



SENTRO 1 UNIVERSAL GAS DETECTOR

USER MANUAL

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1. PRODUCT OVERVIEW



SENTRO 1
Universal Gas Detector



SENTRO 1 with
TX6831 Audio Visual Alarm fitted

TX6351

3/4 wire device with separate output signal and power lines

Can be used with any SENTRO eModule

P9000.260

TX6351 3/4 wire device with integrated TX6831 Audio Visual Alarm

Can be used with any SENTRO eModule

TX6352

2 wire line powered 4 to 20 mA output signal

Can ONLY be used with electrochemical SENTRO eModules

Note: Please refer to TX6831-DSUM-EN · P5459.1602 for full Audio Visual Alarm technical and certification details.

1.1 Features

- Fixed sensor for detection of toxic and flammable gases
- Exclusive pre-calibrated plug-in gas sensing modules for many types of gas
- LCD readout and visual LED alarm indicators
- Choice of output signal format
- Heavy duty housing to IP65
- EMC compliant
- STEL and TWA monitoring for selected gases

1.2 Applications

Fixed point gas detection safety monitoring in hazardous areas and general-purpose applications.

Underground Mining and Tunnelling Ex ia I Ma TX6351.01i TX6352.01i	Supply voltage 12 V dc from an approved power source Type of protection Intrinsically Safe. Ex ia Category I M1
General Purpose TX6351.03.00 TX6352.03.00	Supply voltage 24 V dc

1.3 Product options

Mining Ex ia

TX6351.01i	4 wire connection	Certification (older models with yellow labels)	Certification (newer models with red labels)
	.11 0.4 to 2 V dc	.06 IECEx (Aus) Grp I	.35.05 MASC/IECEX Grp I
	.12 4 to 20 mA	.14 EAC Grp I	.35.15 ATEX/IECEX/ UKEX Grp I
	.14 Dual Relay NC	.19 ATEX/IECEX Grp I	.35.25 KLPL India Grp I
	.17 Dual Relay NO		
	.15 RS485		
TX6352.01i	2 wire connection		
	.12 4 to 20 mA loop		

General Purpose

TX6351.03.00	4 wire connection	Button configuration
	.12 4 to 20 mA	.01 Internal Buttons
	.14 Dual Relay NC	.02 External Buttons
	.17 Dual Relay NO	
	.15 RS485	
	.16 2 to 10 V dc	
TX6352.03.00	2 wire connection	
	.12 4 to 20 mA	

SENTRO 1 with Audio Visual Alarm**Mining Ex ia**

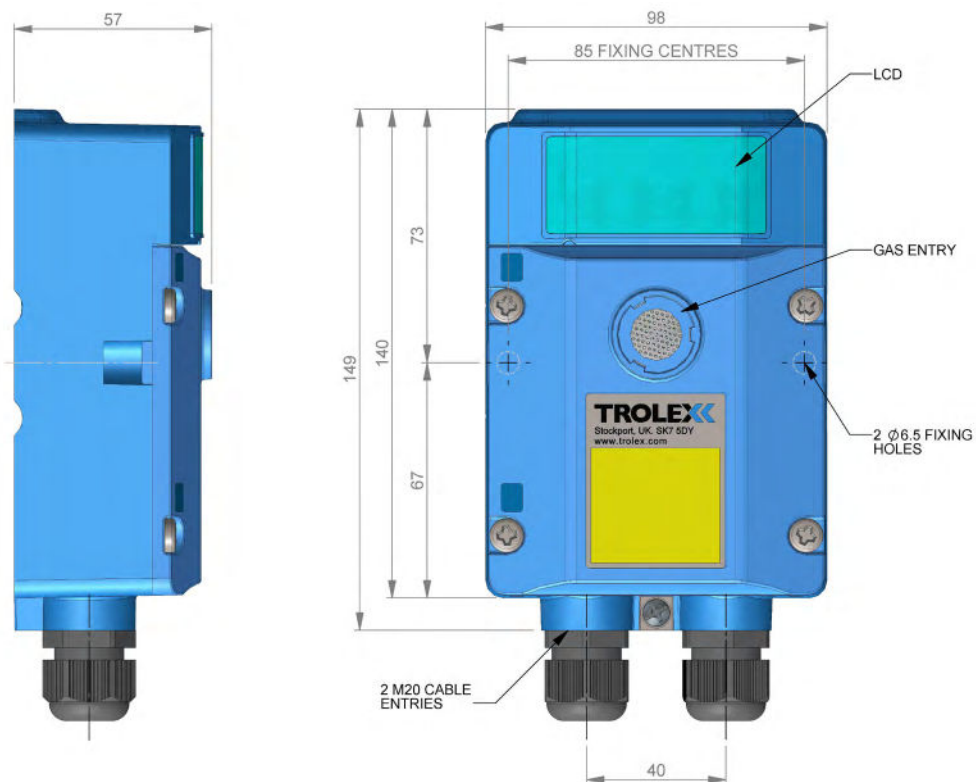
P9000.260	Certification (older models with yellow lables)	Certification (newer models with red lables)
	.05 MASC Grp I	.35.05 MASC/IECEEx Grp I
	.06 IECEEx (Aus) Grp I	.35.15 ATEX/IECEEx/UKEX Grp I
	.14 EAC Grp I	
	.19 ATEX/IECEEx Grp I	

General Purpose

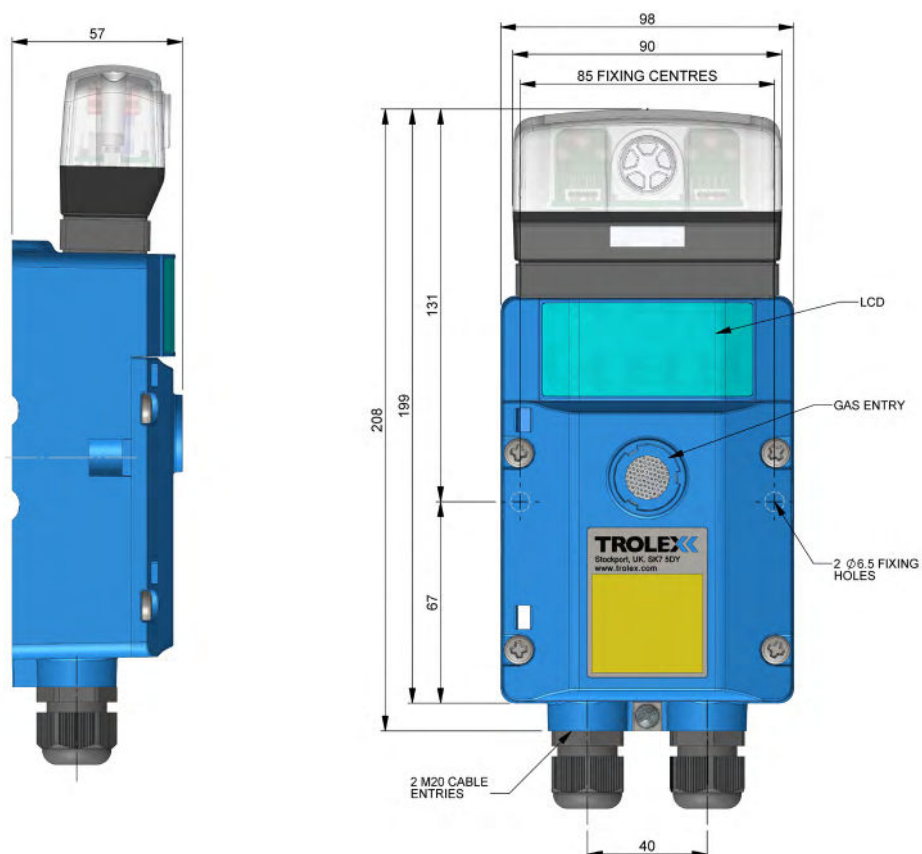
P9000.260	Option
	00 General Purpose

Note: P9000.260 is available in a configuration of 4 to 20 mA output with a single TX6831 Audio Visual Alarm.

1.4 Dimensions



SENTRO 1 with A/V Alarm



1.5 Technical information

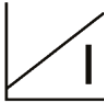
Ambient temperature limits	-20 °C to +40 °C
Storage temperature	-20 °C to +60 °C
Ambient pressure	800 to 1100 mbar
Humidity	15% to 90% non-condensing
Protection classification	• Dust and waterproof to IP65 • Gas port: IP54
Housing material	Reinforced polymer with static charge dissipation
Nett weight	530 g
Cable entries	2 x M20
Electrical connections	4 mm barrier/clamp terminals
Conductors	Max. 2 per terminal
Conductor size	Max 2.5 mm ²
Terminal torque	Max. 2.4 Nm
Information display	128 x 64 dot graphic backlit LCD
Vibration limits	Vibration limits (IEC 60079-29-1): • 10 Hz to 30 Hz – 1.00 mm total excursion • 31 Hz to 150 Hz – 19.6 m/s² acceleration peak
Impact limits	20 joules (housing)
Calibration and setup	Digitally controlled ZERO and SPAN pushbutton setting
Signal fix	The analogue output signal of the sensor is fixed during calibration to prevent false alarms from being initiated
Fault indication	Under-range signal transmitted and fault display for: • Loss of communications from the sensing module • Sensing module absent for more than 10 seconds • Sensor over-range protect
Key coding	Coding stops prevent insertion of a non-valid sensing module

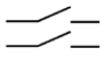
1.5 Technical details (continued)

Alarms	Programmable GENERAL alarms and HIGH alarms with an LED indicator The 2 adjustable alarm setpoints are preset during manufacture to default values appropriate to the type of sensor, determined by the sensing module being used
STEL and TWA	Automatic setting of STEL and TWA limits to EH40 standards • STEL: Exposure over 15-minute successive periods • TWA: Exposure over a continuous rolling 8-hour period
Output signals	• 0.4 to 2 V / 2 to 10 V • 4 to 20 mA • Dual relay contacts. NO or NC to specification • RS485 Modbus datacomms

1.6 Electrical details

Mining and Tunnelling

TX6351	3/4 wire Remote powered 4 to 20 mA Analogue output			
Supply voltage	10 to 14 V			
Max. line load	220 Ω max. @ 12 V dc			
Type of sensor	Toxic	Flammable	Infrared	
Supply current @ 12 V	48 mA	70 mA	91 mA	

TX6351	3/4 wire Remote powered Dual output contacts NC/NO			
Supply voltage	10 to 14 V			
Type of sensor	Toxic	Flammable	Infrared	
Supply current @ 12 V	60 mA	85 mA	105 mA	

Mining and Tunnelling (continued)

TX6351		3/4 wire Remote powered RS485 Datacomms output		
Supply voltage	10 to 14 V			
Line	Modbus protocol			
Type of sensor	Toxic	Flammable	Infrared	
Supply current @ 12 V	25 mA	60 mA	80 mA	

TX6351		3/4 wire Remote powered 0.4 to 2 V Analogue output			
Supply voltage	10 to 14 V				
Min. line load	10 KΩ				
Type of sensor	Toxic	Flammable	Infrared		
Supply current	20 mA	60 mA	80 mA		

TX6352		2 wire Line powered 4 to 20 mA Analogue output	
Supply voltage	10 to 14 V		
Max. line load	90 Ω		
Type of sensor	Toxic only		

General Purpose

TX6351		3/4 wire Remote powered		
		4 to 20 mA Analogue output		
Supply voltage	18 to 28 V			
Max. line load	500 Ω max. @ 24 V dc			
Type of sensor	Toxic	Flammable	Infrared	
Supply current	40 mA	40 mA	60 mA	

General Purpose (continued)

TX6351		3/4 wire Remote powered		
		Dual output contacts NC/NO		
Supply voltage	20 to 28 V			
Type of sensor	Toxic	Flammable	Infrared	
Supply current	35 mA	45 mA	60 mA	

TX6351		3/4 wire Remote powered RS485 datacomms output			
Supply voltage	14 to 28 V				
Line	Modbus protocol				
Type of sensor	Toxic	Flammable	Infrared		
Supply current	35 mA	45 mA	60 mA		

TX6352		2 wire Line powered		
		4 to 20 mA analogue output		
Supply voltage	18 to 28 V			
Max. line load	300 Ω			
Type of sensor	Toxic only			

TX6351		3/4 wire Remote powered RS485 datacomms output			
Supply voltage	14 to 28 V				
Min. line load	10 KΩ				
Type of sensor	Toxic	Flammable	Infrared		
Supply current	20 mA	60 mA	80 mA		

1.7 SENTRO eModules

Plug-in pre-calibrated modules with standardised output data.



SENTRO eModule

- Each module stores all the necessary data about its identification type, sensing range and specific calibration. This data is automatically recognised by SENTRO when the module is loaded into the module bay
- The modules are pre-calibrated so can be substituted at any time by a replacement module – usually of the same type, but an alternative may be inserted if required
- Insert coding stops to prevent non-valid module combinations
- The sensing module will identify itself when plugged into the sensor housing and auto configuration will take place
- All SENTRO Modules have two output alarm signals for GENERAL alarm and HIGH alarm. Default values are entered during manufacture, and these can be changed to preferred values.
- The alarm can be set to illuminate built-in flashing LED indicators
- The signals can operate the two GENERAL alarm and HIGH alarm Relays on the CONTACT OUTPUT version of SENTRO 1
- Service replacement modules can be specified using the appropriate gas type code from the eModule order reference table on the data sheet
- The order reference is also marked on the back of the eModules

Note: The order reference may vary for some eModules dependent upon the year of manufacture of the base unit.

eModules for base units with Yellow certification label

TX6350.xx.

ATEX/IECEX Group I	01	Gas type
IECEX (Aus) Group I	06	Gas type
EAC Group I	14	Gas type


eModules for base units with Red certification label

TX6350.35.xx

ATEX/IECEX/UKEX Group I	19	Gas type
MASC/IECEX Group I	05	Gas type
KLPL India Group I	25	Gas type



Flammable gases: Poison resistant catalytic sensor

INDICATIVE VALUES ONLY, OTHER RANGES AND CALIBRATIONS CAN BE SUPPLIED TO SPECIFICATION.



The sensor can be configured to respond to many flammable gases and vapours. It is usual to calibrate to methane in terms of %LEL or %volume.

	METHANE (CH ₄)		
TX6350.	240	246	244
Sensing element	Poison resistant pellitor with active temperature compensation		
Sensing range	0 to 100% LEL based on 4.4% v/v	0 to 4% v/v	0 to 5% v/v
Linearity	Up to 3% v/v	3% to 5% ±0.25%	
Max. drift @ 25 °C	±0.25% CH ₄ v/v per month		
*Response time T ₍₆₃₎	<15 seconds		
*Response time T ₍₉₀₎	<20 seconds		
Sensing element life	>5 years in clean atmosphere		
Warm up time	<5 minutes in air or 1% v/v CH ₄		
Stabilisation time	≥15 minutes		
GENERAL alarm	10% LEL	0.40%	0.50%
HIGH alarm	25% LEL	1.00%	1.25%

*Response times are testing by flowing test gas using the calibration kit referred to in section 5.2 Maintenance.

Note: Not suitable for use with the TX6352 4 to 20 mA two wire, line powered version of SENTRO.
The Pellistor is automatically protected against exposure to excessively high concentrations of gas.

Toxic gases: Electrochemical cells

INDICATIVE VALUES ONLY, OTHER RANGES AND CALIBRATIONS CAN BE SUPPLIED TO SPECIFICATION.



Selected toxic gas modules are equipped with automatic STEL/TWA calculation in accordance with EH40.

	CARBON MONOXIDE (CO)				HYDROGEN SULPHIDE (H ₂ S)	SULPHUR DIOXIDE (SO ₂)
TX6350.	250.50	250.250	250.300	250.500	251	252
Sensing element	Electrochemical cell					
Sensing range	0 to 50 ppm	0 to 250 ppm	0 to 300 ppm	0 to 500 ppm	0 to 50 ppm	0 to 20 ppm
Linearity	±2% FS					
Drift	2% per month					
Repeatability	±2%					
*Response time T ₍₉₀₎	<30 seconds				<45 seconds	<30 seconds
Operating life	2 years					
Relative humidity	15% to 90% non-condensing					
Operating temperature	-10 °C to +40 °C					
GENERAL alarm	18 ppm	38 ppm	45 ppm	75 ppm	8 ppm	3 ppm
HIGH alarm	15 ppm	75 ppm	90 ppm	150 ppm	15 ppm	6 ppm
STEL	200 ppm				10 ppm	3 ppm
TWA	30 ppm				5 ppm	0.5 ppm

*Response times are testing by flowing test gas using the calibration kit referred to in section 5.2 Maintenance.

Toxic gases: Electrochemical cells (continued)

INDICATIVE VALUES ONLY, OTHER RANGES AND CALIBRATIONS CAN BE SUPPLIED TO SPECIFICATION.

Selected toxic gas modules are equipped with automatic STEL/TWA calculation in accordance with EH40.

	NITROGEN DIOXIDE (NO ₂)		Oxygen (O ₂)	NITRIC OXIDE (NO)	HYDROGEN (H ₂)
TX6350.	254	254.10	257	259	261
Sensing element	Electrochemical cell				
Sensing range	0 to 20 ppm	0 to 10 ppm	0 to 25% v/v	0 to 50 ppm	0 to 1000 ppm
Linearity	±2% FS		±0.3% v/v	±5% FS	±2% FS
Drift	2% per month		10% per year	2% per month	
Repeatability	±2%				
*Response time T ₍₆₃₎	<20 seconds		N/A	<20 seconds	N/A
*Response time T ₍₉₀₎	<30 seconds		<60 seconds	<30 seconds	<90 seconds
Operating life	2 years				
Relative humidity	15% to 90% non-condensing				
Operating temperature	-10 °C to +40 °C				
GENERAL alarm	3 ppm	1.5 ppm	19% (under)	8 ppm	150 ppm
HIGH alarm	6 ppm	3 ppm	23% (over)	15 ppm	300 ppm
STEL	1 ppm	1 ppm	N/A	10 ppm	N/A
TWA	0.5 ppm	0.5 ppm	N/A	25 ppm	N/A

*Response times are testing by flowing test gas using the calibration kit referred to in section 5.2 Maintenance.

Note: Not suitable for use with the TX6352 4 to 20 mA two wire, line powered version of SENTRO.

The Pellistor is automatically protected against exposure to excessively high concentrations of gas.

All values listed are nominal and slight variations may occur depending on operating conditions.

- The natural level of oxygen available in the atmosphere is influenced by relative humidity and temperature. The oxygen sensor will react to these changes
- Sudden changes in atmospheric pressure will also cause temporary instability in electrochemical sensors which may exceed 60 seconds
- Long periods of use in extremely high or low humidity may affect the response of the sensor and shorten the life of electrochemical sensors
- Nitric oxide sensors must be continuously powered to maintain calibration stability. If power has been absent for more than 10 minutes, it may take 24 to 48 hours for the sensor to restore stability. Do not calibrate until the output signal is steady
- The presence of high levels of carbon dioxide (over 5%) may have a minor effect on the accuracy of the oxygen sensor

Periodic calibration of the gas sensor should be carried out whilst it is in service.

For oxygen and carbon monoxide gas sensors, Trolex recommends that this is carried out every three weeks. For other gas sensors, Trolex recommends that this is carried out in accordance with best practice for the industry where the gas sensor is being used and should take into consideration local operating conditions.

Carbon dioxide/Methane gases: Infrared sensor

INDICATIVE VALUES ONLY, OTHER RANGES AND CALIBRATIONS CAN BE SUPPLIED TO SPECIFICATION.

The sensor is highly specific to the selected gas and exhibits consistent sensing accuracy with superior long-term stability.

The linear response means that it can be calibrated for low gas concentrations and high concentrations up to 100% by volume.

	METHANE (CH ₄)			CARBON DIOXIDE (CO ₂)		
TX6350.	243	245	242	278.2	278	279
Sensing element	Infrared					
Sensing range	0 to 5% v/v	0 to 100% LEL	0 to 100% v/v	0 to 2% v/v	0 to 5% v/v	0 to 100% v/v
Zero drift	±0.05% v/v per month	±1% LEL per month	±0.5% v/v per month	±0.05% v/v per month		±1% v/v per month
Repeatability	±0.1% v/v	±2% v/v	±2% v/v	±0.05% v/v		±2% v/v
*Response time T ₍₆₃₎	<15 seconds					
*Response time T ₍₉₀₎	<30 seconds					
Operating life	<5 years					
Relative humidity	15% to 90% non-condensing					
Operating temperature	-10 °C to +40 °C					
GENERAL alarm	0.5% v/v	10% LEL	10% v/v	0.3% v/v	0.75% v/v	15% v/v
HIGH alarm	1.25% v/v	25% LEL	25% v/v	0.6% v/v	1.5% v/v	30% v/v

*Response times are testing by flowing test gas using the calibration kit referred to in section 5.2 Maintenance.

Note: Normal atmosphere contains carbon dioxide which will affect the sensor signal so nitrogen gas must be used to accurately calibrate the Zero value.

Power should be applied to the sensor and the nitrogen applied for at least 5 minutes to ensure that the sensor has stabilised.

Not suitable for use with the TX6352 4 to 20 mA two wire, line powered version of SENTRO 1.

2. CERTIFICATION

2.1 Newer SENTRO 1 models with Red label (designated .35)

	ATEX certification for use in underground mines (Group I) in European Union. Complies with ATEX Directive 2014/34/EU. Standards: EN IEC 60079-0:2018 EN 60079-11:2012
	UKEX certification for use in underground mines (Group I) in Great Britain (England, Scotland and Wales). Complies with UK Regulations 2016 S.I. 2016/1107 Standards: EN IEC 60079-0:2018 EN 60079-11:2012
	IECEx (International) certification for use in underground mines (Group I). Standards: IEC 60079-0:2017 IEC 60079-11:2011
	MASC IA certification for use in underground mines (Group I) in South Africa. Standards: SANS (IEC) 60079-0:2019 SANS (IEC) 60079-11:2012

	Ex Equipment Type Examination Report issued by Karandikar Laboratories (KLPL) for subsequent DGMS Approval for use in underground coal mines (Group I) in India.
	Standards: IS/IEC 60079-0:2017 IS/IEC 60079-11:2023

Product Code	Ex Certificate Number	Ex Certification Code
TX6351.01i.xx.35.19 Sentro 1	CML 20ATEX2271X IECEX CML 20.0158X CML 21UKEX2323X	I M1 Ex ia I Ma -20 °C ≤ Ta ≤ +40 °C
TX6352.01i.12.35.19 Sentro 1		
TX6351.01i.xx.35.05 Sentro 1	MASC M/21-8496X IECEX CML 20.0158X	Ex ia I Ma -20 °C ≤ Ta ≤ +40 °C
TX6352.01i.12.35.05 Sentro 1		
TX6351.01i.xx.35.25 Sentro 1	KLPL/Ex/26-044X	Ex ia I Ma -20 °C ≤ Ta ≤ +40 °C
TX6352.01i.12.35.25 Sentro 1		

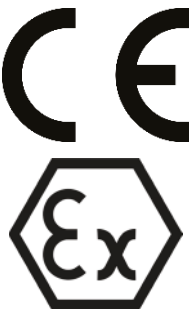
The following Safety Description applies to the equipment listed above

Model No.	Power Input	Output type	Output	
TX6351.01i.11.35	Terminal 5 w.r.t. 6 Ui = 14.4V Ci = 0 Li = 0	0.4V – 2V	Terminal 1 w.r.t. 2 or 3 Ui = 14.4V Uo = 14.4V Io = 40mA Po = 0.135W Ci = 0 Li = 0	
TX6351.01i.12.35		4mA – 20mA	Terminal 1 w.r.t. 2 or 3 Ui = 14.4V Uo = 14.4V Io = 0.477A Po = 1.72W Ci = 0 Li = 0	
TX6351.01i.15.35		RS485	Terminal 1 w.r.t. 3 (RS485 A) Terminal 2 w.r.t. 3 (RS485 B) Parameters for each output:	
			Ui = 6.88 V Ci = 0 Li = 0	Uo = 5.88 V Io = 66 mA Po = 97 mW
TX6351.01i.14.35		Relays NC	Terminal 1 w.r.t. 2 (Relay 1) Terminal 3 w.r.t. 4 (Relay 2)	
			Ui = 30 V Ci = 0 Li = 0	Uo = 0 Io = 0 Po = 0
TX6351.01i.17.35	Relays NO	Terminal 1 w.r.t. 2 (Relay 1) Terminal 3 w.r.t. 4 (Relay 2)		
		Ui = 30 V Ci = 0 Li = 0	Uo = 0 Io = 0 Po = 0	
TX6352.01i.12.35	Terminal 1 w.r.t. 2 Ui = 14.4V Ci = 0 Li = 0	Loop powered	N/A	

The following Specific Conditions of Use apply to the certificates listed above:

- The cable entries to the supply and output terminals shall be made via cable glands which provide a minimum degree of protection of IP54.
- Under certain extreme circumstances, unearthed metal parts of the enclosure may store an ignition-capable level of electrostatic charge. The equipment shall either be earthed via the integral earthing terminal or the user/installer shall implement precautions to prevent the build-up of electrostatic charge. When not earthed, the capacitance of the metallic label to earth is >10pF.

2.2 Older SENTRO 1 models with Yellow label (not designated .35)

	ATEX certification for use in underground mines (Group I) in European Union. Complies with ATEX Directive 2014/34/EU. Standards: EN 60079-0:2012 EN 60079-11:2012
	IECEx (International) certification for use in underground mines (Group I) in Australia (including New South Wales) and New Zealand. Standards: IEC 60079-0:2011 IEC 60079-11:2011
	EAC certification for use in underground mines (Group I) in Eurasian Customs Union (including Russia). Standards: ГОСТ 31610.0-2014 (IEC 60079-0:2011) ГОСТ IEC 60079-1:2013 ГОСТ 31610.11-2014 (IEC 60079-11:2011) ГОСТ МЭК 60079-25-2012

Product Code	Ex Certificate Number	Ex Certification Code
TX6351.01i.xx.19 Sentro 1	Sira 09ATEX2352X IECEX SIR 09.0147X	I M1 Ex ia I Ma $-20\text{ °C} \leq T_a \leq +40\text{ °C}$
TX6352.01i.12.19 Sentro 1		
TX6351.01i.xx.06 Sentro 1	IECEX ITA 14.0006X	Ex ia I Ma $-20\text{ °C} \leq T_a \leq +40\text{ °C}$
TX6352.01i.12.06 Sentro 1		
TX6351.01i.xx.14 Sentro 1	RU C- GB.AA87.B.0015819	PO Ex ia I Ma X $-10\text{ °C} \leq T_a \leq +40\text{ °C}$
TX6352.01i.12.14 Sentro 1		

The following Specific Conditions of Use apply to the IECEX ITA 14.0006X certificate:

- The following safety parameters are applicable to the Sentro 1 Sensors/Transmitters:

Model	Terminals	Input Parameters					Output Parameters				
		Ui	Ii	Pi	Ci	Li	Uo	Io	Po	Co	Lo*5
TX6351.01i.11	5 wrt 6	14.4V	*1	-	*2	*3	-	-	-	-	-
	1 wrt (2 or 3)	-	-	-	-	-	14.4V	40mA	135mW	*4	292mH
TX6351.01i.12	5 wrt 6	14.4V	*1	-	*2	*3	-	-	-	-	-
	1 wrt (2 or 3)	-	-	-	-	-	14.4V	447mA	1.72W	*4	2.1mH
TX6351.01i.15	5 wrt 6	14.4V	*1	-	*2	*3	-	-	-	-	-
	1 wrt 2 2 wrt 3	6.88V	*1	-	0	0	5.88V	66mA	97mW	*4	26mH
TX6351.01i.14 TX6351.01i.17	5 wrt 6	14.4V	*1	-	*2	*3	-	-	-	-	-
	1 wrt 2	30V	*1	-	0	0	0	0	0	0	0
	3 wrt 4	30V	*1	-	0	0	0	0	0	0	0
TX6352.01i.12	1 wrt 2	14.4V	*1	-	*2	*3	-	-	-	0	0

- *1 – Ii Not critical
- *2 – Ci Ci = 0, unless a rModule is connected to the Sentro 1, then Ci=0.38uF plus the Ci of the external sensors connected to the rModule.
- *3 – Li Total Li of all external sensors and equipment connected to the rModule.
- *4 – Co 1uF, unless the conditions stated in 60079-11:2011, Clause 10.1.5.2 part b can be satisfied.
- *5 – Lo Is calculated using the formula $\frac{1}{2} Lo(Io*1.5)^2=525uJ$.

For Specific Conditions of Use, Safety Description and parameters for intrinsically safe systems applicable to other certificates, please refer to the individual certificates listed above.

Installation of equipment

The installation of the product must only be carried out by competent personnel. Each installation needs to be considered with reference to the local safety regulations and authorities. Refer to the following standards for additional guidance:

- IEC/EN 60079-14
- IEC/EN 60079-25

Refer to the Certification Section of this User Manual and to the relevant certificates for any installation parameters and special conditions of safe use.

Commissioning / verification tests prior to first use.

Prior to commissioning and first use, the product shall be inspected for any visible damages and integrity of the enclosure. Never use the product that has damaged housing in hazardous locations.

Maintenance

The maintenance of the product must only be carried out by competent personnel. Maintenance shall be considered with reference to the local safety regulations and authorities. Refer to the following standards for additional guidance:

- IEC/EN 60079-17

It is recommended to periodically check the condition of the product.

The product shall only be serviced and repaired by Trolex Ltd or a local Trolex service agent approved by Trolex Ltd in order to maintain the explosion protection of the product.

Note: Please refer to TX6831-DSUM-EN · P5459.1602 for full Audio Visual Alarm certification details.

3. INSTALLATION

3.1 Safety precautions

It is recommended that users refer to EN / IEC 60079-29-2 for guidance on the selection, installation, use and maintenance of detectors for flammable gases and oxygen, when installed in hazardous areas.

Hazardous areas

Do not disassemble the sensor whilst in the hazardous area or use a sensor that has a damaged housing in the hazardous area. Irrespective of the gas being monitored, the equipment must not be installed where the possibility of an oxygen enriched atmosphere.

Evacuation

If a dangerous level of gas concentration is detected by the instrument, leave the area immediately.

Operating life of gas sensors

Electrochemical cells contain an electrolyte that is gradually consumed during use. The average life is about two years, dependent upon the duty cycle. The response should be checked at regular intervals.

Sensitivity

Electrochemical cells for toxic gases can be affected by other interfering gases which may displace the subject gas being monitored. Steam laden atmospheres and condensation can also reduce the sensitivity.

Flammable

Be aware that some toxic gases are also 'flammable' at high percentage concentrations.

Operating limits of catalytic combustion sensors

Catalytic combustion sensors positively detect the presence of flammable gas. They rely upon the presence of oxygen in the atmosphere and should only be used for gas concentration up to the Lower Explosive Limit (LEL).

After this point, the output becomes non-linear and may erroneously indicate that the gas concentration is below the LEL. They should not be used in oxygen enriched or deficient atmospheres.

Discrimination

Catalytic combustion sensors can detect a wide range of flammable gases, but they cannot discriminate between individual gases. They will respond to most, or all, of the flammable components present in the atmosphere without distinguishing between them.

The table below shows the response variation of the catalytic combustion sensor on exposure to a range of gases and vapours at the same %LEL concentration.

The figures are experimentally derived and expressed relative to the methane signal (=100).

Gas/Vapour	Relative sensitivity	Gas/Vapour	Relative sensitivity
Methane	100	Carbon monoxide	130
Propane	70	Hydrogen	120
n-Butane	70	Ammonia	155
n-Pentane	60	Cyclohexane	55
n-Hexane	60	Ethylene	90
Acetylene	85		

Infrared sensors are highly specific to the defined gas type and may not respond to other similar gases.

Contamination

The response of catalytic combustion gas sensors can be affected by air borne contaminants which will reduce the sensitivity. Substances such as silicones, tetraethyl lead, sulphur compounds and phosphate esters can cause permanent degradation (poisoning). Halogenated hydrocarbons may also cause temporary inhibition.

Interference

If the atmosphere to be monitored contains a gas that dilutes or displaces the air, this may reduce the response of catalytic sensors. Similarly, steam laden atmospheres and condensation can reduce the stability.

Toxicity

Be aware that most flammable gases and vapours are also toxic at low concentrations LEL.

3.2 Tools and equipment required

No special tools are required,

3.3 Siting recommendations

Each installation needs to be considered in its own right, with reference to safety authorities and in compliance with mandatory local safety regulations. The sensor must be operated in accordance with the User Manual to maintain safety, reliability and to preserve safety integrity where applicable.

It is important that sensors are located in positions determined in consultation with those who have specialised knowledge of the plant or installation and of the principles of gas dispersion. Reference should also be made to those responsible for the engineering layout and topology of the plant as they will be most familiar with the nature of the potential dangers and the most likely sources of gas release.

It is also important to recognise that the characteristics of the gas source can be influenced by many factors; including the relative density or buoyancy of the gas, the pressure at the point of release, the ambient temperature and the ventilation of the site.

Sensor coverage cannot be simply expressed in terms of 'number per unit area'. Sensors need to be sited where they are capable of monitoring those parts of a plant where gas may accumulate or where a source of gas release is expected to occur. This way, the earliest possible warning of a gas release can be given to initiate shutdown functions, alarm functions or safe evacuation of the premises.

Sensor management

A very important part of an efficient gas monitoring system is the training of plant personnel in operation and maintenance of the sensors and the complete monitoring system. Training can be provided by qualified Trolex application engineers. Once a sensor installation is complete, the sensor locations and types should be formally recorded and a planned test and maintenance procedure instituted.

STEL and TWA

Specific gas sensors are equipped to automatically set STEL and TWA limits in accordance with EH40 standards. Only gases with a listed EH40 STEL or TWA value have this function enabled by default.

If the function is enabled for use, ensure that all accumulated data is reset to Zero before the commencement of a working period.

3.4 Connections

3.4.1 0.4 to 2 V/ 2 to 10 V analogue output

A low impedance two wire voltage output signal requiring a separate power supply to the sensor.

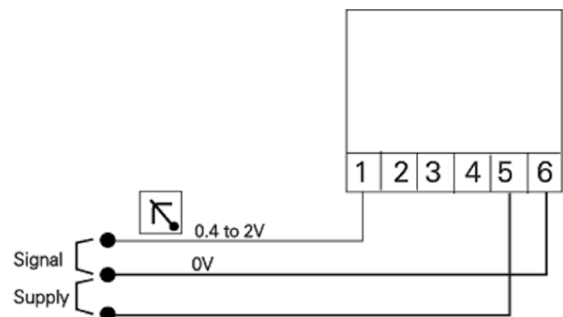
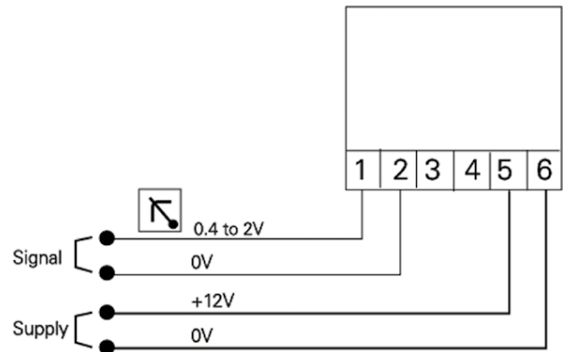
12 V dc power can usually be derived from the monitoring instrument being used.

The connection configuration works well up to 5 to 100 m distance between the sensor and the monitoring equipment, dependent on cabling and sensor current consumption.

Both the signal and the power supply to the sensor are being carried in the common 0 V conductor so at so point – influenced by the length of the cable and resistance of the cable cores – the current flowing in the 0 V conductor will impose an unacceptable voltage error onto the signal.

This effect can be reduced on long distance connections by increasing the size of the cable cores, or even better, by running a separate 0 V conductor to power the sensor enabling operating distances up to 1000 m.

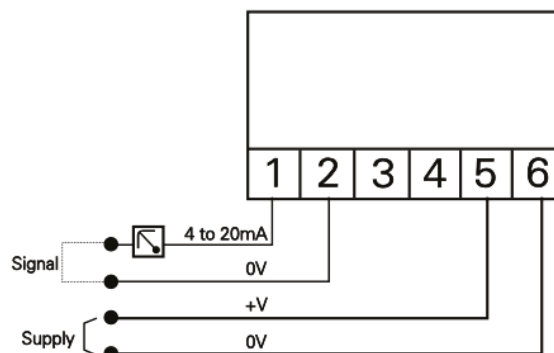
Alternatively, the sensor may be powered by a suitable power source close by.



3.4.2 4 to 20 mA analogue output

TX6351

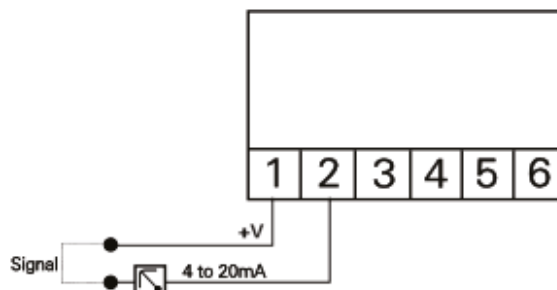
The output signal from terminals 1 and 2 is a conventional 4 to 20 mA two wire current regulated signal loop.



TX6352 (toxic SENTRO eModule only)

The output signal from terminals 1 and 2 is a conventional 4 to 20 mA two wire current regulated signal loop.

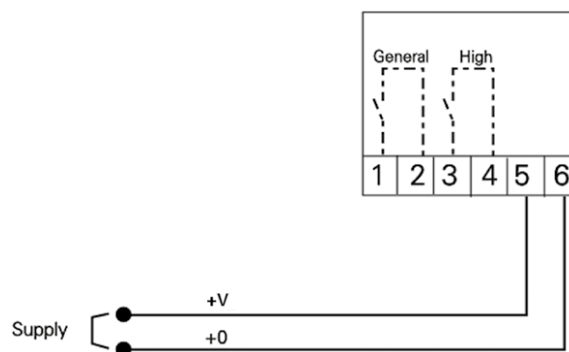
Electrochemical cells have a very low power consumption so the same loop can be used to also power the sensor. No separate power supply is needed.



Note: The TX6352 version of SENTRO is NOT suitable for flammable gas and infrared SENTRO eModules.

3.4.3 Contact output signal

Dual independent output contacts for remote signalling and control. Setpoint values for GENERAL alarm and HIGH alarm are setup during manufacture to prescribed levels appropriate to the type of gas intended to be monitored; determined by the gas sensing module.



The setpoints may be adjusted to preference.

SECTION 4.4.3

Note: The Relay contacts are clearance compatible for use with other intrinsically safe circuits from different IS power sources.

Available with Normally Open or Normally Closed contacts

TX6351.03.00.14 Normally Open (NO)

TX6351.01i.14 Normally Open (NO)

TX6351.03.00.17 Normally Closed (NC)

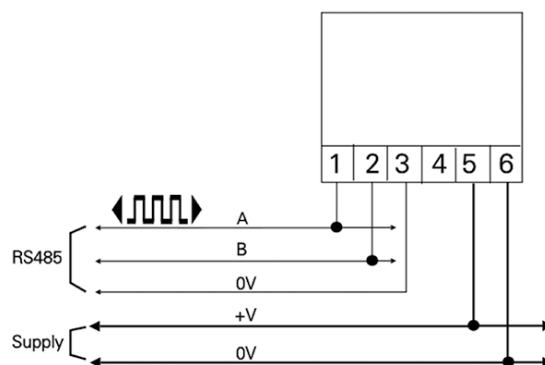
TX6351.01i.17 Normally Closed (NC)

3.4.4 RS485 data output signal

RS485 serial data output with analogue signal intelligence. Use in conjunction with a PC for data display and setpoint alarm warnings.

Up to 32 sensors acting as slaves can communicate with the master unit on a single data cable.

The address code of the sensor is marked on the duty label of the sensor.



Physical layer	RS485
Protocol	Troxel proprietary
Connection mode	Modbus
Number of points	32
Max. distance	1000 m

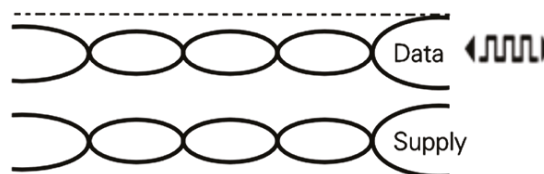
Recommended cable (specified in BS5308 Part 1) for locally powered sensors:

- 1 twisted pair
- 0.5 mm²
- Overall screen



Recommended cable (specified in BS5308 Part 1) for locally powered sensors:

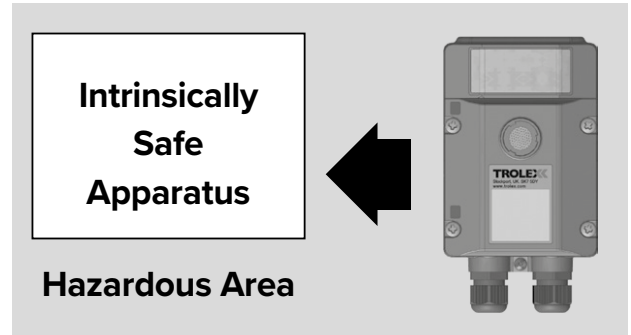
- 2 twisted pairs
- 0.5 mm²
- Individual/overall screen



3.5 Connecting in hazardous areas

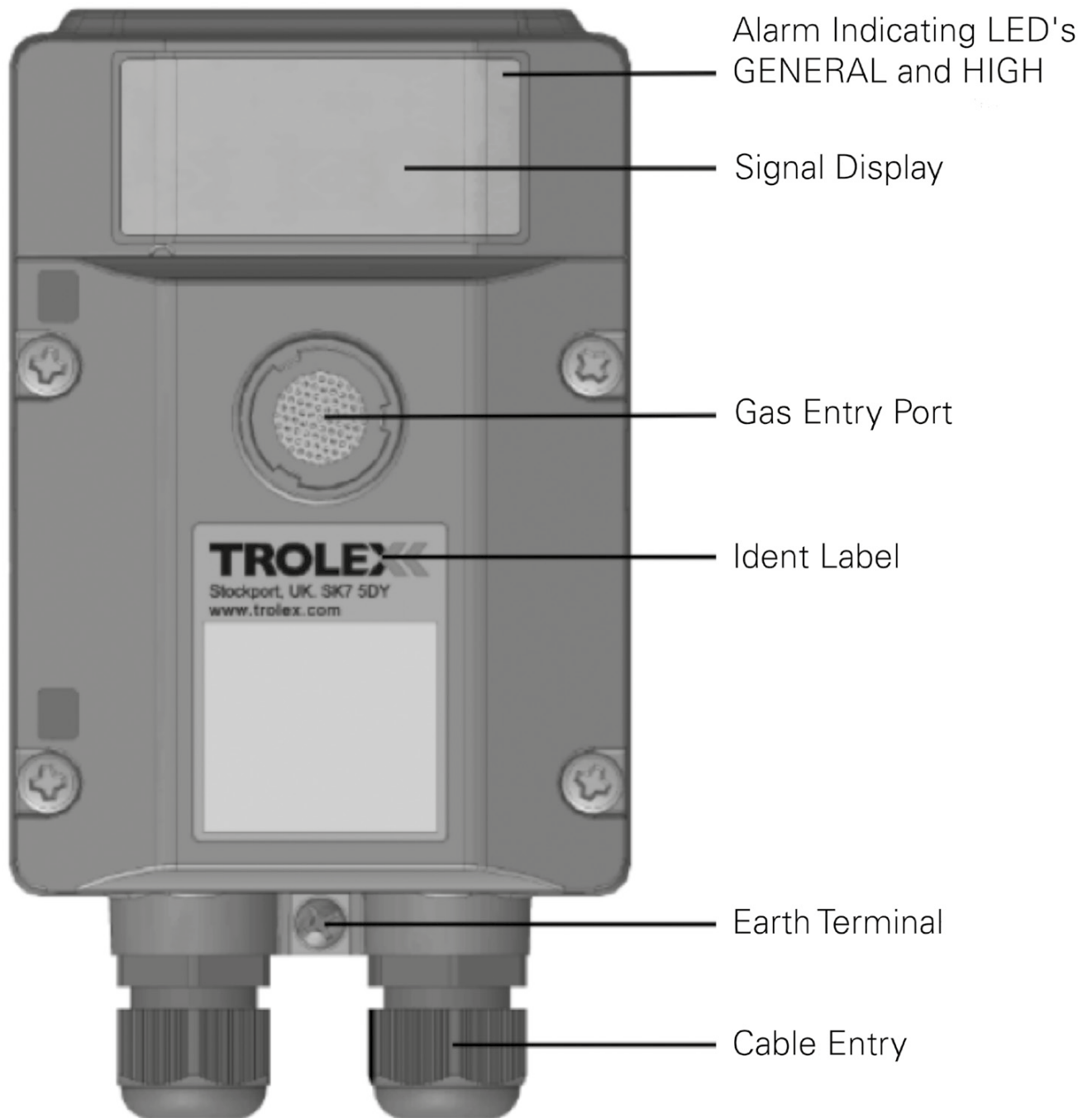
Certified Intrinsically Safe for use in mining hazardous areas, category I M1, when used with approved monitoring apparatus. Power for the sensor must be derived from an approved 12 V dc power supply e.g. TX6642 Intrinsically Safe Power Supply or approved apparatus.

The installation must be in accordance with the SENTRO certification parameters.

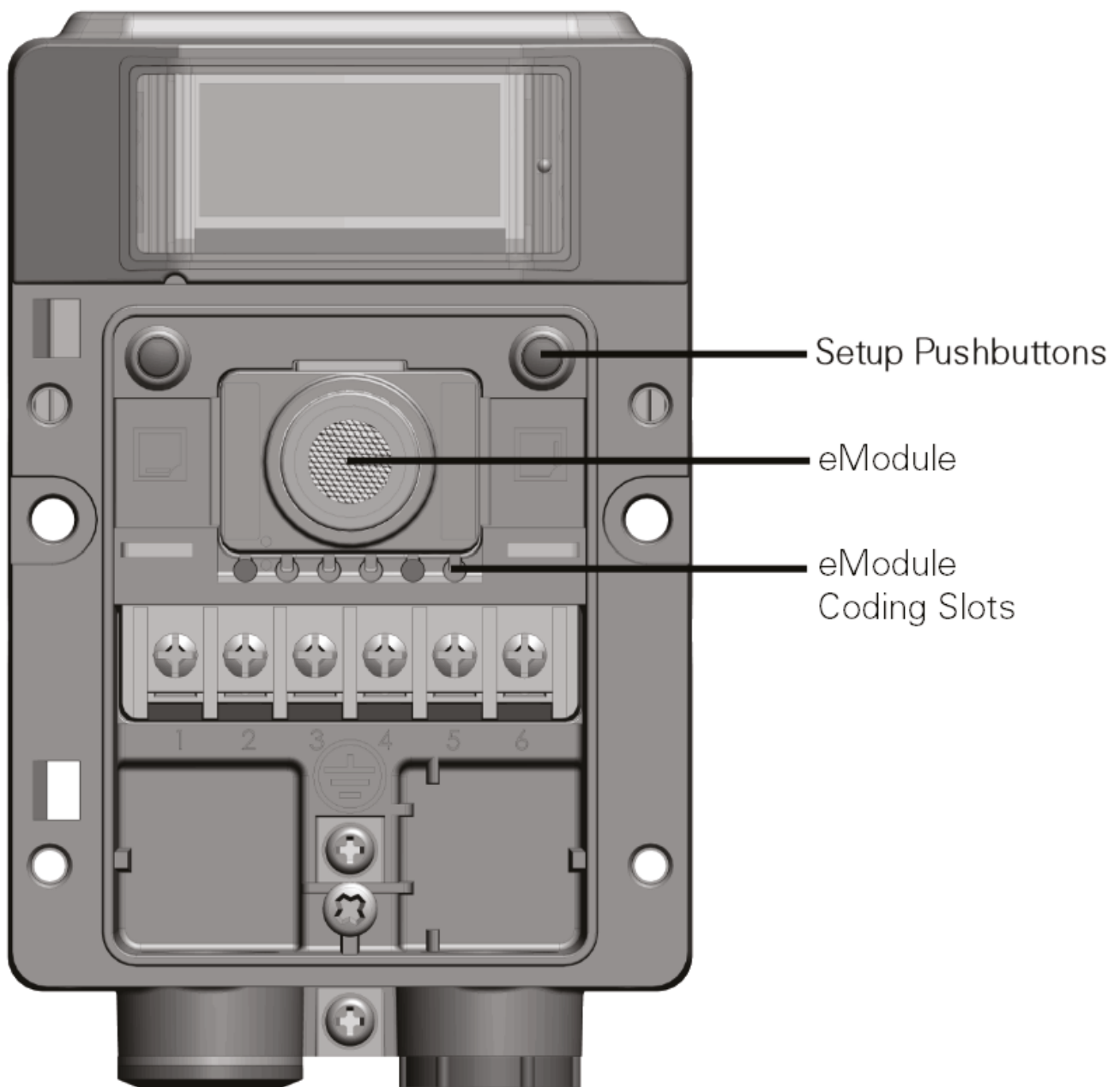


4. SETUP AND CALIBRATION

4.1 Controls and indicators

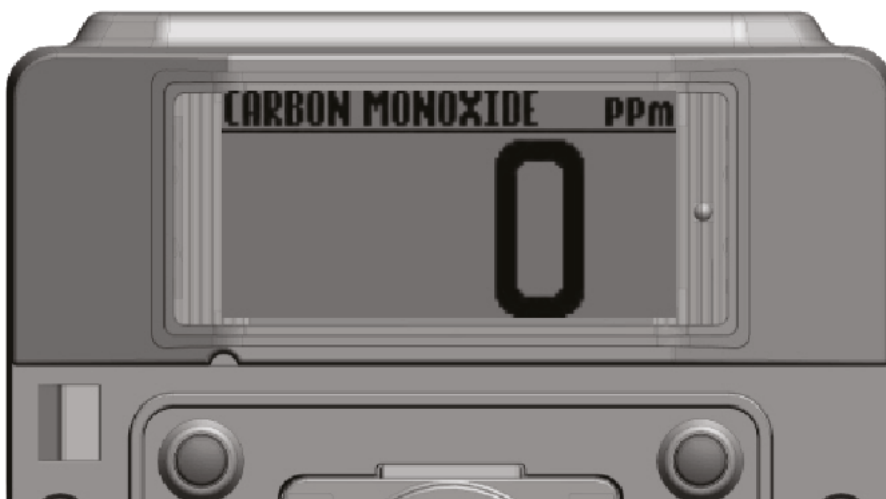
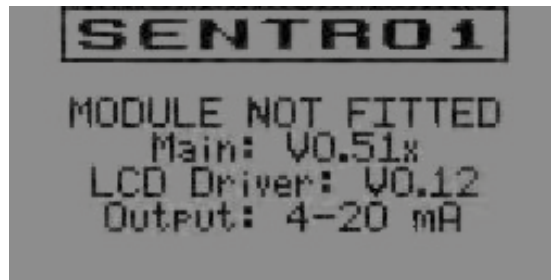


4.1 Controls and indicators (continued)



4.2 Main display

Power on



NEXT/FUNCTION

SELECT/CHANGE

Note: Next/Function is the Left-hand key (L) and Select/Change is the Right-hand key (R).

Main menu

Press the **R** key to enter the Main Menu

SECTION 4.3

SECTION 4.4

Note: The front cover of SENTRO may be safely removed, for setup in a hazardous area, even with the power applied.

4.3 Security code access

A security code may be requested:

Press the **R** key to change the digit



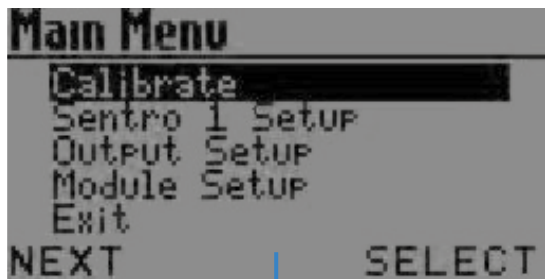
Use the **L** key to increment the digits



Use the **R** key to select Enter and return to the Main Menu

SECTION 4.4

4.4 Main Menu



Note: SENTRO will automatically return to the main display if no commands are given within 1 minute.

The time limit is extended to 8 minutes during calibration to allow the gas value to stabilise.

(L) Prompt bar (R)

Calibrate

SECTION 4.4.1

Zero
Span Test Gas
Span

SENTRO 1 Setup

SECTION 4.4.2

System Information
Display Setup
Alarm Setup
Set Security Code
Exit

Output Setup

SECTION 4.4.3

Output Information
Trim Output Zero
Trim Output Span
Reset Output
Set Relay 1 Mode
Set Relay 2 Mode
Exit

Modbus setup

SECTION 4.4.4

Modbus Address
Baud Rate
TX On Delay
TX Off Delay
Exit

Module Setup

SECTION 4.4.5

Setpoint 1
Setpoint 2
STEL/TWA
Exit

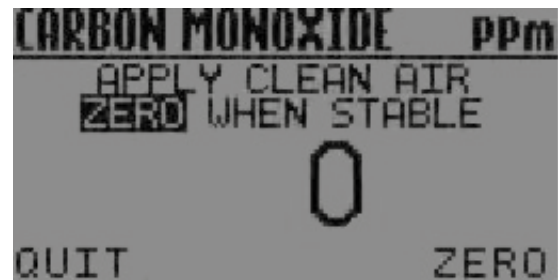
4.4.1 Calibrate

Connect a Gas Test Kit equipped with both 'clean air' and the appropriate test gas canisters.

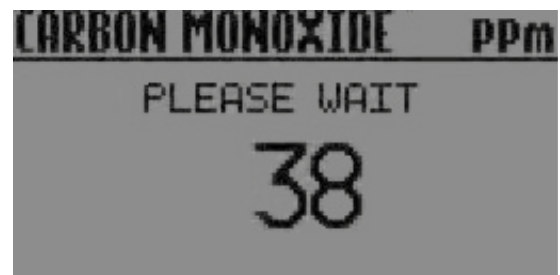
SECTION 5.2

Calibrate Zero

- Follow the prompt bar and screen instructions

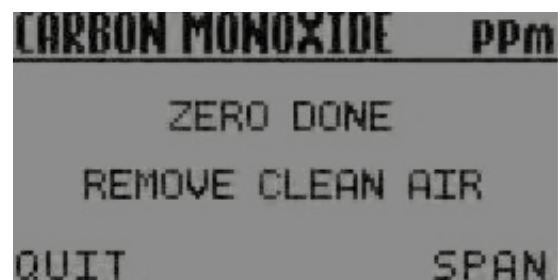


CARBON MONOXIDE PPM
APPLY CLEAN AIR
ZERO WHEN STABLE
0
QUIT ZERO



CARBON MONOXIDE PPM
PLEASE WAIT
38

- Go to Span



CARBON MONOXIDE PPM
ZERO DONE
REMOVE CLEAN AIR
QUIT SPAN

Calibrate Span using a Test Gas of EXPECTED value

- Follow the prompt bar and screen instructions



- Press 'Done' and return to the main display



Note: Press L and R together to quit and return to the main display.

Calibrate Span using a Test Gas of DIFFERENT value

The display will show the concentration of Span gas that is EXPECTED to be used.

Set the expected value to agree with the actual test gas value:

- Follow the prompt bar and screen instructions

- Press **R** to continue with the normal calibration

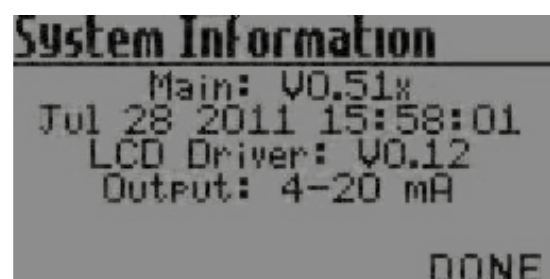


4.4.2 SENTRO 1 setup

The basic functional characteristics of the sensor can be setup or reviewed from a choice of parameters.

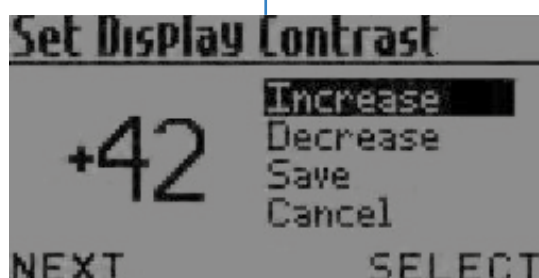


System Information display



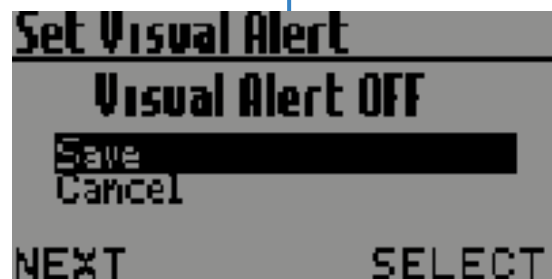
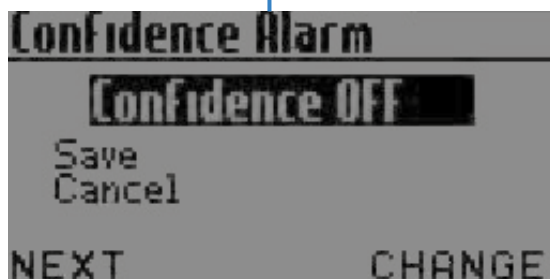
Display setup

- The display backlight illumination may be set to ON or OFF to reduce power consumption (TX6351 only)
- The contrast of the display may be set for the best visual appearance



Alarm Setup (TX6351 only)

- The integral GENERAL and HIGH visual alarms can be set to ON or OFF
- The 'confidence' condition flash can be set to ON or OFF.

**Set security code**

- A four-digit security code can be entered to prevent unauthorised access to the setup menu



Note: 0000 = Security protection OFF.

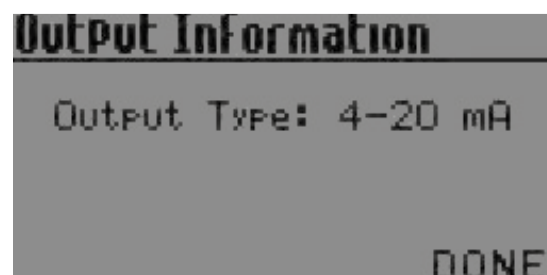
4.4.3 Output Setup

The output signal format can be reviewed and set up to preferred values.



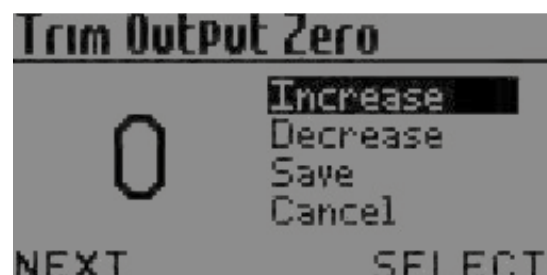
Output Information

- This is the factory setting of the output signal
- Confirm acceptance



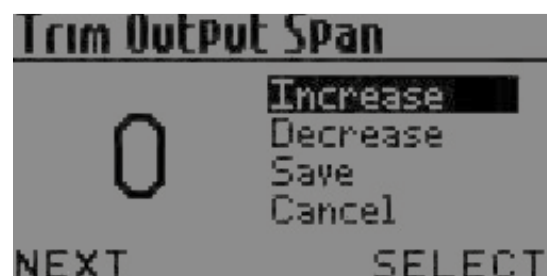
Trim Output Zero

- The level of the transmitted output signal, when the sensor is measuring Zero gas concentration can be trimmed or offset



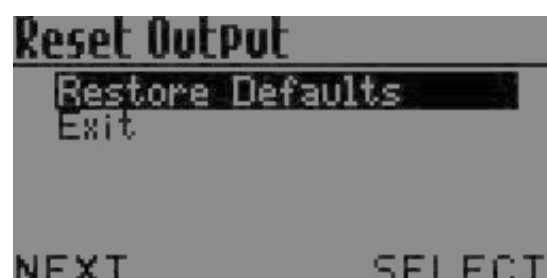
Trim Output Span

- The level of the transmitted output signal when the sensor is measuring given Span can be trimmed or offset



Reset Output

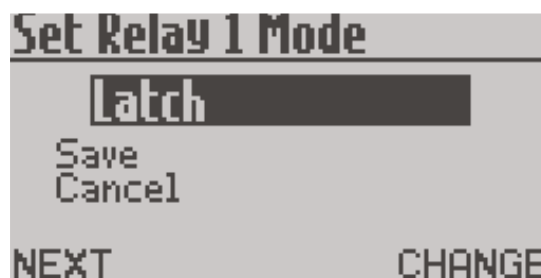
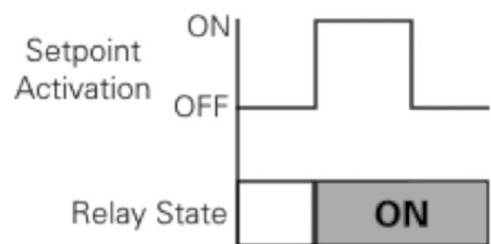
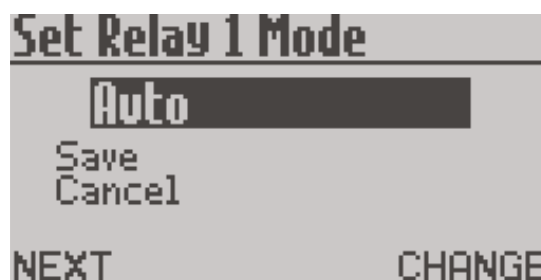
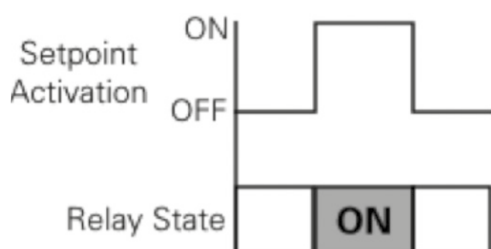
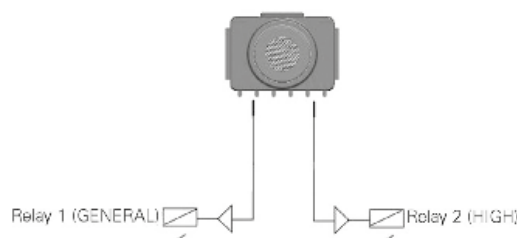
- Reset the Zero and Span output signal levels to the original default settings.



Relay 1 function mode

Relay 2 function mode

- This item will appear in the menu on the Contact Output version only
- The operating function of each Relay can be independently setup



Note: A Relay will stay LATCHED if the initiating signal has not receded.

To reset a Latched Relay

- Press **L** to view Relay states

```
Relay States
Relay 1:
Mode:Latch State:OFF
Relay 2:
Mode:Auto  State:ON
DONE
```

```
Unlatch Relays
Unlatch Relay 1
Unlatch Relay 2
Go to Main Menu
Exit
NEXT SELECT
```

Note: A Relay will stay LATCHED if the initiating signal has not receded.

```
Unlatch Relay
Relay 1
Relay is still Latched.
DONE
```

4.4.4 Modbus

RS485 output

The protocol characteristics required for the Modbus datacomms version can be setup. SENTRO can then be integrated into a wider communication network or to interface with a PC or SCADA system.

Data protocol	Modbus
Addresses	1 to 255
Format	Binary
Databits	8
Stopbits	1
Parity	None
Baud Rate	300/600/1200/2400/4800/9600/14400/19200/28800/38400/57600/115200
TX ON	0 to 99 ms
TX OFF	0 to 99 ms
Duplex	Half

4.4.5 Module setup

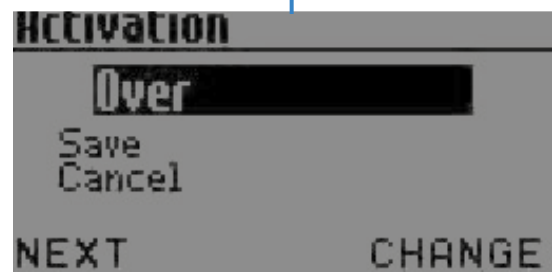
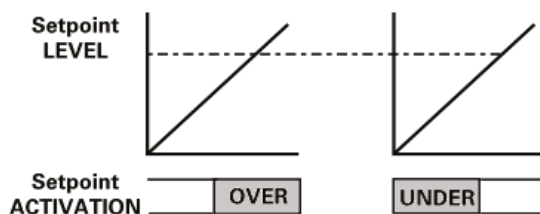
The functional characteristic of the SENTRO eModule may be setup to preference.



Change Setpoint 1 Change Setpoint 2

- The SENTRO Module provides two adjustable setpoint output signals
- When setpoint (General) is activated, the LED alarm indicators in the display window flash simultaneously at a rate of about once every two seconds.

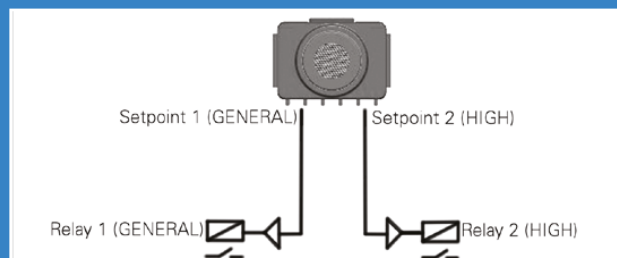
- When setpoint 2 (HIGH) is activated, they flash simultaneously at a rate of about 2 per second
- The Activation mode and operating level of the setpoints can be setup to preference



Note:

The setpoint output signal data will also be available for transmission on the RS485 Modbus version of SENTRO.

The Contact Output version of SENTRO 1 is also equipped with two Relays.



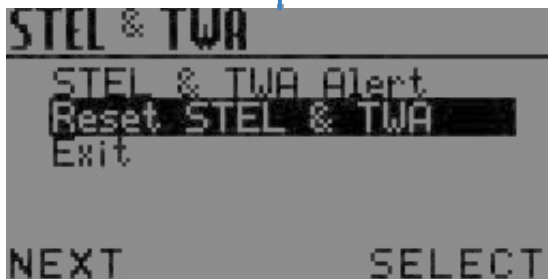
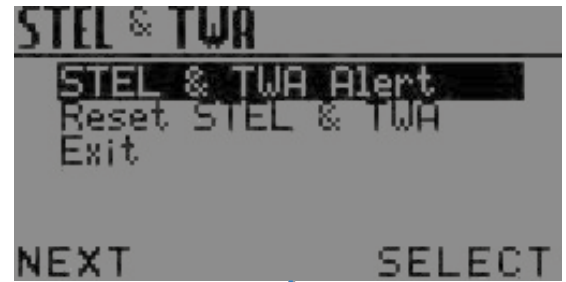
The Activation will operate in the same way.

The Relay function mode can also be set up.

SECTION 4.4.3

STEL and TWA

- Toxic gas sensing SENTRO eModules are equipped to automatically calculate STEL and TWA limits in accordance with international EH40 recommendations
- The Alert can be set to ON or OFF
- The accumulated STEL and TWA data can be reset to zero ready for the start of a new working period



Note:

STEL OVER or TWA OVER will be displayed when limits are exceeded.

If the visual alarm has been enabled, then this will also activate at level 1 when a STEL or TWA limit is exceeded.

For a contact output version, the STEL and TWA alert will also initiate the Activate command for Relay 1.



4.4.6 Support

If you need technical support to operate this product, or would like details of our after sales technical support packages, contact service@trolex.com

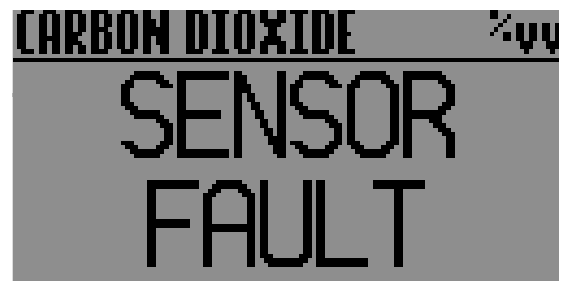
5. DIAGNOSTICS AND MAINTENANCE

5.1 Diagnostic messages

Sensor over-range



Loss of signal from the sensor



Pellistor Over

- The gas sensing concentration exceeds 100% LEL which is the safe working limit of the sensing element



- The transmitted output signal from the sensor will be clamped at full scale to prevent ambiguous output data from being transmitted and will latch in this condition
- The pellistor in the gas sensing module will be switched into a PROTECT state to prevent oxidation damage and will latch in this state
- Check that the gas concentration has receded, then reset the module by removing it for 2 seconds

Module Not Fitted

- The eModule has been removed and is out for more than 10 seconds

MODULE NOT FITTED

Note: Under-range output signal will be transmitted by the sensor.

5.2 Maintenance

Output signal

- Check the accuracy of the sensor at pre-determined intervals by injecting a test gas



Gas sensing modules

- The SENTRO eModule should be changed at regular intervals to ensure the accuracy of response
- Service history is logged within the module, and this data is used to periodically assess its condition whenever it is returned for servicing.

Simply insert the new module into the instrument and return the original for checking and calibration.



Gas Inlet Port

- Check the condition and clean with a small brush to remove dust and debris



Note: If the gas inlet port has been exposed to water conditions that exceed the IPX4 rating, dry the sensor and check its response.

Ingress protection (IP) rating does not imply that the equipment will always detect gas.

Annual safety check

The main sensor unit will not normally require maintenance or calibration, but it is advisable to return it to the Trolex Technical Services for an annual safety check.

Calibration

The SENTRO 1 performs an important safety function, and periodic calibration is an essential part of maintaining safety integrity.

Gas sensors have a known ZERO and SPAN movement related to time, level of exposure to gas, and the nature of the environment, so Trolex recommend that the sensors should be bump tested with a suitable test gas at regular intervals.

This should be carried out in accordance with best practice for the industry where the gas sensor is being used.

Trolex Calibration Recommendation statement

- Methane and hydrocarbon gas sensors often perform an important safety function, and periodic calibration is an essential part of maintaining safety integrity.
- Pellistor gas sensors have a known ZERO and SPAN movement related to time, level of exposure to gas, and the nature of the environment.
- Trolex recommend that these sensors are 'Bump Tested' with a suitable test gas at regular intervals. This should be carried out in compliance with local requirements, or once per month will normally be adequate Calibrate the sensor if necessary, or as a minimum every 6 months, to ensure correct operation.
- All other gas sensor types should be bump tested with a suitable test gas at an interval in line with the site I industry health and safety standards and calibrated as necessary, or as a minimum every 6 months, to ensure correct operation.

Recommended Test Gas concentration

Gas sensor type	Zero gas	Calibration/balance gas
CH ₄ (Pellistor) 100% LEL	Zero air	2.2% v/v CH ₄ in air
CH ₄ (infrared)	Zero air or Nitrogen 100%	50% to 100% of range CH ₄ in N ₂
CO	Zero air	50% to 100% of range CO in air
H ₂ S	Zero air	50% to 100% of range H ₂ S in air
NO	Zero air	50% to 100% of range NO in air
NO ₂	Zero air	50% to 100% of range NO ₂ in air
SO ₂	Zero air	50% to 100% of range SO ₂ in air
CO ₂	Nitrogen 100%	50% to 100% of range CO ₂ in air
O ₂	Nitrogen 100%	Clean air or 50% to 100% of range O ₂ in N ₂

Standard test gas canisters are available from our Technical Services and can be supplied in a range of capacities from 34 litres up to 100 litres.

Please call our sales engineers for advice regarding recommended test gas procedures and product support plans.

Test gas equipment may be ordered from Trolex using the order code P5393.23. The kit is comprised of a 0.5 litre/min gas regulator, pipe-work and gassing hoods.

5.3 Maintenance and Calibration Log

Order reference	TX		
Serial number		Date purchased	
Gas type		Location	

Date	Schedule check	Fault	Recalibrate	Change modules	Return to Trolex	Comments

5.4 Disposal



This symbol, if marked on the product or its packaging, indicates that this product must not be disposed of with general household waste.

In the European Union and many other countries, separate collection systems have been set up to handle the recycling of electrical and electronic waste.

At the end of the product's life, do not dispose of any electronic sensor, component or instrument in the domestic waste. Contact Trolex or the Distributor for disposal instructions.

Note: Consult your local Distributor or Trolex Technical Services (service@trolex.com) if you require assistance with disposal.

DISCLAIMER

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