

CE ATEX

TQ122 GAS SENSOR HEAD



OPERATING MANUAL

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PROPRIETARY

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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

- TO MAINTAIN THE HAZARDOUS AREA CERTIFICATION FOR THE TQ122 GAS SENSOR, IT MUST BE SCREWED INTO A SUITABLY CERTIFIED JUNCTION BOX TO ALLOW CONNECTION TO THE ASSOCIATED CONTROL/DISPLAY UNIT. NEITHER THE COVER OF THE TQ122 NOR THE ENCLOSURE INTO WHICH THE SENSOR UNIT IS SCREWED MAY BE REMOVED UNLESS ALL POWER TO IT HAS BEEN REMOVED OR THE AREA HAS BEEN TESTED AND CERTIFIED TO BE FREE OF COMBUSTIBLE GAS AND THAT CONTINUOUS MONITORING OF THE AREA IS PERFORMED BY SUITABLE INDEPENDENT EQUIPMENT UNTIL THE COVERS ARE REPLACED.
- THIS TQ122 GAS SENSOR HAS BEEN CERTIFIED AS FLAMEPROOF FOR NORMAL ATMOSPHERES ONLY. USE OF THIS SENSOR IN AN OXYGEN-ENRICHED ATMOSPHERE IS NOT INCLUDED IN THIS CERTIFICATION.
- TO MAINTAIN THE HAZARDOUS AREA CERTIFICATION THE TQ122 MUST BE USED IN ACCORDANCE WITH THE REQUIREMENTS GIVEN IN SECTION 5.
- FOR SAFETY REASONS, THE TQ122 GAS SENSOR MUST BE INSTALLED, OPERATED AND SERVICED BY QUALIFIED PERSONNEL ONLY. READ AND UNDERSTAND THIS INSTRUCTION MANUAL COMPLETELY BEFORE OPERATING THE GAS SENSOR.

APPLICATION

THIS OPERATING MANUAL DESCRIBES THE INSTALLATION AND OPERATION OF THE FOLLOWING SENSORS:-

122-001	Oxygen
Toxic Gases	
122-002	Carbon Monoxide
122-003	Hydrogen Sulphide
122-004	Sulphur Dioxide
122-007	Nitric Oxide
122-017	Ethylene Dioxide
122-210	Methane based
122-211	Petrol vapour (n-pentane)
122-212	Ammonia
122-215	Hydrogen

SECTION 1 - DESCRIPTION

1.1 GENERAL DESCRIPTION

The **TQ122** series is a range of highly reliable gas sensors designed to give extended service under extreme conditions. The sensor is specifically manufactured and calibrated to detect the presence of the gas indicated on the body of the sensor. The sensors are either 24v dc operation in 4-20mA current sink mode or form part of a “Wheatstone Bridge”. With either type, the Control Unit must be capable of supplying the operating power, handling the signal generated by the sensor, calculating and displaying the gas/vapour concentration as well as generating any alarms required by the application.

The **TQ122** Sensors are used for diffusion sensing applications. These are applications in which the sensor continuously monitors that part of the environment with which it is in contact, with the gas diffusing into the sensor’s active area. This technical manual covers the use of the **TQ122** Sensor as a diffusion type sensor. A suitable device may be connected to the sensor to allow its use in flow through applications.

1.2 METHOD OF DETECTION.

The gas being monitored diffuses through the stainless steel membrane on the head of the unit. This then passes into a cell where the gas of interest reacts chemically with a sensing element housed within a secure unit inside the device. The chemical reaction generates a voltage proportional to the concentration of the gas being monitored. In sensors providing a current output an electronic circuit within the device provides a current output within the range 4 to 20 mA. The current is proportional to the concentration of gas being measured. In flammable gas sensors the gas is burned catalytically in the presence of oxygen (pellistors) generating an “out of balance” signal from a Wheatstone Bridge arrangement.

The devices have a lifetime limited by a number of factors depending upon the gas being monitored and the type of sensing element. Many of the chemical reactions taking place within the cell will require the presence of oxygen in the gas being monitored.

1.3 SENSOR UNIT DESCRIPTION.

The fully assembled **TQ122** Sensor unit (Figure 1) has the approximate dimensions of 70 mm long (including the M20 thread used to fasten the sensor to the junction box) x 50mm diameter. The M20 thread is approximately 15mm long. A nylon washer and M20 nut are provided for attaching to the junction box.

Two or three wires, approximately 190mm long, protrude from the potting on the unit to allow connection to other cabling in the junction box.

A flame arrestor / diffusion device is provided on the head of the unit to allow the gas for measurement to enter the device.

A M30 x 2mm pitch thread is provided on the head to allow connection of a suitable flow through device if required by the application. The thread is approximated 14mm deep.

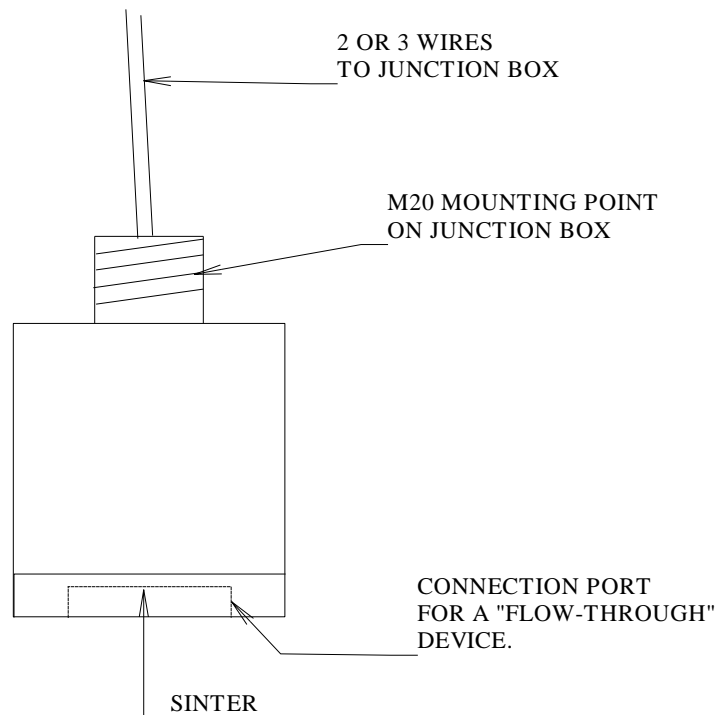


FIGURE 1.---GENERAL OVERVIEW

1.4 GASES MONITORED.

A number of different types of sensing elements may be fitted to the TQ122 Gas Sensor depending upon the gas being monitored and the composition of the background gas present. Table 1 details the sensors available. The measurement of toxic gases and oxygen are 4-20mA based sensors (electrochemical cells) whilst, in the flammable gas sensors, the gas is burnt catalytically in the presence of air (pellistors).

Table 1. TQ122 Sensor Ranges

TQ PART NO	GAS/VAPOUR	RANGE
122-001	Oxygen	0 – 25 %volume
Toxic Gases		
122-002	Carbon Monoxide	0 – 1000 ppm
122-003	Hydrogen Sulphide	0 – 50 ppm
122-004	Sulphur Dioxide	0 – 20 ppm
122-007	Nitric Oxide	0 – 100 ppm
122 - 020 - 5000	Ammonia	0 – 5000 ppm
122 - 213	Ammonia	0 – 1000 ppm
122 – 213 - 500	Ammonia	0 – 500 ppm
122 - 214	Ammonia	0 – 100 ppm
122-017	Ethylene Dioxide	0 – 50 ppm
Flammable Gases/Vapours		
122-210	Methane based	0 – 100 % LEL (5% volume)
122-211	Petrol vapour (n-pentane)	0 – 100 % LEL (1.4% volume)
122-212	Ammonia	0 – 20 % LEL (3.0 % volume)
122-215	Hydrogen	0 – 100 % LEL (4% volume)

1.5 PERFORMANCE SPECIFICATIONS.

The performance of the TQ122 will depend upon the gas being monitored and the background gas composition.

Table 2. TQ122 Sensor Performance Specifications.

FACTOR	SPECIFICATION
Detection Method:	Electrochemical, pellistor or similar cell
Sampling Method:	Continuous Diffusion (option of flow through cell)
Accuracy:	Application Dependent
Repeatability:	Application Dependent
Gas Temperature Range:	Pellistor -30°C to +60°C ¹ Electrochemical -20°C to +50°C ¹
Gas Pressure Range	+/- 200mm wg
Humidity Range:	0 - 99% Relative Humidity (Non-condensing)
Mean Time Between Failures:	Application Dependent
Operating Voltage:	24 Vdc
Output Current: (4-20mA Sensors)	4 – 20 mA into 600ohm max load.
Connections:	2 Wire or 3 wire
Construction Materials:	Flame Arrestor: 316 Sintered Stainless Steel Body: 316 Stainless Steel
Weight:	540g (excluding junction box)
Electrical Hazardous Area Certifications:	Ex db IIC T5 Gb (Ta= -20 to +40C) Ex db IIC T6 Gb (Ta= -20 to +30C) EN60079-0:2018+CORR1:2020 & EN60079-1:2014+CORR1:2018
Shelf Life & Storage:	O ₂ & Toxic:- 6 months, Flammable:-12months. All must be stored at 0 – 30 C in dry air (or nitrogen in the case of O ₂).

¹. In hazardous area applications the gas temperature range must be read in conjunction with the maximum ambient temperature (Ta) assigned to the instrument.

Table 3. Individual Sensor Performance

TQ PART NO	T₉₀ RESPONSE (sec) (max)	RESOLUTION
122-001	40	0.1% volume O ₂
Toxic Gases		
122-002	30	10 ppm CO
122-003	50	1 ppm H ₂ S
122-004	40	1 ppm SO ₂
122-007	30	1 ppm NO
122-017	30	1 ppm Ethylene Oxide
Flammable Gases/Vapours		
122-210	30	1 % LEL CH ₄
122-211	30	1 % LEL petrol
122-212	30	1 % LEL NH ₃
122-215	30	1 % LEL H ₂

The Response times are approximate and will depend upon configuration and sample system. They are based upon a sensor fitted with a flow through cap, vented to atmosphere and with gas flowing at 500 cm³/min.

1.6 CROSS-SENSITIVITY

Most electrochemical sensors and all pellistors are non-specific in the gas or vapour monitored. The End-User must be satisfied that the sensor is “fit” for the application intended. Please consult TQ Environmental LTD in selecting the most appropriate sensors.

Pellistors show a general response to most combustible gases. Table 4 shows a typical response for the TQ122-210 sensor to % LEL concentrations of various gases where the sensor has been previously calibrated with 100% LEL methane.

Pellistors may be subject to poisoning in some applications. Common gases and vapours which should be avoided include silicones and hydrogen sulphide. Even low levels (100ppm) of eg hexamethyl disiloxane or hydrogen sulphide may cause irreversible damage to the TQ122 series of pellistor based sensors even with short exposure.

Table 4. TQ122-210 Response to Combustible Gases

GAS/VAPOUR	RESPONSE (% LEL)
100% LEL Methane	100
100% LEL Propane	50
100% LEL n-Butane	40
100% LEL Acetone	30
100% LEL Hydrogen	80

1.7 PERFORMANCE TESTS

The performance of the TQ122-210 in conjunction with a TQ series 8000 control unit has been tested against the relevant parts of BS EN 61779-1 and BS EN 61779-4. A copy of the test results is available from TQ Environmental LTD.

SECTION 2 - INSTALLATION

2.1 MECHANICAL INSTALLATION.

2.1.1 GENERAL.

The **TQ122** Sensor is designed to be installed with a suitably certified junction box, preferably with the sinter pointing downwards to prevent the direct ingress of water.

2.1.2 INSTALLATION GUIDELINES.

To ensure continued reliable operation of the **TQ122** Sensor, the following installation guidelines should be taken into consideration in the siting of sensors. More information on flammable gas and oxygen sensor applications may be found in BS EN 50073: 1999. The document may also prove useful for applications involving toxic gas sensors.

CAUTION

In safety critical applications the pellistor based sensors (TQ122-210, TQ122-211, TQ122-212 & TQ122-215) must be used as part of a system meeting the requirements of BS EN 61779-4:2000.

CAUTION

The calibration of the sensor may be affected by exposure to direct sunlight. If it is necessary to install the sensor unit in a sunlit area, provide an adequate sunshade for the sensor unit.

- For the monitoring of heavier-than-air gases, mount the sensor unit as close as practical to the floor or ground. For monitoring of lighter than air gases, install the sensor unit as high as practical.
- The sensor unit should be installed in a location where it is easily accessible for repairs.
- Mount the sensor unit in a position that minimises the risk of mechanical damage.
- Prevent water and dust accumulation from affecting operation by mounting the sensor unit with the sinter at the bottom.
- It is important to ensure the connection between the TQ122 and the junction box is watertight.
- The only method of mounting the TQ122 is through the M20 thread on the top of the unit.

2.2 ELECTRICAL INSTALLATION.

Figure 2 shows the installation of a 2-wire TQ122. Table 5 shows the connections of a pellistor based sensor. An Addendum to this manual will be provided for installations using sensing elements requiring connections which differ from those shown above.

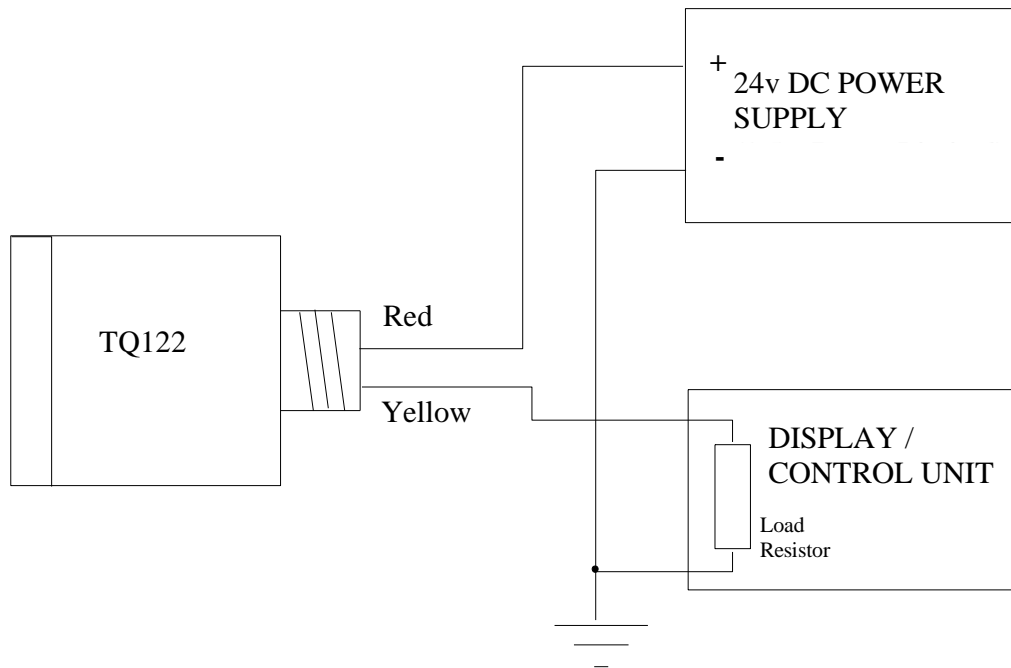


Figure 2 -- Wiring of Two Wire TQ122

**Table 5. Connections to Pellistor Based Sensors
(TQ122-210, TQ122-211, TQ122-212, TQ122-215)**

Cable	Colour
+2v Power Supply	Blue
0v	Red
Signal Out	Green

2.2.1 Cabling.

For all installations involving 4-20 mA oxygen and toxic sensors TQ recommend that 2 core cables with overall screen be used. Individual cores should be 1.5mm², type 7/0.53.

For the TQ122-210, 122-211, 122-212 & 122-215 sensors it is essential that the resistance of each conductor does not exceed 3 ohm. Figure 3 shows an installation where the sensor and control unit are separated by K metres. Table 6 shows the maximum value of “K” for common types of cables. “K” is the maximum length in meters recommended for use with the cable specified.

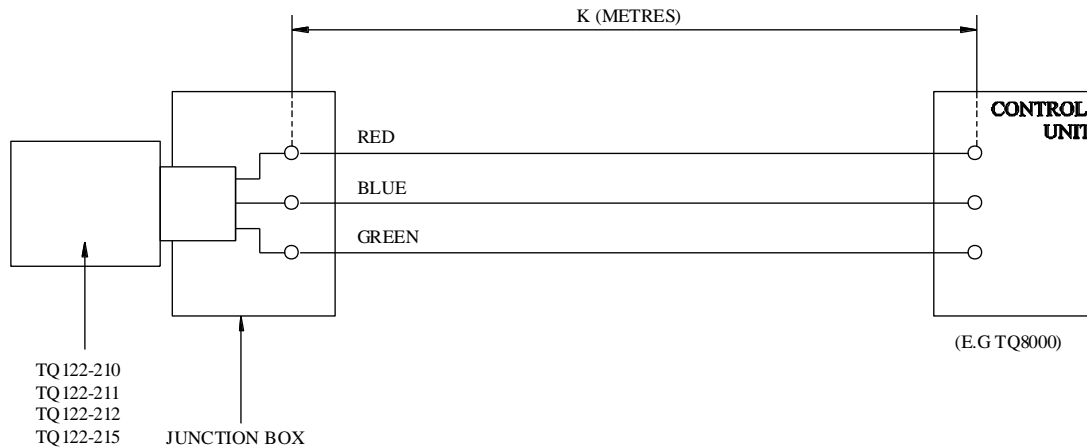


Figure 3 – Separation of Sensor & Control Unit

Table 6. TQ122-210, TQ122-211, TQ122-212 TQ122-215 Recommended Cable Lengths

X- Section Area (mm ²)	No. of Wires/Size of Wire (mm)	Approx. Resistance @20C (ohms/km/conductor)	“K” (m)
0.5	1/0.80	34.3	80
1.0	7/0.43	18.3	150
1.5 *	7/0.53	12.0	250
2.5	7/0.67	7.4	380

* Recommended cable type for most applications

CAUTION

It is important that for installation in hazardous areas, approved and certified junction box and cable glands are used together with steel wire armoured (SWA) cable when connecting to the power source and Control/Display Unit.

CAUTION

Please contact TQ Environmental Ltd if there is any doubt concerning the wiring of the TQ122 or its operation in a hazardous environment.

SECTION 3 - COMMISSIONING & CALIBRATION

3.1 COMMISSIONING.

Prior to connecting power to the **TQ122** Sensor, the following preliminary checks should be made.

- a. Ensure the Sensor is screwed tightly into its junction box.
- b. Check that the Sensor is correctly wired.
- c. It is essential that pellistors (TQ122-210, TQ122-211, TQ122-212 & TQ122-215) operate from the correct head voltage. For the sensor types above, this head voltage is 2.0, 2.5, 2.0 & 2.0v respectively. The procedure for establishing this is detailed in the Operating Manual for the TQ8000 Control Unit. If the TQ8000 unit is NOT used with these sensors the End-User MUST use a Control Unit which can provide these head voltages.

CAUTION

TO AVOID DAMAGE TO THE EQUIPMENT, ENSURE THE VOLTAGE APPLIED TO THE TQ122 DOES NOT EXCEED THE STATED VOLTAGE.

- d. Sensors based upon pellistors do not always “fail safe” in the event of an accidental short on any of the 3 wires connecting the sensor to the control unit or upon exposure to flammable gas or vapour at concentrations approaching or exceeding the LEL of the gas or vapour.

CAUTION

IT IS ESSENTIAL THAT PELLISTORS (TQ122-210, TQ122-211, TQ122-212 & TQ122-215) ARE USED WITH A CONTROL UNIT WHICH CAN INTERRUPT THE POWER TO THE SENSOR AND GIVE A WARNING UNDER THE CONDITIONS STATED ABOVE. A SUITABLE CONTROL UNIT IS THE TQ8000.

- e. After power has been applied, let the sensor unit function for 60 minutes prior to further monitoring.

3.2 CALIBRATION.

The TQ122 is factory calibrated for the gas and range as engraved on the body of the sensor. **User adjustment of the instrument or output signal is not possible.**

Instead any calibration adjustments (zero and span) of the displayed value should be carried out on the associated Monitoring Equipment or Control Unit attached to the TQ122.

Table 7 shows the concentration of gases normally used to check the calibration of the various sensors. In each case the background gas is air, not nitrogen. In all cases except TQ Part No 122-001 the “zero” gas is air. Nitrogen should be used as a “zero” gas for the oxygen sensor. A suitable gassing cap should be used to introduce test gas to the sensor

Table 7. Concentration of Calibration Check Gases

Part No	Gas Measured	Calibration Gas Concentration
122-001	O ₂	Air (21%)
122-002	CO	500ppm CO
122-003	H ₂ S	25ppm H ₂ S
122-004	SO ₂	20ppm SO ₂
122-007	NO	100ppm NO
122-210	Methane	2.5%vol CH ₄ (50% LEL)
122-212	Ammonia	1.5% vol NH ₃
122-215	Hydrogen	2%vol H ₂ (50%LEL)
122-013		Gassing cap and flow through adaptor

The calibration and checking of the ethylene oxide (TQ122-017) and petrol (TQ122-211) sensors should be carried out after discussion with TQ Environmental Ltd.

SECTION 4 - MAINTENANCE

4.1 ROUTINE MAINTENANCE.

Please note there are no User Serviceable parts on the TQ122.

Ongoing repair of the sensor is not possible. If the sensor appears damaged, malfunctioning, or is not functioning correctly following a calibration check (see section 3.2 Calibration) then the sensor should be replaced.

It is recommended that a system calibration check is performed on a frequent basis (3 to 6 monthly intervals) depending on the application and local ambient conditions, to ensure correct operation. If the sensor is slow to respond or does not reach the calibration value, then this would indicate End of Life and the sensor should be replaced.

4.2 WARRANTY

When the TQ122 Gas Sensor is operated in accordance with conditions described in this Manual the Standard Warranty is the shelf life detailed in Table 2.

SECTION 5 –CERTIFICATION

Installations in hazardous areas are covered by certificate number:- **SIRA 03ATEX1304X**

SPECIAL CONDITIONS FOR SAFE USE

The TQ122 gas sensor shall not be used as a safety related device as defined in ATEX Directive 2014/34/EU.

The TQ122 gas sensor shall be connected to an enclosure that has been suitable certified by a notified body and provides:-

- **The external conductors with suitable mechanical and explosion protection,**
- **The setting compound with protection against light and mechanical damage,**
- **Suitable earthing or equi-potential bonding facilities.**

The TQ122 may be used with flammable gases and vapours with apparatus groups IIA, IIB, IIC and temperature classes T1, T2, T3, T4, & T5 (where the ambient temperature does not exceed +30 degrees Celsius) or T6 (up to a maximum of +40 degrees Celsius).

Installation shall be carried out by suitably trained personnel in accordance with the applicable code of practice e.g. EN 60079-14, and using approved cable glands.

Inspection and maintenance of this equipment shall be carried out by suitably trained personnel in accordance with the applicable code of practice e.g. EN 60079-17.

Repair of this equipment shall be carried out by suitably trained personnel in accordance with the applicable code of practice e.g. EN 60079-19.

The entry into service, use, assembling, and adjustment of the equipment shall be in accordance with this Operating Manual.

The certification of this equipment relies upon the following materials used in its construction:

Covers & Housings: Grade 316 stainless steel

Sintered Element: Grade 316 stainless steel

If the equipment is likely to come into contact with aggressive substances, then it is the responsibility of the user to take suitable precautions that prevent it from being adversely affected, thus ensuring that the type of protection provided by the equipment is not compromised.

Aggressive substances, e.g. acidic liquids or gases that may attack metals, or solvents that may attack polymeric materials.

Suitable precautions: e.g. regular checks as part of routine inspections or establishing from the material's data sheets that it is resistant to specific chemicals.

Certification Details:-

CE Surveillance Authority Marking	2813
TQ's Manufacturing Mark	TQ122
ATEX Group & Category	Ⓔ II 2G
CENELEC Marking	Ex db IIC T5 Gb (Ta= -20 to +40C) Ex db IIC T6 Gb (Ta= -20 to +30C) EN 60079-0:2018+CORR1:2020 EN 60079-1:2014+CORR1:2018
Apparatus Certificate No	SIRA 03 ATEX I304X
Certificate Holder	TQ Environmental Ltd

DECLARATION REGARDING DIRECTIVE 2014/34/EU

This declaration confirms that the TQ122 Gas Sensor has been designed and constructed in accordance with good engineering practice and is suitable for use in foreseeable indoor and outdoor industrial environments. TQ Environmental Ltd attests to the following:

- The equipment has been designed such as to avoid the possibility of physical injury or other harm that may be caused by direct or indirect contact – ESHR 1.2.7
- Analysis reveals that dangerous situations due to possible operating faults, including foreseeable misuse, are precluded – ESHRs 1.0.2 & 1.2.7
- There is no potential source of ignition formed by optical or acoustic radiation or electromagnetic energy – ESHR 1.3.1
- The equipment does not emit, nor is susceptible to, electrostatic discharges, extraneous voltages or environmental effects when used within the stated operating conditions – ESHRs 1.3.2 & 1.4.1
- Authorised European Representative

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ADDENDUM I DUCT MOUNTING KIT Pt No 122-019

1 GENERAL DESCRIPTION

The TQ122 series may also be supplied with a kit which will allow the TQ122 gas detector to be fitted in a constant velocity, low pressure air duct and provide a means of calibrating or checking the calibration in situ.

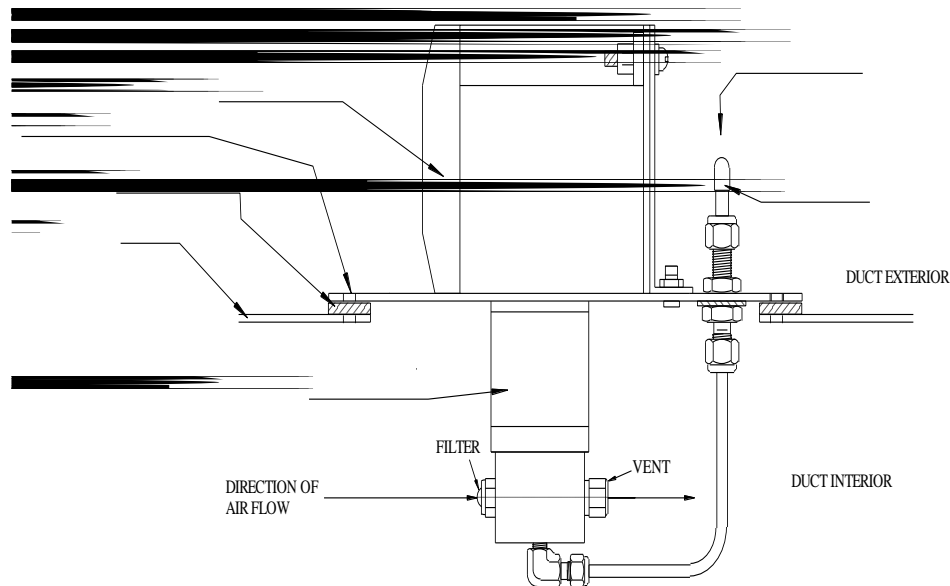


Figure 4 – Duct Mounting Kit Overview

2 INSTALLATION

The sensor on the TQ122 duct mounting kit should be positioned vertically from the top of the duct as shown in Figure 4 to prevent any condensing water collecting in the sensor.

The orientation of the duct mounting kit **MUST** be as shown in Figure 5 below. The latter is important as, during normal operation, a partial vacuum inside the sensor must be created and maintained to ensure a constant flow of gas through the cell. Any other orientation may cause air in the sensing element to stagnate

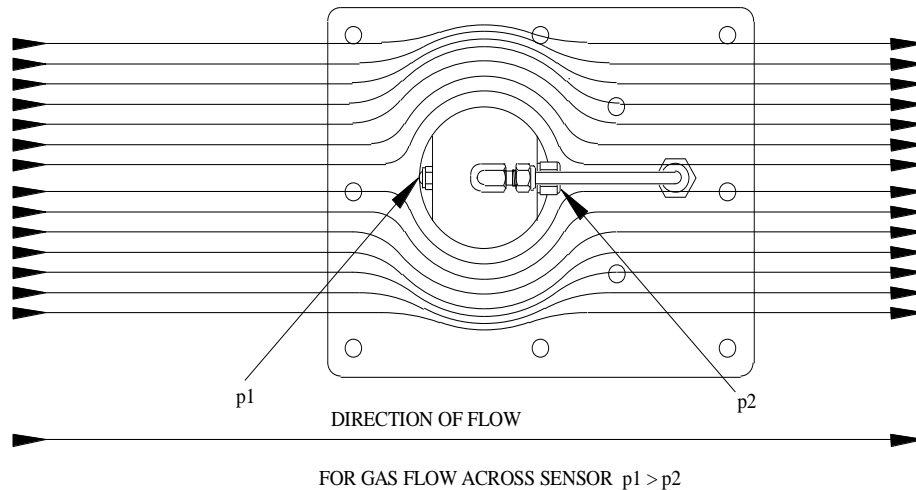


Figure 5 – Orientation of Duct Mounting Kit

Excessive duct pressure may cause leakage through the rubber cap. In these cases an alternative must be used. e.g. a shut off valve. Contact TQ for advice

It is recommended that sealing strip be used between the plate on the kit and the duct to prevent leakage. Mounting holes are provided on the plate of the kit to fasten the kit to the duct using screws or bolts applicable to the duct material.

3 COMMISSIONING

The **TQ122** duct mounted sensor is commissioned in the same way as section 3.1 in this Manual.

However extra attention will require ensuring the duct mounted plate has maintained a good air tight seal with the duct wall. Failure to do this may result in unwarranted gasses entering the area external to the duct mount sensor.

4 CALIBRATION

The **TQ122** duct mounted sensor is calibrated as described in section 3.2 in the main body of this manual. The duct mount kit provides a port for test gas / calibration connection. (see Figure 4)

Before calibration, it is strongly recommended the air flow in the duct be turned off whilst the cap on the calibration port is not in place. This is for two reasons:-

- i) To stop potentially hazardous gas from within the duct coming out of the calibration port into a safe area.

- ii) To make sure the calibration gas when injected is not diluted by flowing gas inside the measurement cell. Under these static flow conditions the calibration gas will swamp the cell allowing accurate calibration to be established.

CAUTION
CALIBRATION WHILST GAS IS FLOWING THROUGH THE DUCT.

If it is not possible to stop the air flow within the duct then:-

- a) The gas cylinder must be fitted with a 2 stage regulator with a gauge measuring the exit pressure. The gauge should be ranged to include the expected pressure in the duct.**
- b) During calibration the applied gas pressure must be greater than the duct pressure but must not exceed the duct pressure + 0.1bar.**

The sensors are normally calibrated at atmospheric pressure. A deviation in duct pressure greater than 0.1 bar is likely to affect the accuracy of the calibration.

After calibration the rubber cap must be replaced. However if excessive duct pressure causes leakage through this cap, then an alternative means of sealing must be implemented.