00702 | 00750 | 00798 | 00846 | 00894 |
| 8 | 00943 | 00607 | 00655 | 00703 | 00751 | 00799 | 00847 | 00895 |
| 9 | 00944 | 00608 | 00656 | 00704 | 00752 | 00800 | 00848 | 00896 |
| 10 | 00945 | 00609 | 00657 | 00705 | 00753 | 00801 | 00849 | 00897 |
| 11 | 00946 | 00610 | 00658 | 00706 | 00754 | 00802 | 00850 | 00898 |
| 12 | 00947 | 00611 | 00659 | 00707 | 00755 | 00803 | 00851 | 00899 |
| 13 | 00948 | 00612 | 00660 | 00708 | 00756 | 00804 | 00852 | 00900 |
| 14 | 00949 | 00613 | 00661 | 00709 | 00757 | 00805 | 00853 | 00901 |
| 15 | 00950 | 00614 | 00662 | 00710 | 00758 | 00806 | 00854 | 00902 |
| 16 | 00951 | 00615 | 00663 | 00711 | 00759 | 00807 | 00855 | 00903 |
| 17 | 00952 | 00616 | 00664 | 00712 | 00760 | 00808 | 00856 | 00904 |
| 18 | 00953 | 00617 | 00665 | 00713 | 00761 | 00809 | 00857 | 00905 |
| 19 | 00954 | 00618 | 00666 | 00714 | 00762 | 00810 | 00858 | 00906 |
| 20 | 00955 | 00619 | 00667 | 00715 | 00763 | 00811 | 00859 | 00907 |
| 21 | 00956 | 00620 | 00668 | 00716 | 00764 | 00812 | 00860 | 00908 |
| 22 | 00957 | 00621 | 00669 | 00717 | 00765 | 00813 | 00861 | 00909 |
| 23 | 00958 | 00622 | 00670 | 00718 | 00766 | 00814 | 00862 | 00910 |
| 24 | 00959 | 00623 | 00671 | 00719 | 00767 | 00815 | 00863 | 00911 |
| 25 | 00960 | 00624 | 00672 | 00720 | 00768 | 00816 | 00864 | 00912 |
| 26 | 00961 | 00625 | 00673 | 00721 | 00769 | 00817 | 00865 | 00913 |
| 27 | 00962 | 00626 | 00674 | 00722 | 00770 | 00818 | 00866 | 00914 |
| 28 | 00963 | 00627 | 00675 | 00723 | 00771 | 00819 | 00867 | 00915 |
| 29 | 00964 | 00628 | 00676 | 00724 | 00772 | 00820 | 00868 | 00916 |
| 30 | 00965 | 00629 | 00677 | 00725 | 00773 | 00821 | 00869 | 00917 |
| 31 | 00966 | 00630 | 00678 | 00726 | 00774 | 00822 | 00870 | 00918 |
| 32 | 00967 | 00631 | 00679 | 00727 | 00775 | 00823 | 00871 | 00919 |
| 33 | 00968 | 00632 | 00680 | 00728 | 00776 | 00824 | 00872 | 00920 |
| 34 | 00969 | 00633 | 00681 | 00729 | 00777 | 00825 | 00873 | 00921 |
| 35 | 00970 | 00634 | 00682 | 00730 | 00778 | 00826 | 00874 | 00922 |
| 36 | 00971 | 00635 | 00683 | 00731 | 00779 | 00827 | 00875 | 00923 |
| 37 | 00972 | 00636 | 00684 | 00732 | 00780 | 00828 | 00876 | 00924 |
| 38 | 00973 | 00637 | 00685 | 00733 | 00781 | 00829 | 00877 | 00925 |
| 39 | 00974 | 00638 | 00686 | 00734 | 00782 | 00830 | 00878 | 00926 |
| 40 | 00975 | 00639 | 00687 | 00735 | 00783 | 00831 | 00879 | 00927 |
| 41 | 00976 | 00640 | 00688 | 00736 | 00784 | 00832 | 00880 | 00928 |
| 42 | 00977 | 00641 | 00689 | 00737 | 00785 | 00833 | 00881 | 00929 |
| 43 | 00978 | 00642 | 00690 | 00738 | 00786 | 00834 | 00882 | 00930 |
| 44 | 00979 | 00643 | 00691 | 00739 | 00787 | 00835 | 00883 | 00931 |
| 45 | 00980 | 00644 | 00692 | 00740 | 00788 | 00836 | 00884 | 00932 |
| 46 | 00981 | 00645 | 00693 | 00741 | 00789 | 00837 | 00885 | 00933 |
| 47 | 00982 | 00646 | 00694 | 00742 | 00790 | 00838 | 00886 | 00934 |
| 48 | 00983 | 00647 | 00695 | 00743 | 00791 | 00839 | 00887 | 00935 |

In the above 0 means that Status is ok 1 means the status is active. The sensor is in normal state if the addresses in columns 3 -9 are not active

**7.2.2.2 Concentrations**

Concentrations are stored in Scientific form and stored in two parts, a reading and a precision part. This should be read RR E PP where RR is the reading and PP is the precision, e.g. 21.2% will be represented as 212E-1 or 212x 10-1.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Channel** | **Reading** | **Precision** | **Channel** | **Reading** | **Precision** |
| 1 | 40200 | 40248 | 24 | 40223 | 40271 |
| 2 | 40201 | 40249 | 25 | 40224 | 40272 |
| 3 | 40202 | 40250 | 26 | 40225 | 40273 |
| 4 | 40203 | 40251 | 27 | 40226 | 40274 |
| 5 | 40204 | 40252 | 28 | 40227 | 40275 |
| 6 | 40205 | 40253 | 29 | 40228 | 40276 |
| 7 | 40206 | 40254 | 30 | 40229 | 40277 |
| 8 | 40207 | 40255 | 31 | 40230 | 40278 |
| 9 | 40208 | 40256 | 32 | 40231 | 40279 |
| 10 | 40209 | 40257 | 33 | 40232 | 40280 |
| 11 | 40210 | 40258 | 34 | 40233 | 40281 |
| 12 | 40211 | 40259 | 35 | 40234 | 40282 |
| 13 | 40212 | 40260 | 36 | 40235 | 40283 |
| 14 | 40213 | 40261 | 37 | 40236 | 40284 |
| 15 | 40214 | 40262 | 38 | 40237 | 40285 |
| 16 | 40215 | 40263 | 39 | 40238 | 40286 |
| 17 | 40216 | 40264 | 40 | 40239 | 40287 |
| 18 | 40217 | 40265 | 41 | 40240 | 40288 |
| 19 | 40218 | 40266 | 42 | 40241 | 40289 |
| 20 | 40219 | 40267 | 43 | 40242 | 40290 |
| 21 | 40220 | 40268 | 44 | 40243 | 40291 |
| 22 | 40221 | 40269 | 45 | 40244 | 40292 |
| 23 | 40222 | 40270 | 46 | 40245 | 40293 |
| 24 | 40223 | 40271 | 47 | 40246 | 40294 |
| 25 | 40224 | 40272 | 48 | 40247 | 40295 |

**7.2.2.3 Cancelling Alarms**

Whilst it is not recommend that alarms be cancelled or acknowledged from the MODBUS master, the facility exists. If an alarm occurs it is best that the cause is investigated and therefore the status is changed at the slave end. when it is known that the zone is safe. The alarms are acknowledged or cancelled by changing the coil state from 0 to 1 at the following addresses:-

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Channel** | **Acknowledge Alarm** | **Cancel Alarm** | **Channel** | **Acknowledge Alarm** | **Cancel Alarm** |
| 1 | 00100 | 00200 | 25 | 00124 | 00224 |
| 2 | 00101 | 00201 | 26 | 00125 | 00225 |
| 3 | 00102 | 00202 | 27 | 00126 | 00226 |
| 4 | 00103 | 00203 | 28 | 00127 | 00227 |
| 5 | 00104 | 00204 | 29 | 00128 | 00228 |
| 6 | 00105 | 00205 | 30 | 00129 | 00229 |
| 7 | 00106 | 00206 | 31 | 00130 | 00230 |
| 8 | 00107 | 00207 | 32 | 00131 | 00231 |
| 9 | 00108 | 00208 | 33 | 00132 | 00232 |
| 10 | 00109 | 00209 | 34 | 00133 | 00233 |
| 11 | 00110 | 00210 | 35 | 00134 | 00234 |
| 12 | 00111 | 00211 | 36 | 00135 | 00235 |
| 13 | 00112 | 00212 | 37 | 00136 | 00236 |
| 14 | 00113 | 00213 | 38 | 00137 | 00237 |
| 15 | 00114 | 00214 | 39 | 00138 | 00238 |
| 16 | 00115 | 00215 | 40 | 00139 | 00239 |
| 17 | 00116 | 00216 | 41 | 00140 | 00240 |
| 18 | 00117 | 00217 | 42 | 00141 | 00241 |
| 19 | 00118 | 00218 | 43 | 00142 | 00242 |
| 20 | 00119 | 00219 | 44 | 00143 | 00243 |
| 21 | 00120 | 00220 | 45 | 00144 | 00244 |
| 22 | 00121 | 00221 | 46 | 00145 | 00245 |
| 23 | 00122 | 00222 | 47 | 00146 | 00246 |
| 24 | 00123 | 00223 | 48 | 00147 | 00247 |

1. **FAULT FINDING**

There is no requirement for special equipment or tools when ‘Fault Finding’ on the TQ8000.

Diagnosis is limited to a few basic checks with a Digital Multi-meter, and must be carried out only by a competent person.

**8.1 Power Supply**

To aid fault diagnosis LED’s have been fitted to the ‘Adaptor Board’ to indicate the presence of the 24 & 5 volt dc power supplies, and the ‘Relay Board’ to indicate for 24 & 5 volt dc power supplies, and relay coil operation.

Failure of either of the 24 & 5 volt dc LED’s to operate firstly check the fuses fitted to the respective board. If the supplies are not available to the Adaptor or Relay Board, check;

F2 +5 volt dc @2A

F3 +24volt dc @3A

For a power supply fault on the standard TQ8000 8 way 24 volt dc powered relay outputs, check the ‘Auxilliary’ output fuse ‘F4’. This is rated for the service required and should not be greater than 2.0A.

Failure of the TQ8000 to provide any indications, including LED’s, check Fuse ‘F1’ on the Input Terminals.



For 9-48 TQ8000sensor version please check drawing supplied for supply fuses and ratings.

* 1. **Sensor**

In a situation where a TQ8000 displays a higher, or lower, than expected sensor reading, it will initially need to have the sensor location monitored for abnormal conditions.

If the local conditions are confirmed as normal, then a re-calibration could be sufficient.

A useful check at this point is to measure the voltage at the sensor input between ‘S’ & ‘0v’. This will provide a reading in relation to the 4-20mA input from the sensor, and should be between 0.88v & 4.4v dc. Values outside of this range could indicate a suspect sensor or wiring fault. Although on some devices a low reading could mean that a fault is apparent, and in this case always refer to the manufactures’ data sheet.

Pellistor sensors can be also checked using a digital Multi-meter as in 5.3of this Manual.

In addition to checking the bridge voltage to the manufacturers’ instructions, and the bridge zero, the Pellistor sensor can be resistance tested with a multi-meter.

Disconnect the Pellistor sensor, and check the resistance value between ‘+V’ and ‘0V’. This should be a low value from 3 Ohms upwards, depending upon the manufacturer.

For Technical assistance on any problem encountered when using the TQ8000, please do not hesitate to contact:

**TQ Environmental Ltd Tel: 01924 380 700**

**Fax: 01924 361 700**

**Email: engineers@tqenv.com**

**Web:http://www.tqenv.com**



Notes:

1. **Passwords**

Passwords below allow access to the menu structure of the TQ8000. Please remove this page if they are a security issue with the end user.

|  |  |
| --- | --- |
| **Sub-menu** | **Password** |
| Configure | 19660 |
| Set alarms | 19740 |
| Calibration | 19700 |
| Reset Over range fault. | 19780 |
| Test System | 19840 |

1. **Modicon Modbus Protocol Reference Guide**, PI-MBUS-200 Rev J, June 1996. [↑](#footnote-ref-1)