PRESSURE
SENSOR/TRANSMITTER

INSTALLATION & OPERATING DATA

ATEX
M1
GROUP I & II
INTRINSICALLY
SAFE

PETROCHEMICAL PROCESSING
•
MINING & TUNNELLING

contents...

INSTALLATION & OPERATING DATA

1 PRINCIPAL OPERATING FEATURES

The TX6140 Series Pressure Sensors employ a high accuracy pressure diaphragm which provides exceptional corrosion resistance to the most aggressive media. The Differential Pressure Series uses stainless steel diaphragms for best performance in double sided wet/wet applications.

The measuring element is a Piezo resistive strain gauge giving a high electrical output with excellent linearity, and negligible zero drift.
The information from the sensing bridge is processed by a specially designed software programme to provide user configurable information display and a conditioned output signal.

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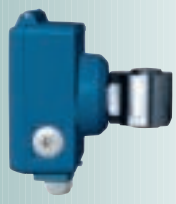
- High accuracy pressure capsule with characterised temperature compensation incorporating EPROM intelligence to give a standardised output signal. This simplifies service and replacement of the sensing element.
- Programmable information display for zero, span, signal offset, turndown, signal transfer characteristic, engineering units, signal damping, display suppression, fault mode, contrast and signal clamp.
- Language display text options.
- Keycode software security option.
- Simple pushbutton scaling to match on-site parameters: signal offset, elevated zero, etc.
- Output signal versions:
  4...20mA / 0.4...2V / 5...15Hz.
- Choice of pressure ranges from 0 to 600bar.
  Gauge, Absolute and Differential.
- Intrinsically Safe version for use in hazardous areas.
- Automatic self test function.



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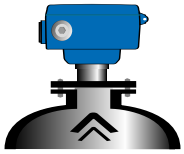
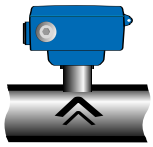
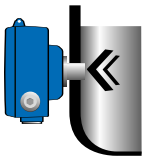
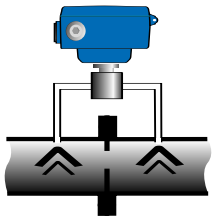
2 APPLICATION

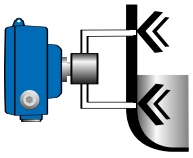


High accuracy analogue pressure measurement in process systems and plant monitoring applications, with data communications for interfacing with display/control instruments and distributed control systems.









- **GAUGE pressure measurement in pipes, vessels, containers, receivers and process equipment.**

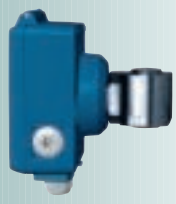
- **ABSOLUTE pressure measurement for atmospheric pressure monitoring, environmental monitoring and process systems.**

- **DIFFERENTIAL pressure measurement, hydrostatic level sensing in pressurised vessels, process pressure comparison, DP flow measurement in pipes and ventilation ducts, blocked filter detection, DP measurement across pumps and hydraulic machinery, transformer cooling circuits, etc.**
- **A choice of output signals for direct interfacing with most standard industrial monitoring systems.**
- **A range of primary instrumentation and monitoring modules is available from Trolex to which the sensors can be directly connected to provide a flexible choice of display and control functions.**

TRIP AMPLIFIER
for use with analogue output pressure sensors.

CONFIGURABLE SENSOR CONTROLLER
for monitoring up to 8 pressure sensors.

COMMANDER DISTRIBUTED I/O SYSTEM
for large scale general plant monitoring systems and the mining and tunnelling industries.



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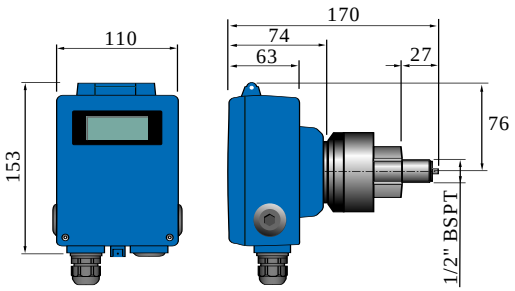
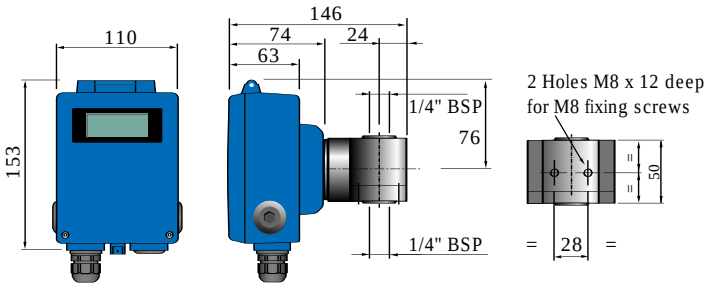
3 DIMENSIONS

3.1
TX6141
GAUGE
ABSOLUTE



ALL DIMENSIONS IN MM

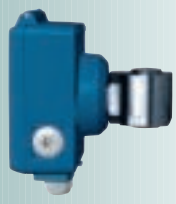
3.2
TX6143
DIFFERENTIAL
STAINLESS STEEL
DIAPHRAGM



4 TECHNICAL DETAILS

4.1 Specification

Overall Accuracy:	±0.25%.
Long Term Drift:	±0.5% per annum.
Linearity:	±0.25%.
Temperature Stability:	±0.06% / °C.
Ambient Temp. Limits:	Housing: –10...50°C. Sensor: –20...150°C.
Humidity:	0...95% non-condensing.
Vibration Limits:	0.25min pk (10Hz...100Hz) 2g pk (100Hz...600Hz) 40g (Impact)
Protection Classification:	Dust and waterproof to IP66.
Housing Material:	Stainless steel filled Polyamide 6.
Wetted Parts Material:	TX6141 • Stainless steel/Ceramic diaphragm TX6143 • Stainless steel/Stainless steel diaphragm.
Nett Weight:	0.7kg.
Cable Entries:	M20 x 1.5.
Sensing Element:	Positive strain gauge with integral data intelligence and standardised conditioned output signal. Gauge, Absolute, Differential.
Electrical Connections:	4mm Barrier/clamp terminals.
Information Display:	Dot Matrix alpha numeric LCD 17 characters.
Operation:	Microprocessor controlled with non-volatile data retention.
Menu System:	Keycode.
	Programming of Span, Zero, On-site scaling, Signal offset, Failure mode, Turndown, Hydrostatic level factor, Square law transfer function, Engineering units, Signal damping, Display contrast, Display suppression, Signal fix.
	Master Reset.
	Text Language: English German French Spanish Czech



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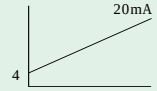
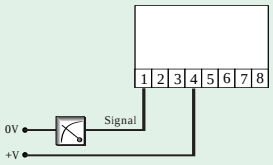
4 TECHNICAL DETAILS continued

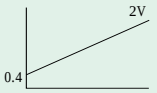
4.2 Electrical Details

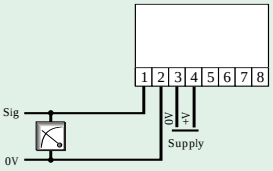
GENERAL PURPOSE AND Ex GROUP II APPLICATIONS (24V dc)

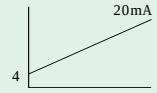
TX6141 • TX6143		
	OUTPUT	4...20mA (2 wire)
	Load	600 ohms at 24V dc
	Supply	10...30V dc
	Max. Current	20mA

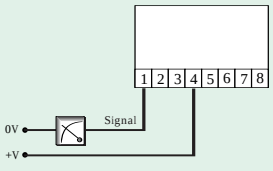


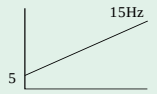
Ex GROUP I APPLICATIONS (12V dc)

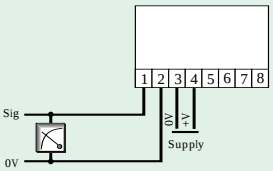
TX6141 • TX6143		
	OUTPUT	0.4...2V dc (4 wire)
	Load	10k ohms at 12V dc
	Supply	6.5...16.5V dc
	Max. Current	15mA



TX6141 • TX6143		
	OUTPUT	4...20mA (2 wire)
	Load	300 ohms at 12V dc
	Supply	6.5...16.5V dc
	Max. Current	20mA



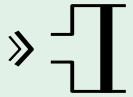
TX6141 • TX6143		
	OUTPUT	5...15Hz (4 wire)
	Load	Opto isolated. 2mA max.
	Supply	6.5...16.5V dc
	Max. Current	25mA



4.3 Pressure Measurement Range

TX6141

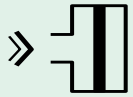
GAUGE CERAMIC DIAPHRAGM (21) **FOR GAS & LIQUID APPLICATIONS**



Range	0...2bar	0...5bar	0...10bar	0...20bar	0...50bar	0...100bar	0...200bar	0...400bar
Max.	3bar	7.5bar	15bar	30bar	75bar	150bar	300bar	600bar
Burst	6bar	15bar	30bar	60bar	150bar	300bar	600bar	1200bar

TX6141

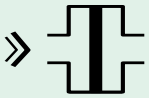
ABSOLUTE CERAMIC DIAPHRAGM (22) **FOR GAS & LIQUID APPLICATIONS**



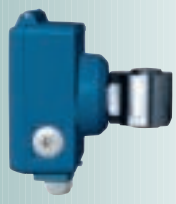
Range	0...2bar	0...5bar	0...10bar	0...20bar	0...50bar	0...100bar	0...200bar	0...400bar
Max.	3bar	7.5bar	15bar	30bar	75bar	150bar	300bar	600bar
Burst	6bar	15bar	30bar	60bar	150bar	300bar	600bar	1200bar

TX6143

DIFFERENTIAL STAINLESS STEEL DIAPHRAGM (24) **FOR GAS & LIQUID APPLICATIONS**



Range	0...0.1bar	0...0.2bar	0...0.5bar	0...1bar	0...2bar	0...5bar	0...10bar	0...20bar
Max.	+2.5,–1bar	+2.5,–1bar	+2.5,–1bar	+3,–1bar	+4,–3bar	+10,–5bar	+20,–7bar	+40,–10bar
Burst	200bar	200bar	200bar	200bar	200bar	200bar	200bar	200bar



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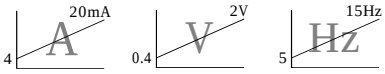
5 INSTALLATION

5.1 Conformity Check

(Refer to Test Certificate provided with the sensor).



- Does the output signal of the sensor concur with the input requirement of the monitoring equipment being used?

12V dc 24V dc

- Is the correct supply voltage available for the sensor?

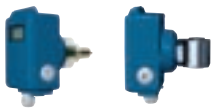
- Is the pressure operating range of the system within the stated measuring range of the sensor?

- Does the pressure measuring format of the sensor concur with the requirements of the process?

- Is the maximum static pressure of the system within the stated pressure rating of the sensor?

- Is the temperature variation range of the process medium within the stated temperature range of the sensor?

- Is the hazardous area classification correct?



STANDARD OPTIONS AVAILABLE

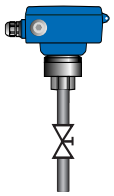
TX6141 PRESSURE SENSOR/ TRANSMITTER • GAUGE • ABSOLUTE
TX6143 PRESSURE SENSOR/ TRANSMITTER • DIFFERENTIAL

CERTIFICATION	• Intrinsically Safe Group I	(01)
	• Intrinsically Safe Group II	(02)
	• General Purpose	(03)
OUTPUT SIGNAL	• 0.4...2V (Group I only)	(11)
	• 4...20mA	(12)
	• 5...15Hz (Group I only)	(13)
PRESSURE FORMAT (TX6141 only)		
	• GAUGE	(21)
	• ABSOLUTE	(22)

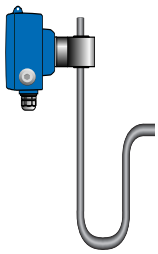
ATEX
GROUP I
HAZARDOUS AREAS

5 INSTALLATION continued

5.2 Process Fittings

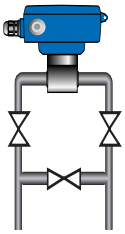


- Ensure that the pressure rating of the process fittings used is compatible with the maximum pressure anticipated in the system.
- Isolating valves should be fitted where pressure surges may be anticipated during commissioning or shutdown.



The sensor will tolerate reasonable levels of contamination and foreign particles present in the process medium but where conditions are particularly aggressive, the sensor should be protected with a U-bend or an isolating seal.

5.3 DP Sensors



- Differential pressure sensors must be protected against excessive static pressure particularly during commissioning or shutting down a system.
  It is recommended that a direct mounted valve manifold is included in the process connection for pressure isolation purposes.

Trolex TX9200.11 pipe mounting bracket for convenient mounting of DP sensors.

5.4 High Pressure

- Where the sensor is used on high pressure systems, care should be taken to isolate or relieve the system pressure before installation or removal.

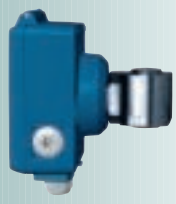
  Ensure that all couplings are fully tightened before applying pressure to the system.

5.5 Pressure Surges

- High pressure surges in the system can cause permanent damage or de-calibration to the pressure capsule.
  Protect the sensor pressure inlet whenever maintenance work is being carried out on the system.

5.6 Caution

- Do not insert sharp or metallic objects into the pressure orifice, this may cause damage to the sensing element. Excessive test pressure applied to the diaphragm of low pressure sensors may also de-calibrate the output signal.



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5 INSTALLATION continued

5.7 Mounting Attitude of the Sensor Housing

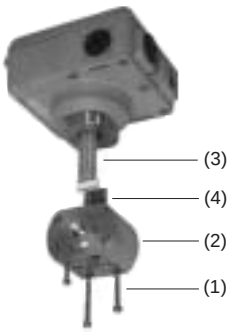
- In most cases the sensor is not significantly affected by its mounting attitude.
  A small amount of zero shift may be observed in very low pressure sensors, as a result of gravitational influence on the diaphragm in some positions.

  This can be corrected by calibration of the sensor.

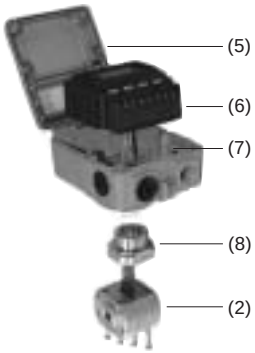
Refer to Section
9.8.5 Set Input Zero

5.8 Orientation of the Housing (Differential Pressure only)

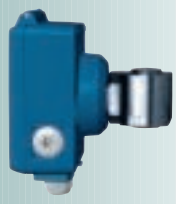
The housing of the sensor can be adjusted to a choice of four angular positions after installation for the preferred mounting orientation or for the most convenient cable routing access.



- Remove the four socket cap head screws (**1**) to release the pressure capsule (**2**).
- Disconnect the ribbon cable (**3**) from the capsule PCB (**4**).
- Open the top cover (**5**) of the housing.
- Remove the electronic module (**6**).
- Remove the four internal screws in the base of the housing (**7**) to release the adaptor (**8**).
- Rotate the adaptor to the desired position and refit the four internal screws.
- Refit the electronic module, being careful not to trap the ribbon cable.
- Reconnect the ribbon cable to the capsule PCB.
- Refit the four socket cap head screws to secure the pressure capsule (**2**).
- Close and secure the top cover of the housing.



CHECK POINT
- Is the top cover seal in place?



ATEX
M1
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SAFE

5 INSTALLATION continued

5.9 System Integrity

If a pressure monitoring system should fail for any reason, it is important that the system is capable of immediately alerting operational staff to this fact.
The sensor will indicate a system failure or mechanical defect and this information can be utilised to initiate a warning alarm. It is good practice to provide emergency facilities to protect against the loss of the mains power supply.
Standby batteries can be incorporated with automatic changeover facilities, so guaranteeing continued operation of the pressure sensing system even in the event of a plant breakdown as a result of a power supply failure.
Certainly, in critical plants, duplication or triplication of sensors is recommended.

The Trolex TX9042 or TX9044 Programmable Sensor Controller can be programmed to operate with sensors in the multiple voting mode.

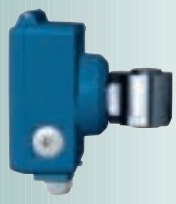
5.10 Sensor Management

A very important part of an efficient pressure monitoring system is the training of plant personnel in operation and maintenance of the sensors and the complete monitoring system. Training facilities 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.

5.11 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.



ATEX
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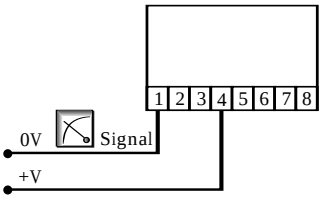
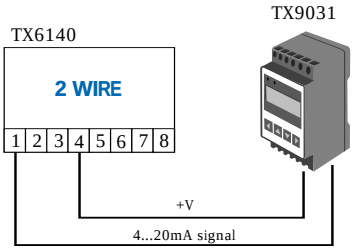
6 CONNECTIONS



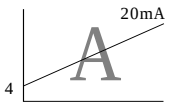
TX6141 **PRESSURE SENSOR/ TRANSMITTER • GAUGE • ABSOLUTE**
TX6143 **PRESSURE SENSOR/ TRANSMITTER • DIFFERENTIAL**

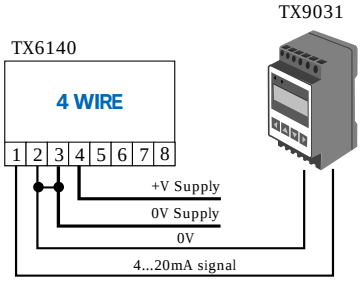
6.1 4...20mA Output Signal



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

The same loop also powers the sensor and no separate power supply is required.

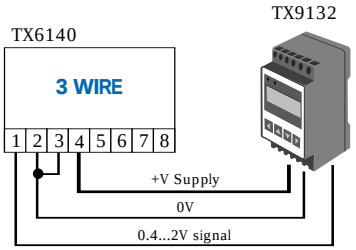




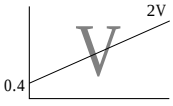
The sensor can also be operated in the 3 or 4 wire mode using a separate power supply.

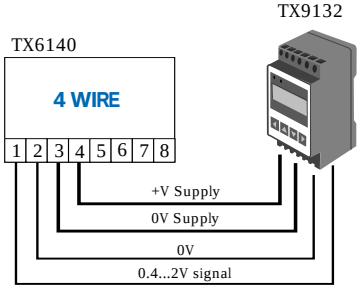
The 4...20mA signal loop still functions in the normal current regulation mode, so ensuring the accuracy of the system.

6.2 0.4...2V Output Signal



A low impedance two-wire voltage output signal requiring a separate power supply to the sensor.
This can be derived from a Trip Amplifier or Programmable Sensor Controller, when one of those is used as the monitoring instrument.





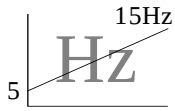
This connection configuration works well up to about 100 metres distance between the sensor and the monitoring equipment.

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

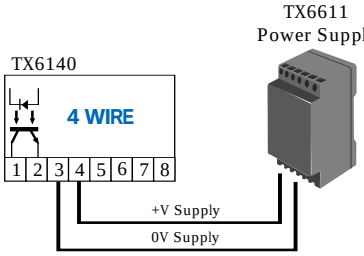
This effect can be reduced on long distance connections by increasing the size of the cable cores, or even better, running a separate 0V conductor to power the sensor.

6 CONNECTIONS continued

6.3 0.4...2V Output Signal



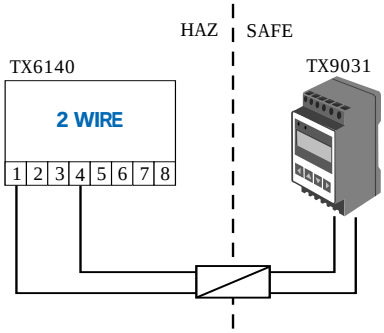
A square wave, frequency variable output that is proportional to the measured value. The output device is an uncommitted NPN transistor.



Output:	5...15Hz. (zero = 5Hz). (span = 15Hz).
Maximum Voltage:	15.4V.
Maximum Current:	2mA.
Minimum Pulse Rise Time:	5V/ms.

6.4 Group II Hazardous Areas

ATEX
M1
GROUP I & II
INTRINSICALLY
SAFE



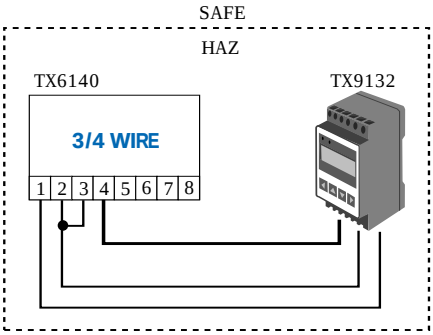
IMPORTANT
Ensure that the sensor is the INTRINSICALLY SAFE version; TX6141.02/TX6143.02

All output signal options of the sensor are certified Intrinsically Safe for use in Group II hazardous areas, zones 0, 1 and 2, when used in conjunction with zener safety barriers or isolation safety barriers. Only the sensor may be mounted in the hazardous area.

Suggested Zener safety barrier: MTL7087 +
Suggested Isolating safety barrier: MTL5042

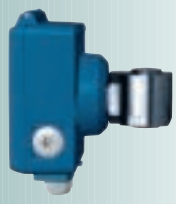
If you require any help in the use of safety barriers please contact the Trolex Technical Department.

6.5 Group I Hazardous Areas (Mining)



IMPORTANT
Ensure that the sensor is the INTRINSICALLY SAFE Group I version; TX6141.01/TX6143.01

All output signal options of the sensor are certified Intrinsically Safe for the use in Group I hazardous areas (Mining) when used with approved equipment eg. TX9130 Series Trip Amplifier or a TX9042 Programmable Sensor Controller.
The complete system, both sensor and monitoring device can be mounted in the hazardous area.

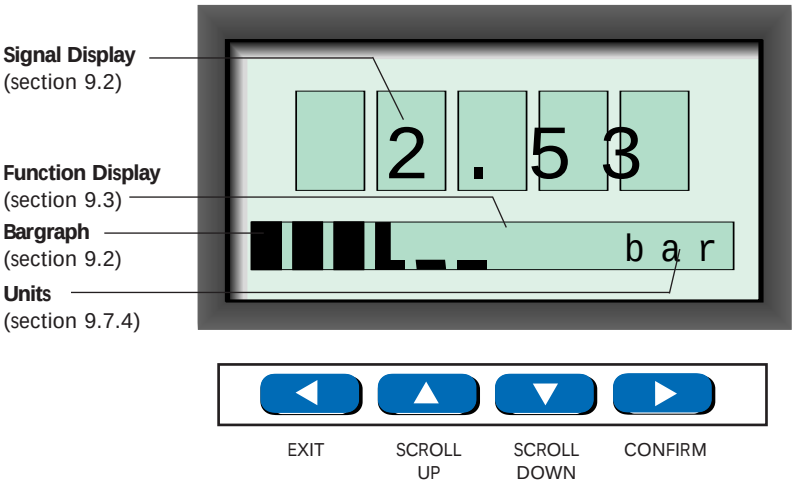


ATEX
M1
GROUP I & II
INTRINSICALLY
SAFE

7 CONTROLS AND INDICATORS

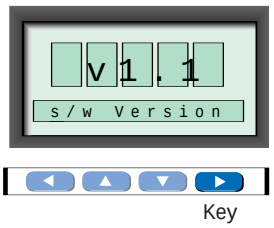
The programming and setting routines for the sensor have been designed for utmost simplicity and the programming system is completely menu driven. There is no special software programme and a data input terminal and/or PC is not required.

There are just four keys for controlling the complete operation and the digital display provides instructions throughout the programming process. All entries are verified in the display.



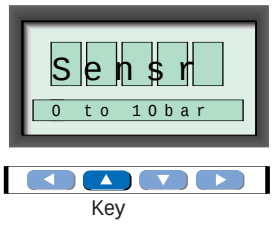
- Hold the SCROLL Keys down for two seconds for rapid self keying.
- All data settings are retained under power failure.

Data Review



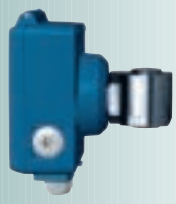
Key

Software version.



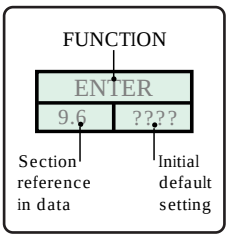
Key

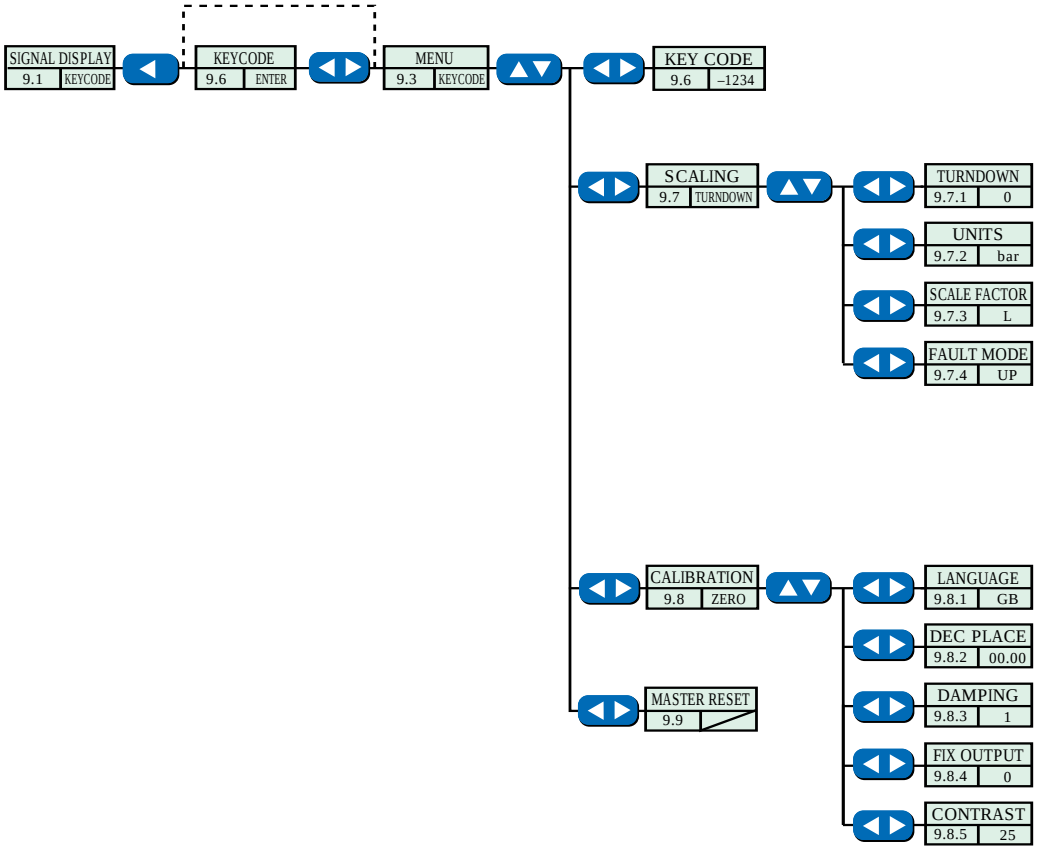
Range of the pressure sensing module fitted (Section 4.3)



ATEX
M1
GROUP I & II
INTRINSICALLY
SAFE

8 THE MENU OF FUNCTIONS

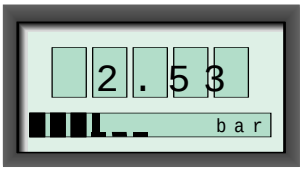




ATEX
M1
GROUP I & II
INTRINSICALLY
SAFE

9 PROGRAMMING AND CALIBRATION

9.1 Switching On



When switched on, the processor will initialise all the default values unless new values have previously been programmed.

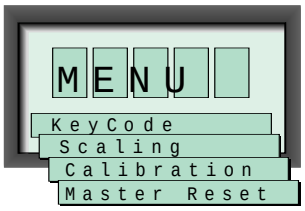
9.2 Signal Display

After two seconds, the display will switch to the SIGNAL DISPLAY mode, showing the measured signal value with the selected engineering units (bar).

- The bargraph will also show an indication of the input signal level.

- Signal over range.

9.3 Entering the MENU

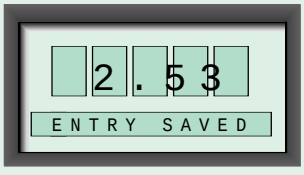


All the operating functions of the sensor can be programmed by entering into the MAIN MENU.

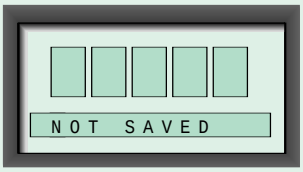
Key ▲ or ▼ to SCROLL up and down the MENU.

Key ▶ to CONFIRM.

Previously programmed values will be shown in the main sectors of the display. Function changes can be programmed as described in the following sections.



- Entry SAVED will appear briefly whenever a new value is entered during programming.



- NOT SAVED will appear briefly if a value is not entered during programming.

9.4 Exit

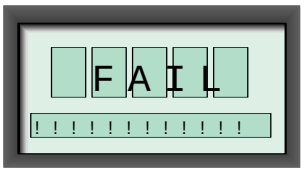
Key ◀ to EXIT from any position in the MENU sequence.

Each operation of the key will revert the display one step back in the MENU table until the SIGNAL DISPLAY is reached.

ATEX
M1
GROUP I & II
INTRINSICALLY
SAFE

9 PROGRAMMING AND CALIBRATION continued

9.5 Self Test



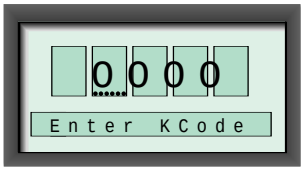
The processor will constantly carry-out a self-test routine of the main circuit elements; EPROM, memory, comms and display read/write function.
Any malfunction registered will be denoted by a FAIL message in the display. The output signal will also be forced to the UPSCALE or DOWNSCALE condition, whichever one is selected as the FAULT MODE.

Refer to Section 9.7.4

9.6 Keycode

A four digit security keycode can be entered to prevent unauthorised access to ALL setup items in the menu.

9.6.1 Enter **Keycode**

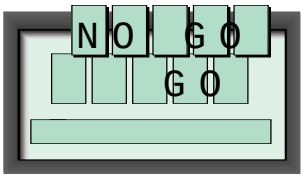


This entry screen will only show if an active keycode has been set. If the entered keycode is accepted, the display moves on to the MENU section. If the entered keycode is invalid, the display returns to the normal measurement mode.

Key ▼ to TRAVERSE the cursor.

Key ▲ to INCREMENT the digit with the cursor under.

Key ▶ to CONFIRM.

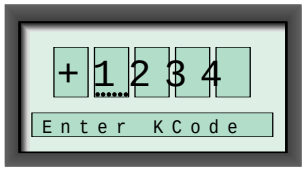


GO or NO GO will appear briefly to confirm keycode status.

This request will not appear if the KEYCODE is not active.

Refer to Section 9.6.2

9.6.2 Set **Keycode**



− NOT ACTIVE (Unrestricted Access)

\+ ACTIVE (NO Access)

Access to ALL menu items can be prevented.

The keycode is a selectable option and the code can be changed at any time.

The keycode can also be set to be ACTIVE or NOT ACTIVE.

Key ▼ to TRAVERSE the cursor.

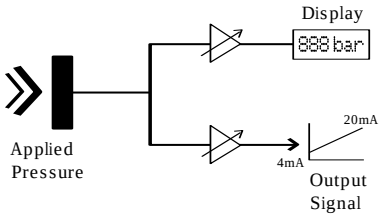
Key ▲ to INCREMENT the digit with the cursor under.

Key ▶ to CONFIRM.

ATEX
M1
GROUP I & II
INTRINSICALLY
SAFE

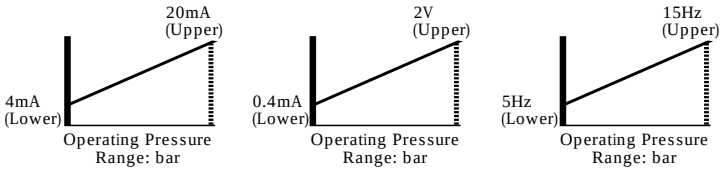
9 PROGRAMMING AND CALIBRATION continued

9.7 Scaling



The scaling of the output signal and the corresponding value of pressure presented on the display of the sensor is accurately calibrated, in bar, during manufacture.

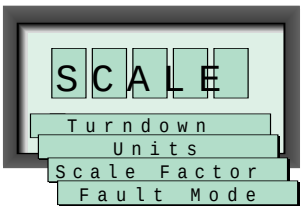
There are three standard output signal formats available, each representing the maximum operating pressure range (bar) of the sensor.



4...20mA output **0.4...2V output** **5...15Hz output**

The various parameters of the signal scale and display values can be *modified* to suit the individual characteristics and imperatives of a particular installation or process.

- **Turndown or pressure operating range.**
- **Change the units of display from bar to another.**
- **Apply linear or non-linear scale multipliers.**
- **Upscale or downscale fault-mode selections.**



Key ▲ or ▼ to SELECT the function.

Key ▶ to CONFIRM.

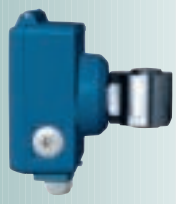
CHECK POINT

Making any of the modifications to the SCALING parameters naturally assumes that the fundamental pressure calibration of the sensor is accurate.

Although this will be so on a new sensor, it is good safety practice to re-affirm the pressure calibration at periodic intervals.

If calibration is necessary – do it BEFORE making any modifications to the scaling parameters.

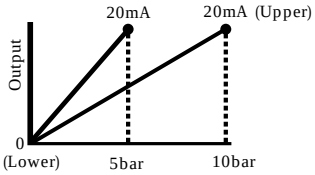
Refer to Section 9.8



ATEX
M1
GROUP I & II
INTRINSICALLY
SAFE

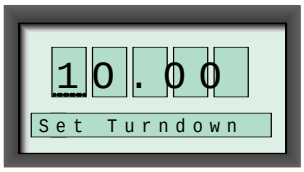
9 PROGRAMMING AND CALIBRATION continued

9.7.1 Turndown

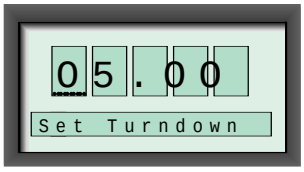


The sensor may be installed in an application that requires a lower operating pressure range than the standard ***calibrated*** range (e.g. 5bar utilisation on a 10 bar full scale sensor).

The complete response range of the output signal can be utilised by 'Turning Down' the sensor response to the required maximum pressure range of the system being monitored.



Adjustable Range:
25%...100% of full scale



Key ▼ to TRAVERSE the cursor.

Key ▲ to INCREMENT the digit with the cursor under.

Key ▶ to CONFIRM.

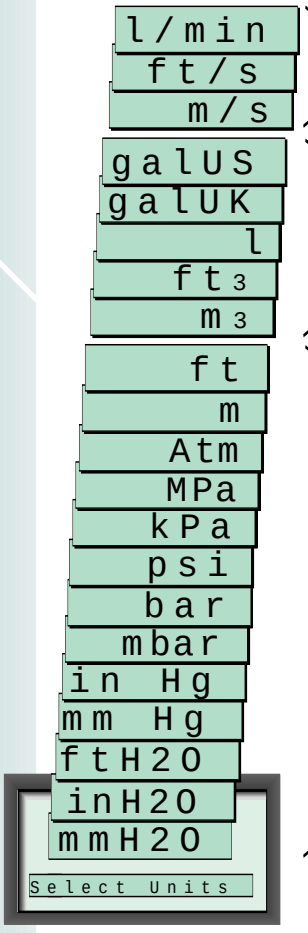
CHECK POINT The overall response accuracy of the sensor is defined at the MAXIMUM calibrated pressure range.
Be aware that any TURNDOWN applied will slightly reduce the overall response accuracy in proportion to the amount of turndown introduced.

Refer to Section 4.1

9.7.2 Units

PRESSURE UNITS

The sensor is calibrated in bar (gauge pressure) during manufacture. There is a choice of alternative units of pressure measurement:



CHECK POINT All display values within the SCALING and CALIBRATION functions will automatically be presented in the PRESSURE units selected.

CHECK POINT If the sensor is being used to measure hydrostatic pressure (level) using the metre (m) or feet (ft) units, remember to include a correction factor for the specific gravity of the liquid, if necessary.

Refer to Section 9.7.3

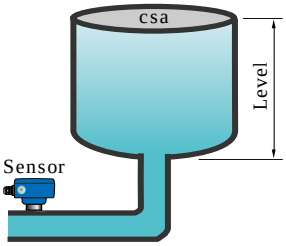
CAUTION Units of measurement must be restricted to the choice listed in the PRESSURE UNITS menu.
Special consideration is needed for units within the VOLUMETRIC and FLOW menus.

Key ▲ or ▼ to SELECT the UNITS.

Key ▶ to CONFIRM.

ATEX
M1
GROUP I & II
INTRINSICALLY
SAFE

9 PROGRAMMING AND CALIBRATION continued

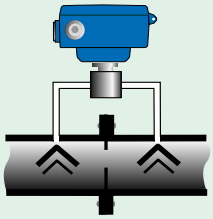


VOLUMETRIC UNITS

When the sensor is being used to measure the hydrostatic pressure level of a liquid, the processor can be setup to calculate the contained VOLUME.

It will also be necessary to enter an appropriate multiplication factor relating to the response characteristics of the orifice plate or venturi system used.

Refer to Section 9.7.3



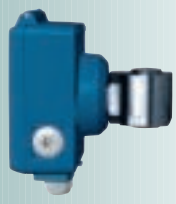
FLOW UNITS (Differential Pressure)

One of the three FLOW measurement units may be selected where a TX6143 series Differential Pressure Sensor is installed across an orifice plate or venturi to monitor flow velocity.

Any one of these selections will automatically produce a square-root transfer function in the sensor processor for use with DP measuring points, so enabling the sensor to provide a linearised output signal.

It will be necessary to enter an appropriate multiplication factor relating to the response characteristics of the orifice plate or venturi system being used.

Refer to Section 9.7.3



ATEX
M1
GROUP I & II
INTRINSICALLY
SAFE

9 PROGRAMMING AND CALIBRATION continued

9.7.3 Scale Factor

Multiplication factors can be entered for SPECIFIC GRAVITY correction or for use with the VOLUMETRIC and FLOW functions.

Refer to Section 9.7.2

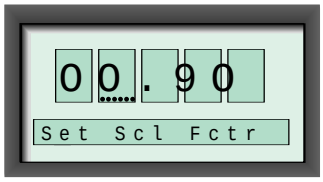
Specific Gravity Correction

Where the sensor is applied to hydrostatic level measurement, the choice of units available is m or ft, calibrated with respect to water.

Refer to Section 9.7.2

If the specific gravity of the liquid being monitored is different to that of water a correction factor may be entered:

Factor = SG of liquid (ie: 0.9).



Key ▼ to TRAVERSE the cursor.

Key ▲ to INCREMENT the digit with the cursor under.

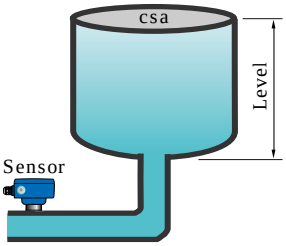
Key ▶ to CONFIRM.

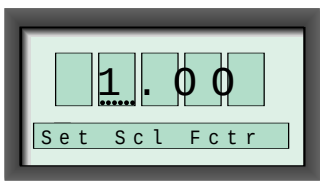
VOLUMETRIC UNITS

If one of the five VOLUMETRIC measurement units is selected, it will be necessary to enter a multiplication factor relating to the cross-sectional area of the vessel.

Refer to Section 9.7.2

Factor = Cross-sectional area x SG.





Key ▼ to TRAVERSE the cursor.

Key ▲ to INCREMENT the digit with the cursor under.

Key ▶ to CONFIRM.

- The cross-sectional area Factor MUST be entered in the corresponding dimensional units.

Unit	Cross-sectional Area	
m^3/s	square metres	(m^2)
ft^3	square feet	(ft^2)
l	square metres	(m^2)
gal	square feet	(ft^2)

ATEX
M1
GROUP I & II
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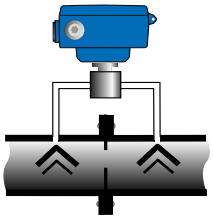
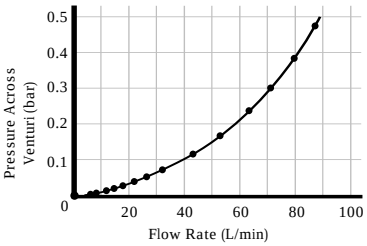
9 PROGRAMMING AND CALIBRATION continued





Response characteristic of a venturi system in a Ø25 pipe.

FLOW UNITS (Differential Pressure)

One of the three FLOW measurement units may be selected where a TX6143 series Differential Pressure Sensor is installed across an orifice plate or venturi to monitor flow velocity. Any one of these selections will automatically produce a square-root law transfer function in the sensor processor for use with DP measuring points, so enabling the sensor to provide a linearised output signal.

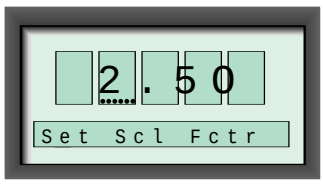
It will be necessary to enter an appropriate multiplication factor relating to the response characteristics of the orifice plate or venturi system used.

This relationship can be mathematically calculated if sufficient data is available relating to the structure of the process flow system and the dynamic characteristics of the flow medium.

Alternatively the scaling factor can be easily established by taking a sample measurement of the actual flow velocity, together with a measurement of the associated differential pressure and applying the formula:

$$\text{Factor} = \frac{\text{Flow}}{\sqrt{\text{DP}}}$$

- Flow measured in the units of flow selected in the menu.
- DP measured in bar.

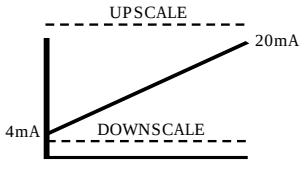


Key ▼ to TRAVERSE the cursor.

Key ▲ to INCREMENT the digit with the cursor under.

Key ▶ to CONFIRM.

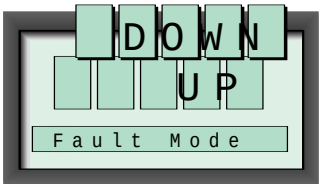
9.7.4 Fault Mode



The output signal of the sensor can be selected to go UPSCALE or DOWNSCALE when a sensor malfunction or connection failure occurs.

If a sensor is monitoring low pressure failure on a pressurised system the DOWNSCALE failure mode will force the output signal down into the system alarm region.

Similarly, the UPSCALE failure mode will initiate an alarm in a system that is employed to monitor excess pressure level.



Key ▲ or ▼ to SELECT the MODE.

Key ▶ to CONFIRM.

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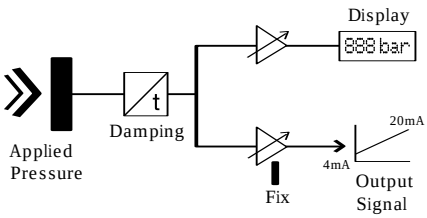
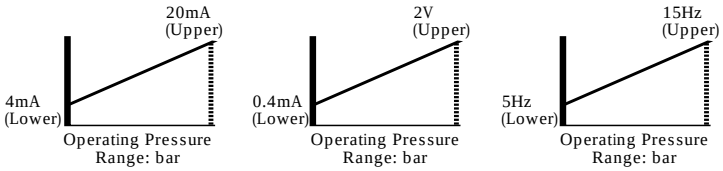
9 PROGRAMMING AND CALIBRATION continued

9.8 Calibration

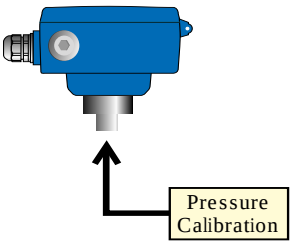


The scaling of the output signal and the corresponding value of pressure presented on the display of the sensor is accurately calibrated, in bar, during manufacture.

There are three standard output signal formats available, each representing the maximum operating pressure range (bar) of the sensor.



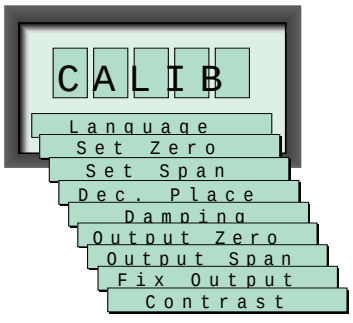
4...20mA output **0.4...2V output** **5...15Hz output**



The fundamental calibration of the sensor with respect to an applied pressure should be checked at periodic intervals using a calibrated pressure source.

Setup functions are available when fundamental pressure re-calibration has become necessary.

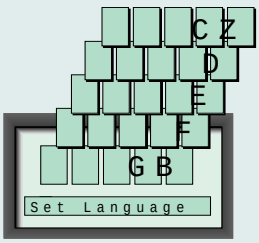
- **The language used in the display.**
- **Damping adjustment of the sensor response.**
- **Fix the output signal during calibration or servicing.**
- **Adjust the contrast of the display.**



Key ▲ or ▼ to SELECT the function.

Key ▶ to CONFIRM.

9.8.1 Language



The display text can be shown in five different languages.

English (GB) French (F) Spanish (E) German (D) Czech (CZ)

Key ▲ or ▼ to SELECT.

Key ▶ to CONFIRM.

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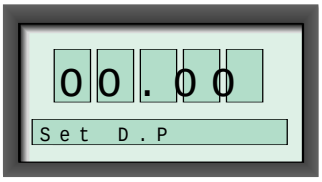
9 PROGRAMMING AND CALIBRATION continued

9.8.2 Decimal Place



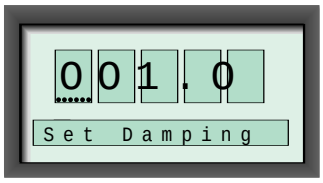
Range: 0.000 to 00000

When the sensor is measuring a rapidly fluctuating signal, the fluttering minor digits in the display can be distracting.
The position of the decimal point can be moved to any position in the figure to minimise this effect.

Key ▲ or ▼ to TRAVERSE the decimal point.

Key ▶ to CONFIRM.

9.8.3 Damping



Range: 0 to 999.9s

The immediacy of response of the sensor can be DAMPED to filter unwanted spurious changes in the process pressure.

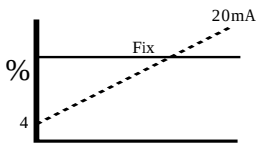
Key ▼ to TRAVERSE the cursor.

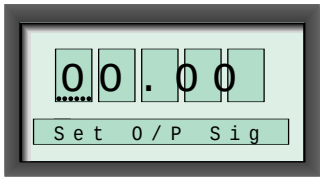
Key ▲ to INCREMENT the digit with the cursor under.

Key ▶ to CONFIRM.

- The value entered approximates to the time taken in seconds for the signal to reach 63% of the final value (ie. one time constant).

9.8.4 Fix Output





Range: 0 to 99.99%

It may be necessary, to temporarily shut down the process to carry out maintenance or servicing which will probably mean removing the system pressure.

To prevent an alarm condition being transmitted by the sensor, the output signal can be temporarily FIXED at any desired PERCENTAGE value of the output signal range.

The FIXED LEVEL selected is a calibrated value so this feature can also be used to test the integrity of the signal loop and any remote monitoring equipment, by simulating an output signal of defined value.

Remote display systems can be calibrated and any alarm set point levels can be checked for function and accuracy.

Key ▼ to TRAVERSE the cursor.

Key ▲ to INCREMENT the value of the digit with the cursor under.

Key ▶ to CONFIRM.

The signal will be RELEASED when the MENU position is vacated.

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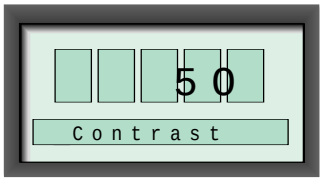
9 PROGRAMMING AND CALIBRATION continued

9.8.5 Contrast



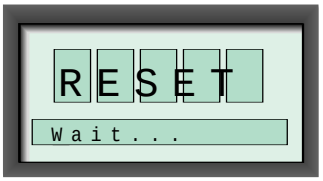
Range: 100 = Minimum Contrast
0 = Maximum Contrast

The contrast of the LCD can be varied to compensate for the effect of ambient temperature and light conditions.

Key ▲ or ▼ to SET the contrast.

Key ▶ to CONFIRM.

9.9 Master Reset

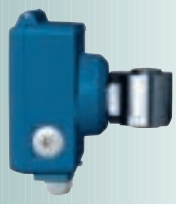


All data will be re-initialised.

Refer to Section 8

Key ▶ to RESET.

The display will return to the SIGNAL DISPLAY mode.



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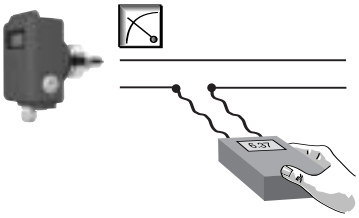
10 MAINTENANCE

There are no degradable components, but it is good safety practice to carry out regular preventative maintenance to confirm correct operation.

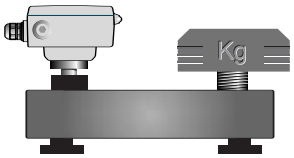
10.1 Output Signal



Check at regular intervals, that the value of the output signal agrees with the value of the display reading.
Re-calibrate if necessary.

Refer to Section 9.8

10.2 Pressure Capsule



Under normal circumstances, the calibration of the actual pressure capsule will not change by any significant degree. Check the accuracy at least once per year by comparing the display reading with an accurate standard.

Alternatively the sensor can be returned to our Product Support Department for checking and calibration.

10.3 Seals and Couplings

Periodically check the tightness of the process couplings and the condition of pressure seals.

10.4 Main Circuit Module

The main circuit module inside the sensor housing can be removed from the housing for maintenance purposes.

Disconnect the ribbon cable from the capsule PCB.

10.5 Annual Safety Check

The main transmitter itself will not normally require maintenance or calibration but it is advisable to return it to the Trolex Product Support Department for an annual safety check.

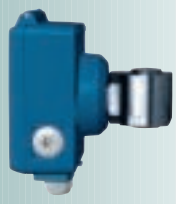
10.6 Damaged Sensors

A Sensor that has been dropped or damaged in any way should be taken out of service immediately for inspection, repair and re-calibration.

10.7 Record Keeping

Institute a regular calibration and maintenance procedure and keep a record.

Incorrect use of the Sensor or inadequate maintenance may not necessarily be self evident in the Sensor and consequently it must be regularly checked and maintained.



ATEX
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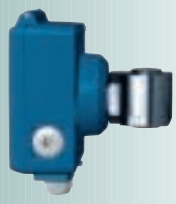
SAFE

10 MAINTENANCE continued

10.8 Maintenance and Calibration Log

ORDER REF **TX**	DATE SUPPLIED
SERIAL No.	USER
PRESSURE RANGE	LOCATION

DATE	SCHEDULED	FAILURE	RE-CALIBRATE	CHANGE GAS SENSING	RETURN TO MANUFACTURER MODULE	COMMENTS



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11 APPROVALS AND CERTIFICATION

11.1 Intrinsically Safe

The instrument is certified Intrinsically Safe Group I and Group II apparatus for use in potentially explosive atmospheres to EURONORM standards when used with an approved power supply or safety barrier.

The sensor is designed to comply with the **ATEX directive (94/9/EEC).**

EEx ia IIC T4: 98E2094
EEx ia I: 98Y2111X

11.2 Electro Magnetic Compatibility.

The instrument is designed to comply with the EC directive on EMC (89/336/EEC).

11.3 Compliance with ATEX Directives

GB

Instructions specific to hazardous area installations (reference European ATEX Directive 94/9/EC, Annex II, 1.0.6.)

The following applies to equipment covered by certificate number Sira 00ATEX2001X:

1. To comply with the requirements for intrinsic safety, the equipment must be supplied only from associated apparatus with an appropriate safety description matching the input parameters detailed in the certificate.
2. The equipment has not been assessed as a safety-related device (Directive 94/9/EC, Annex II, 1.5.1 to 1.5.8).
3. In Group I applications, the equipment is certified as Category M1.
4. In Group II applications, the equipment is certified as Category 1G and may be used with flammable gases and vapours with apparatus groups IIA, IIB & IIC and with temperature classes T1, T2, T3 and T4. The equipment has not been assessed for suitability with flammable dusts.
5. The equipment is only certified for use in ambient temperatures in the range –20°C to +60°C and should not be used outside this range.
6. The certicate number has an 'X' suffix which indicates that special conditions of installation and use applies. Those installing or inspecting this equipment must have access to the contents of this certificate.
7. Installation and repair shall be carried out in accordance with the applicable code of practice by suitably-trained personnel.
8. The equipment relies on the following materials used in its construction:

   Enclosure: polycarbonate
   Sensing Head: stainless steel
   Window: polycarbonate

   The equipment should not be exposed to substances, which could degrade these materials.

D

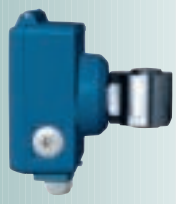
Bedingungen für die Installationen in explosionsgefährdeten Räumen (Europäische ATEX-Richtlinie 94/9/EC, Zusatz II, 1.0.6.)

Die folgende Bedingungen gelten für Geräte, die die Zertifikationsnummer. Sira 00ATEX2001X tragen:

1. Zwecks Erfüllung der Andforderungen bezüglich derEigensicherheit, darf das Geräte nur an Versorgungen angeschlossen werden, deren sicherheitstechnische Auslegung mit den im Zertifikat aufgeführten Eingangsgrössen übereinstimmt.
2. Das Gerät ist nicht als sicherheitstechnisches Gerät eingestuft (Richtlinie 94/9/EC, Zusatz II 1.5.1 bis 1.5.8).
3. Die Zertifikationskategorie des Gerätes für Einsätze in Gruppe 1 ist M1.
4. Die Zertifikationskategorie des Gerätes für Einsätze in Gruppe II ist 1G, d.h. es darf mit entflammbaren Gasen und Dämpfen mit Geräten der Gruppen IIA, IIB und IIC und Temperaturklassen T1, T2 und T4 eingesetzt werden. Das Gerät wurde nicht in Hinblick auf seine Einsatzfähigkeit mit entflammbaren Stauben geprüft.
5. Das Gerät ist nur für den Einsatz bei Umgebungsteperaturen von –20°C bis 60°C zertifiziert und darf außerhalb dieses Bereiches nicht eingesetzt werden.
6. Die mit dem Suffix "X" behaftete Zertifikationsnummer weist darauf hin, daß die Installation und der Einsatz des Gerates an eine spezielle Bedingung gebunden sind. Personen, die die Installation bzw. Prüfung des Gerätes vornehmen, müssen Zugriff auf das Zertifikat und dessen Inhalt haben.
7. Installation und Reparaturen müssen nach den jeweils geltenden Betriebsvorschriften von qualifizierten Personen vorgenommen werden.
8. Für die Herstellung des Gerätes wurden folgende Werkstoffe eingesetzt:

   Gehäuse: Polycarbonat (PC)
   Meßkopf: Edelstahl
   Sichtglas: Polycarbonat (PC)

   Das Gerät darf nicht mit Substanzenin Kontakt kommen, die zu einer Zersetzung dieses Werkstoffes führen könnten.



ATEX
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INTRINSICALLY
SAFE

11 APPROVALS AND CERTIFICATION continued

NL

Informatie bedoeld voor installaties in explosie gevaarlijke ruimtes. (Refererend aan de Europese ATEX richtlijn 94/9/EC, bijlage II, 1.0.6.)

De onderstaande instructies zijn van toepassing op apparatuur, volgens certificaat nummer Sira 00ATEX2001X:

1. Om te voldoen aan de eisen van intrinsieke veiligheid, mag het apparaat alleen worden gevoed door instrumenten die voldoen aan de veiligheidsvoorschriften volgens de ingangsparameters gespecificeerd in het certificaat.
2. Het apparaat is niet bedoeld als een veiligheid gerelateerd instrument (Richtlijn 94/9/EC, bijlage II, 1.5.1 tot 1.5.8).
3. In groep I toepassingen, is de apparatuur gecertificeerd als categorie M1.
4. In groep II toepassingen, is de apparatuur gecertificeerd als categorie 1G en mag worden gebruikt bij brandbare gassen en dampen bij de apparatuur groepen IIA, IIB & IIC en temperatuur klasssen T1, T2, T3 en T4. De apparatuur is niet beoordeeld op geschiktheid bij ontbrandbare stoffen.
5. De apparatuur is alleen gecertificeerd voor het gebruik bij omgevingstemperaturen tussen –20°C tot +60°C en mag dit bereik niet te buiten gaan.
6. Aan het gecertificeerde nummer is een “X” toegevoegd die verwijst naar de speciale installatie- en gebruiksvoorschriften die van toepassing zijn. Zij die het apparaat installeren of inspecteren, moeten de beschikking hebben over dit certificaat.
7. Installatie en reparatie zal worden uitgevoerd in overeenstemming met de gebruikelijke voorschriften door voldoende gekwalificeerd personeel.
8. De volgende materialen zijn gebruikt in de constructie:

Behuizing:	polycarbonaat
Sensor kop:	roestvrij staal
Venster:	polycarbonaat

Deze materialen mogen niet in aanraking komen met substanties die de materialen kunnen aantasten.

N

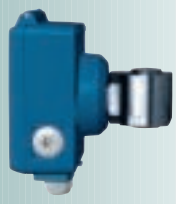
Spesifikk informasjon om risiko på installasjoner i eksplosjonsfarlige soner (ref. Europeisk ATEX Direktiv 94/9/EC, Anneks II, 1.0.6.)

Følgende brukes til utstyr dekket av sertifikatnummer Sira 00ATEX2001X:

1. For å imøtekomme krav for egensikkerhett, må utstyret vaere forsynt kun fra tilknyttede apparater med passende inngangsparametrene beskrevet i sertifikatet.
2. Utstyret har ikke blitt vurdert som en sikkerhetsrelatert innretning. (Direktiv 94/9/EC, Anneks II, 1.5.1 til 1.5.8).
3. I Gruppe I versjonen, er utstyret sertifisert som Kategori M1.
4. I Gruppe II versjonen er utstyret sertifisert som Kategori 1G, og kan brukes i faresoner med brennende gasser og damp med apparatet fra grupper IIA, IIB og IIC med temperatur klasser T1, T2, T3 og T4. Utstyret er ikke vurdert som tilpasset omgivelse med antennelig støv.
5. Utstyret er kun sertifisert for bruk i omgivelsestemperaturer i område –20°C til +60°C og må ikke brukes utenfor dette området.
6. Nummeret i sertifikatet har en "X" suffiks som indikerer spesielle regler ved installasjon og bruk av utstyret. De som installerer eller inspiserer utstyret må ha adgang til innholdet i sertifikatet.
7. Installering og reparasjon skal bli utført av kompetent personale i samsvar med gjeldende regler.
8. Utstyret henspeiles til de følgelde materialer benyttet i konstruksjonen som:

Hus:	polycarbonate
Sensorhode:	rustfritt stål
Vindu:	polycarbonate

Utstyret kan ikke bli utsatt for forhold som kan degradere materialet.



ATEX
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11 APPROVALS AND CERTIFICATION continued

E

Instrucciones especificas para instalaciones de áreas peligrosas (con referencia a la Directiva Europea ATEX 94/9/EC, Anexo II, 1.0.6.)

Las siguientes instrucciones se aplican a equipos cubiertos por el certificado número Sira 00ATEX2001X:

1. Para cumplir con los requisitos de seguridad intrínseca, el equipo deberá ser suministrado solo por aparatos asociados, con una apropiada descripción de seguridad que igualen los parámetros de entrada detallados en el certificado.
2. El equipo no ha sido evaluado como una unidad relacionada con la seguridad (Directiva 94/9/CE, Anexo II, 1.5.1 to 1.5.8).
3. En aplicaciones del Grupo I, el quipo está certificado como Categoría M1.
4. En aplicaciones del Grupo II, el quipo está certificado como Categoría 1G y podrá ser usado con gases inflamables y vapores con aparatos del grupo IIA, IIB y IIC y con clases de temperatura de T1, T2, T3 y T4. El equipo no ha sido evaluado para ser usado con polvos inflamables.
5. El equip está certificado solo para usar en temperaturas ambientales dentro de un margen de –20°C a +60°C y no deberá ser usado fuera de este margen.
6. El número del certificado tiene un sufijo "X" el cual indica que se deben aplicar condiciones especiales de instalación y uso. Aquellas personas que realicen la instalación e inspección de este equippo deberán tener acceso al contenido del certificado.
7. La instalación y reparación deberá ser realizada de acuerdo con el código de practica indicado y por personal adecuadamente entrenado.
8. El equipo se basa en los siguientes materiales usados en su construcción:

Recinto:	polycarbonato
Cabeza detectora:	acero inoxidable
Ventana:	polycarbonato

El equipo no deberá ser expuesto a sustancias que puedan degradar estos materiales.

INSTALLATION & OPERATING DATA

PROTECTING THE ENVIRONMENT

Many of our products are often used to monitor the quality of environmental conditions consequently Trolex is also particularly aware of the need to protect human health and the environment in which we live.

The Company has instituted a radical environment protection policy to ensure that all aspects of our manufacturing programme have the minimum possible detrimental impact on the environment. This covers all stages beginning with sustainable product design supported by careful selection of the materials used in their production, through to managed recovery and disposal at the end of the useful life of a product.

This policy also incorporates the principles of the Waste Electrical and Electronics Equipment (WEEE) directive, and the associated Restriction of Hazardous Substances (RoHS) directive, to be implemented in EU countries.

Progress is already well advanced on the introduction of a completely new range of products that maximise the central principle of sustainable design with the intention of reducing the end-of-life cost to the end user.

All Trolex products are manufactured to exacting standards in accordance with our stringent quality control ethos. Having chosen to use one of our products will, in itself, guarantee extended durability and a long operating life, endorsed by our commitment to recycling and recovery.

- All packaging materials are carefully selected to be bio-degradable or re-cycleable where possible.
- All plastic materials are identified for recycling purposes and re-cycled materials are used where it is possible to do so.
- Printing paper and material are sourced from suppliers that have a declared environmental management system.
- Product design centred around high quality and long term durability. Modular architecture both in construction and software design suitable for future upgrades and adaptability to alternative duty.
- Ease of product disassembly, minimisation of fixing devices, and clear separation of functional parts to benefit re-use and re-cycling.
- Control and monitoring of suppliers of components and sub-assemblies. Deal only with uppliers that have a defined commitment to environmental monitoring principles.
- Control the use of restricted substances within the design process. Deal only with suppliers that have a defined commitment to the control of restricted substances.
- Provide an efficient high speed service within Trolex for repair, refurbishing and conversion of products for alternative duty.
- Provision of an end-of-life product Take-back service for recovery, re-use, and recycling of electrical and electronic components. Retain the packaging of a new product and re-use it to return the device to us at the end of its working life. Trolex will guarantee to recover all materials and components, where practicable and arrange for them to be re-cycled in an appropriate and in a safe manner.

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