RotoLevel LT

Non-Intrusive Level Measurement Transmitter

User Manual

S-359A

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Rototherm Support and Service

The equipment you have purchased has been built to the highest quality standards, and has been thoroughly tested before leaving our factory. It will give you many years of reliable and accurate service.

If you require additional information, or have any queries or problems, our technical staff will be pleased to assist.

For advice or information contact our Service Support Team:

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Company Registration Number: 2570730

Warranty

Rototherm Canongate Technology warrants your VesselCheck system hardware product against defects in materials and workmanship for a period of one year from receipt by end user. If Rototherm receives notice of such defects during the warranty period, Rototherm will either, at its option, repair or replace products, which prove to be defective.
Should Rototherm be unable to repair or replace the product within a reasonable amount of time, the customer's alternative recourse shall be a refund of the purchase price upon return of the product.

Exclusions

The above warranty shall not apply to defects resulting from: improper or inadequate maintenance by the customer; customer-supplied software or interfacing; unauthorised modification or misuse; operation outside the environmental specifications for the product; or improper site preparation and maintenance.

Obtaining Warranty Service

To obtain warranty service, the customer should contact Rototherm Canongate Technical support, as detailed at the beginning of this manual, or the authorised distributor through whom the product was purchased.

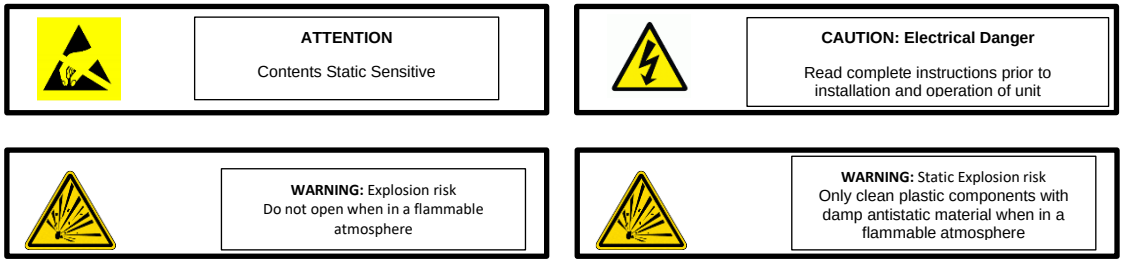
Obtaining Service After Warranty

If you are experiencing problems with your equipment after the warranty period, follow the procedures in the manual to determine whether service is required. If service is required, follow the procedure detailed for obtaining Warranty Service.

Notice

The information contained in this document is subject to change without notice.
Rototherm makes no warranty of any kind with regard to this material, including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose.

Rototherm shall not be liable for errors contained herein or for incidental or consequential damages in connection with the furnishing, performance, or use of this material.



1 Introduction

This manual has been written to support the RotoLevel LT software version V1.00 or above.

The RotoLevel LT is a highly versatile and non-invasive liquid level measurement system for use in either zone 1 or 2 in potentially explosive atmospheres. This manual details the installation, set up and operation of the RotoLevel LT. It also details the special precautions that should be taken when installing and using the RotoLevel LT in a potentially explosive atmosphere.

The processor unit drives a remotely mounted sensor attached to the outside surface of a vessel. The sensor transmits pulses into the monitored vessel. The reflections of the ultrasonic pulses from the liquid surface are detected by the sensor and communicated back to the processor unit. The time taken for an echo to be received from the liquid surface is measured electronically by the processor unit. This time is directly proportional to the distance to the liquid surface. Corrections for temperature variations are made either by a temperature compensated ultrasonic sensor (TIUP2) or a second ultrasonic sensor (Reference) fitted on the side wall of the vessel.

The system requires a 12..26Vdc electrical supply and is supplied with a user selectable 4..20mA or 0..5 volt analogue output and RS485 communications. The processor unit is supplied with an integral LCD display for local indication.

The processor unit is certified flameproof Ex db [Ex ia] and the ultrasonic sensor is certified encapsulated Ex ia. Details of the ATEX and IECEx certificates are listed below.

2 Technical Specification

2.1 Controller

Environmental Protection	IP66
Power	12 to 26VDC 100mA
Material	Powered Coated Aluminium
Weight	2.5KG
Size	138x147x144
Operational Temperature	-10 to 40°C
Entries	¾” NPT
Maximum Cable Distance from Sensor	20m
Analogue Output	4..20mA or 0..5Volts
RS485 Serial Communications	RTU
Sensor Connection	M12 Female Waterproof Connector

2.2 Ultrasonic Sensor (TIUP2)

Environmental Protection	IP67
Material	Acetal / Tufnell
Weight	0.4 KG
Size	60mm x 38mm
Operational Temperature	-10 to 40°C
Cable Length	5m
Connection	M12 Male Waterproof Connector

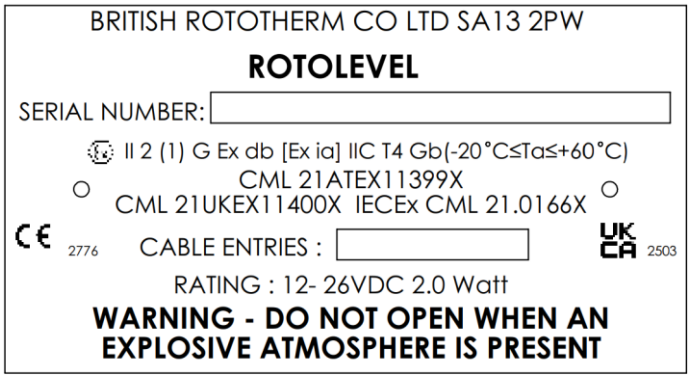
2.3 Certification and Compliance

2.3.1 EMC

- EN61326-1:2013 Electrical equipment for measurement, control and laboratory use
- EN 301 489-17 V3.2.4:2020 - ElectroMagnetic Compatibility (EMC) standard for radio equipment and services - Part 17: Specific conditions for Broadband Data Transmission Systems - Harmonised Standard for ElectroMagnetic Compatibility

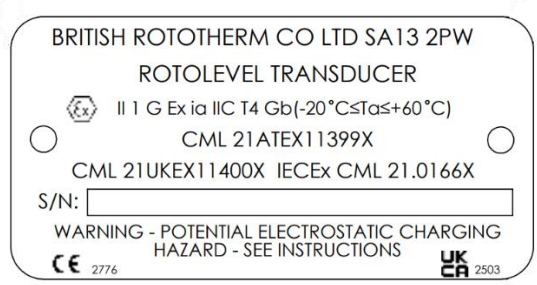
2.3.2 Hazardous Area Classification - Controller

Marking	Certificate	Standards
Ex II 2 (1) G Ex db [Ex ia] IIC T4 Gb (-20°C≤Ta≤+60°C)	CML21ATEX11399X CML21UKEX11400X IECEx CML 21.0166X	EN IEC 60079-0 Ed 7 EN IEC 60079-1 Ed 7 EN IEC 60079-11 Ed 6



2.3.3 Hazardous Area Classification - Ultrasonic Sensor (TIUP2)

Marking	Certificate	Standards
II 1 G Ex ia IIC T4 Gb (-20°C≤Ta≤+60°C)	CML21ATEX11399X CML21UKEX11400X IECEx CML 21.0166X	EN IEC 60079-0 Ed 7 EN IEC 60079-11 Ed 6



3 Installation

The certification of the RotoLevel LT installation is NOT covered by these notes, which are for guidance only. All work must be in accordance with the codes of practice and other safety procedures, based on local and national standards, which apply to the use of electrical equipment at the location in which the RotoLevel LT is installed. Installation should only be carried out by competent individuals.

Before use the RotoLevel LT must be free from mechanical damage and certification checked as suitable for the application and area in which it is to be used. Certified apparatus should not be modified in any way.

When installation work is completed no electrical supply should be connected until all work relating to the apparatus has been approved. Approval should be provided by a competent person authorised to certify that the apparatus is ready for use and satisfies the certification as detailed on the product label.

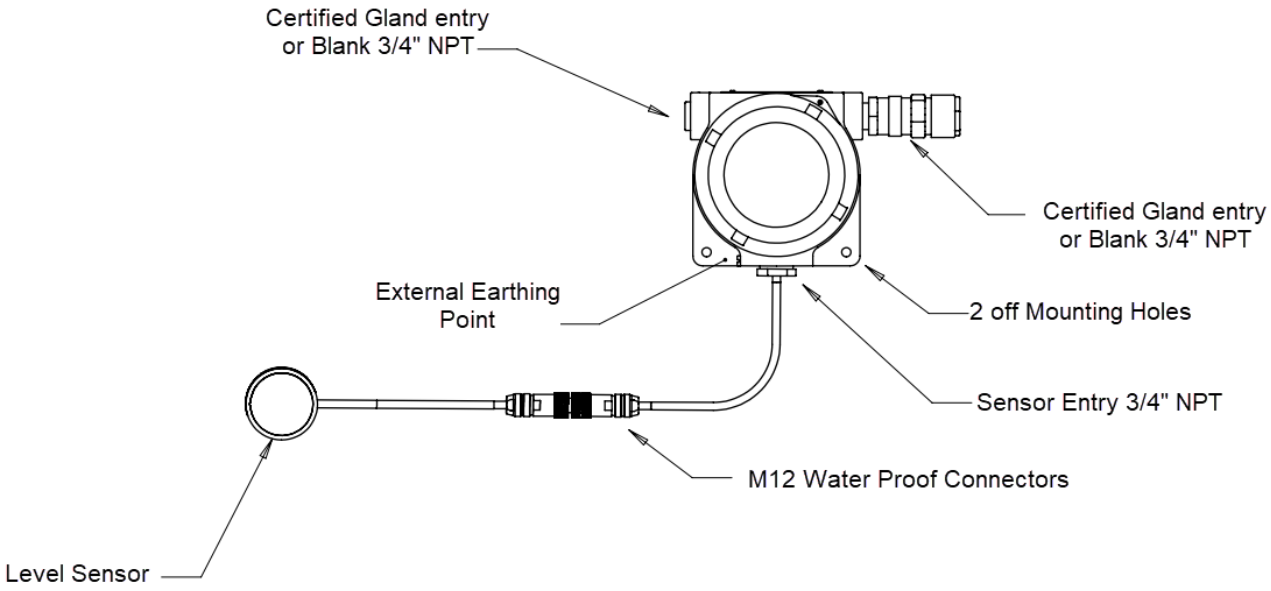
Exposure of the RotoLevel LT to direct sunlight should be such that the heat gain due to absorption of radiant energy does not cause the equipment temperature to exceed the maximum stated for the device. In addition, heat conduction from the process or environment must not cause the RotoLevel LT to operate outside of the stated ambient temperature limits.

The signal processor unit and sensor are supplied with M12 waterproof connectors, these must not be removed or tampered with and should only be connected as directed to in this manual. Each sensor is supplied with 5 meters of cable and M12 male connector. The sensor can connect directly into the signal processor unit, to a Sensor Interface Module (RL-011) or to a 5 meter sensor extension cable (RL-005). It is recommended that no more than one extension is used per sensor.

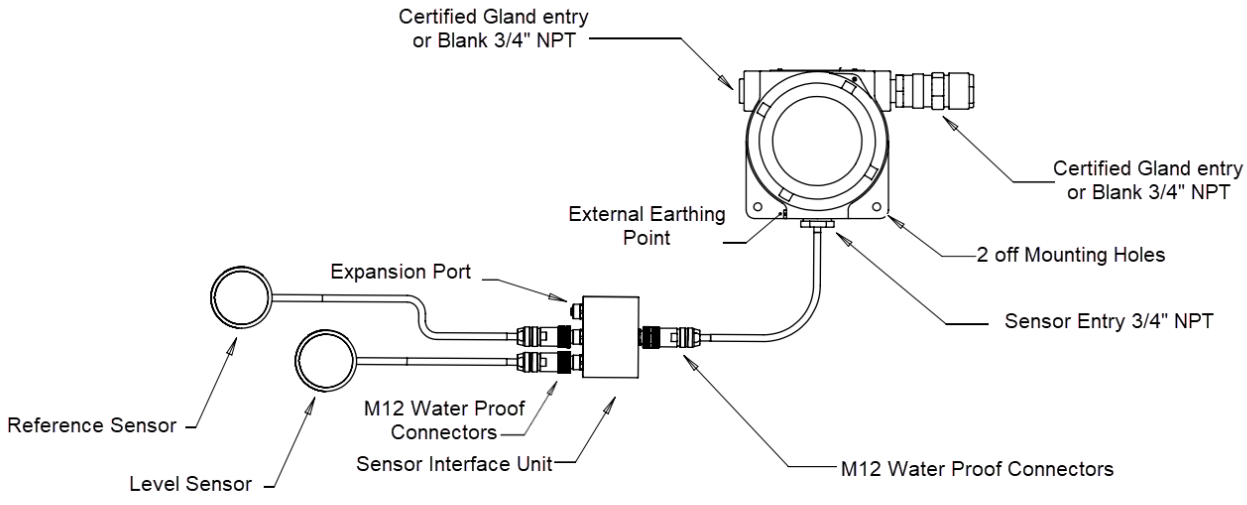
The system will be fitted with either a line bushing or gland at the sensor entry point. This will be sealed with a small bead of thread sealant and should not be removed or loosened.

Typically the RotoLevel will be connected to a RotoHub to transfer data to our portal (RotoData). The RotoHub will also allow for seamless remote support and maintenance of the RotoLevel. Up to 5 RotoLevel’s can be connected to a single RotoHub.

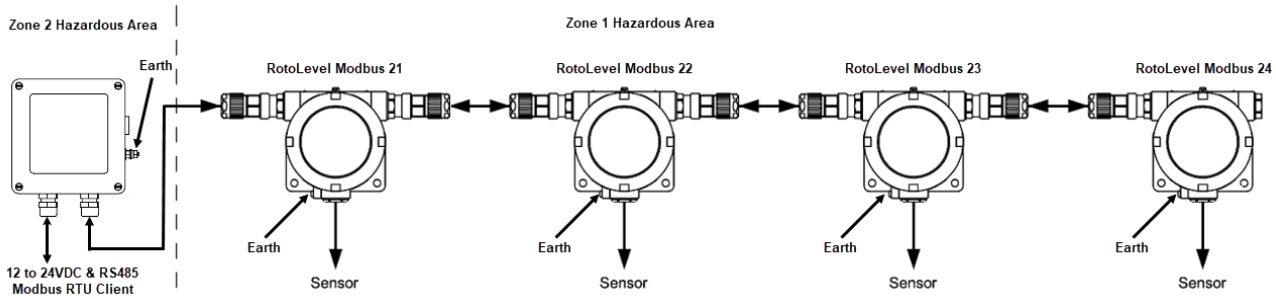
3.1 System Layout Single Sensor



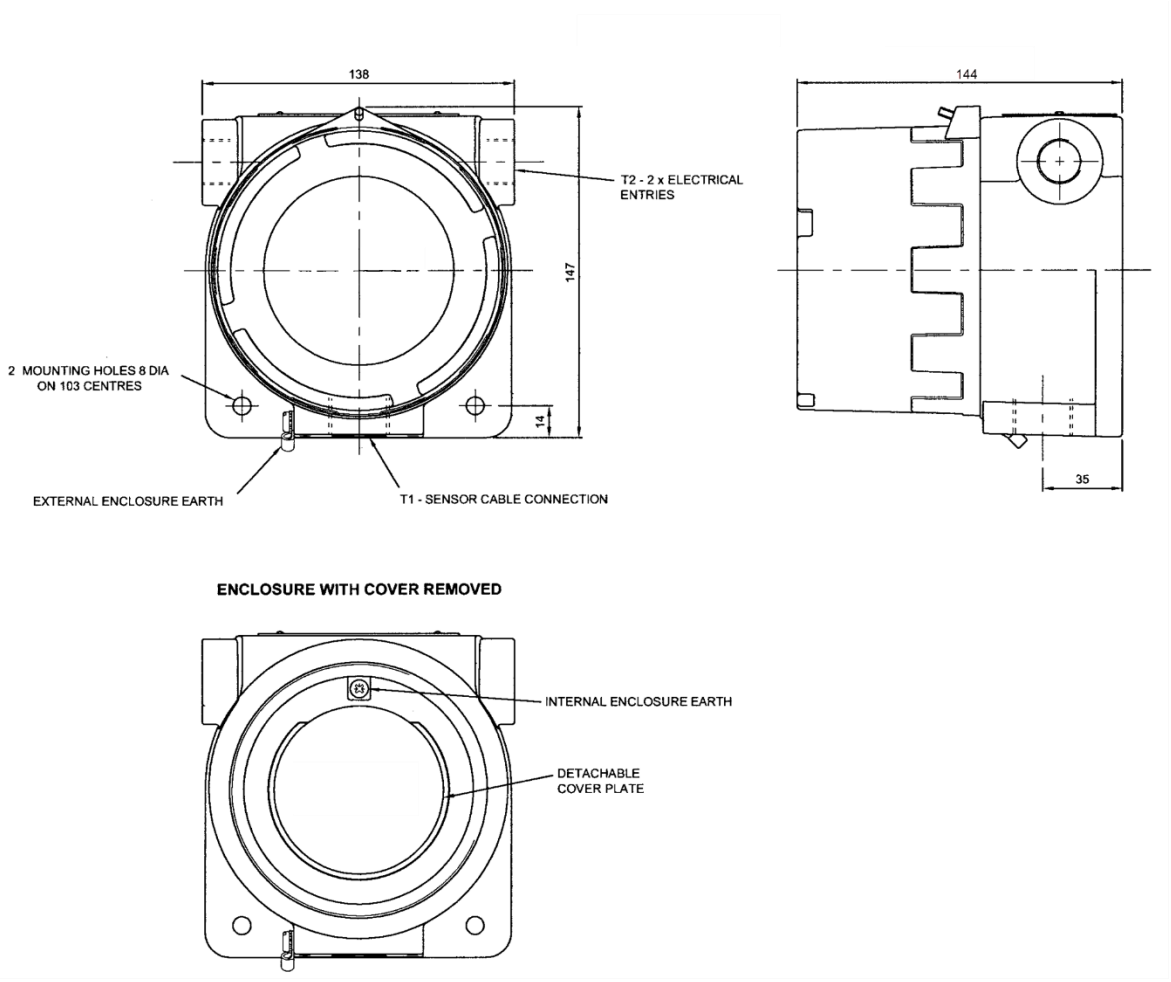
3.2 Dual Sensor (Reference) Layout



3.3 Multiple Processor Layout



3.4 RotoLevel LT Processor Dimensions



3.5 Installation Equipment

The following items will be required before you can begin the installation and calibration of the system:

- Structural Adhesive: Loctite 326 with Activator N7469
- Silicon rubber sealant
- Paint remover (where vessels are painted)
- Cleaning solvent / degreaser
- Abrasive paper
- Male USB A to Male Mini USB B Cable
- RotoLevel Setup Program

Items that may be useful during installation:

- Basic hand tools
- Marker pen
- Paper towel roll

3.5.1 RotoLevel LT Processor Unit Installation

Location: Select a suitable location to mount the unit away from sources of electrical interference and excessive vibration. Mount via the 2 holes in the flange of the enclosure. It is recommend that the processor unit is mounted in a shaded area at eye level.

Opening and closing the enclosure: The screw cover is locked in place by a socket screw. Loosen but do not remove this screw, then the cover can be removed for access to the internal connections.

The enclosure screw cover and mating enclosure threads are precisely dimensioned to meet certification requirements. Both cover and mating enclosure threads must be protected from damage when separated.

The screw cover, cover O ring, enclosure threads and faces must all be clean prior to final closure. A small amount of non-setting grease may be applied to mating threads and the O ring. Ensure the grease used is compatible with the enclosure material, cover O ring and the location in which the RotoLevel LT is installed.

The screw cover should be carefully mated with the enclosure and should rotate smoothly by hand until the machined faces tend to compress the O ring. Hand tight should be sufficient, however, to close the cap more securely use a bar, such as the edge of a spanner, across the screw cover castellations. Maximum torque need not exceed 20 Nm (15 lbf ft).

After closing, lock the screw cover in place with the socket screw.

Field wiring: Connections T2 (typically ¾” NPT) on drawing 2.2 are for field wiring. The electrical entry threads of the Ex d enclosure form potential flamepaths and are precisely dimensioned. The utmost care should be taken not to damage the threads.

Always use a suitable electrical entry device. Consider the area of installation, IP rating of the enclosure, type of protection and cable type. Certified cable entry devices must be used in a potentially explosive atmosphere.

Flameproof cable entry devices should be suitable certified Ex d IIC flameproof and may be used with a suitable certified Ex d IIC flameproof thread adapter. Unused entries should be fitted with suitable certified Ex d IIC flameproof stopping plugs. Flameproof cable entry devices, adapters and stopping plugs must be certified as IIC equipment (not a component) under an EC type examination certificate.

Sensor connection: All sensor connections must be made using the supplied M12 connectors, cables should only be extended using a approved extension cable part number RL-011. It is recommended that no more the one extension is used on each sensor.

Warning: The sensor line bushing or gland must always be at the base of the enclosure as supplied, removing the line bushing or gland may invalid the hazardous area approval for this apparatus.

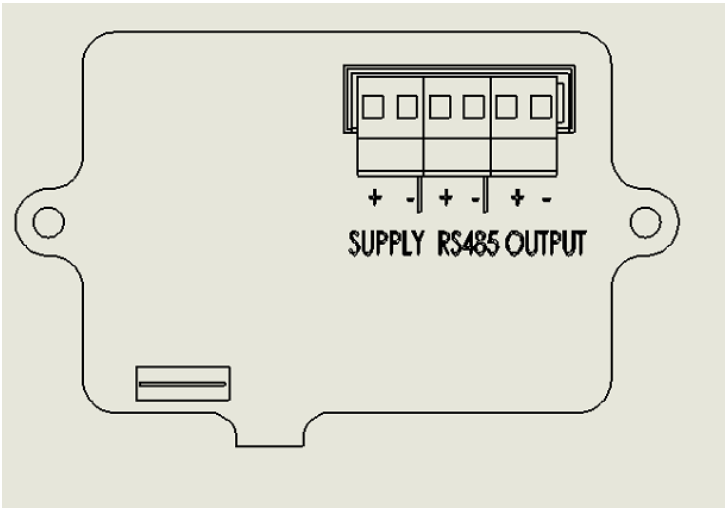
3.5.2 Electrical Connections

To access the electrical connections remove the screw cover from the processor unit following the instructions in section 2.4.

Remove the display cover by sliding vertically upwards.

Carefully remove the display by unscrewing the two M4 pan head screws, disconnect the display board from the ribbon cable and remove the 6 way socket.

Place the display board to the side in a dry and dust free area, make connections as detailed in the table below. All cores must be terminated with the appropriate crimps to suit the installation cable conductor size.



RotoLevel Terminal	RotoHub Terminal	Description
SUPPLY +	12-24V OUT +	Power Supply + (12 - 26V d.c.)
SUPPLY +	12-24V OUT -	Power Supply – (0V)
RS 485 +	RS485 HOST +	RS485 Communications + (RTU)
RS 485 -	RS485 HOST -	RS485 Communications – (RTU)
OUTPUT +	N/A	Analogue Output + (4..20mA or 0..5V)
OUTPUT -	N/A	Analogue Output – (4..20mA or 0..5V)

Analogue Output Connections

The analogue output can either 4..20mA or 0..5Volt, the 4..20mA is an active output.

Power Connection
The unit will work over a supply voltage range of 12Vd.c. to 26Vd.c., however a regulated 24Vd.c. supply is preferred. Cable drain wires must be connected to the earth screw on the base of the enclosure.

External Earth (Ground) Connection
An external earth (ground) connection must be attached to the instrument enclosure, via the supplied eye crimp.

Once the connections have been made in the socket, carefully refit the ribbon cable and socket into the display board and secure back in place with the two pan head screws.

3.5.3 USB Connection

The USB Micro Type B plug is connected via the socket on the bottom lefthand conner of the processor board. Care must be taken when fitting the USB as excess force may damage the socket.

DO NOT POWER UP THE ROTOLEVEL LT WITH THE ENCLOSURE COVER REMOVED IF A FLAMMABLE ATMOSPHERE IS PRESENT.

3.5.4 Gland Entries

Enclosure Style	Field Wiring	Sensor
Aluminium	¾”NPT	¾”NPT

3.6 Sensor Installation

To satisfy certification requirements the transducer must not be subjected to any external source of heating or cooling outside the stated ambient temperature limits.

The sensor has to be bonded to the vessel to ensure an effective acoustic coupling that conducts the sensor’s ultrasonic signal through the vessel wall and into the monitored liquid. Sensors cannot be dry coupled.

Once the sensor has been permanently bonded to the vessel it cannot be removed without damaging it.

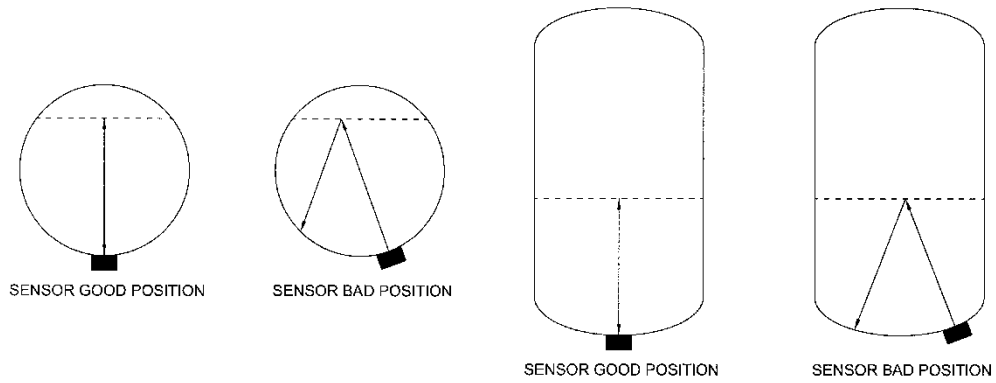
For test purposes the sensor can be used with coupling grease that will allow removal and repositioning.

3.6.1 Sensor Positioning

To ensure optimum performance, it is imperative that the ultrasonic sensor is installed in the best location on the vessel. Carefully study the sensor location diagrams below. An angle of up to 2° from horizontal is usually satisfactory, however the smaller the angle the better the signal will be. An angle finder or spirit level can be used to find the best position.

The sensor must not be placed over welds or irregularities on the vessel surface. Ensure the sensor is not placed below filling points or where an obstruction may be directly in the line of fire of the sensor.

On applications where there is a high level of sludge build up in the tank it may be best to locate the sensor near the outlet. The higher flowrate near the outlet typically has less sludge build up.



3.6.2 Sensor Mounting

The sensor should be bonded to the vessel surface with structural adhesive, typically Loctite adhesive 326 and Activator 7649, section 2.5.3

If the sensor is not to be permanently bonded then a clamping arrangement will be required to hold the sensor. When using this arrangement a heavy duty grease will be required to couple the sensor to the tank.

Warning: Personal Protection Equipment must be worn when preparing the surface and adhering the sensor, minimum protection gloves and goggles.

3.6.3 Adhesion using Loctite 326 and Activator N7469

The adhesive will cure best when warm, so when working in a cold environment keep the adhesive warm until applied.

- Ensure the tank surfaces are clean and free from paint, rust, dirt and grease. Use an abrasive to remove paint and corrosion.
- Degrease both the sensor and vessel surfaces with a solvent cleaner. The cleaner must not leave a residue, must be compatible with the adhesive and the sensor surface.
- Follow the adhesive manufacture's instructions for the best possible bond and safety instructions.
- The best bond for conducting the ultrasonic beam is as thin as possible. The joint must be completely filled with adhesive with no bubbles or voids.
- Apply the adhesive to the sensor and mating surface. Lightly press the sensor onto the vessel surface and rotate backwards and forwards slightly, 4 or 5 times, increasing the applied pressure on each rotation. Maintain the applied pressure until the sensor is bonded.

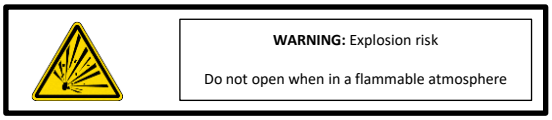
It is recommend that a silicon sealant should be used to form a continuous sealing fillet around the joint between sensor and vessel, also any bare metal surfaces must be repainted.

3.6.4 Fixing with Clamp and High Density Grease

On applications where the sensor is to be secured with a clamp, a high density grease must be used to ensure a reliable sensor coupling, recommended part CONS1635. The clamping arrangement must be spring tensioned, to ensure the sensor does not work loose. The grease should cover the complete sensor face with a thickness of no more the 1 mm.

4 Configuration

Once the equipment is installed it's simply configured using the RotoLevel Setup program running on a Windows 10 PC . The PC can either connect via Bluetooth, RS845 serial port or the MICRO USB B port .



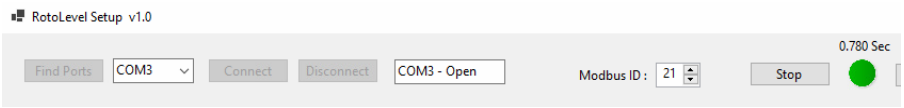
DO NOT OPEN THE ROTOLEVEL LT ENCLOSURE IF A FLAMMABLE ATMOSPHERE IS PRESENT.

4.1 Serial Connection

With your PC connected to the Rotolevel via the RS485 serial terminal, run the SetupRotoLevel program.

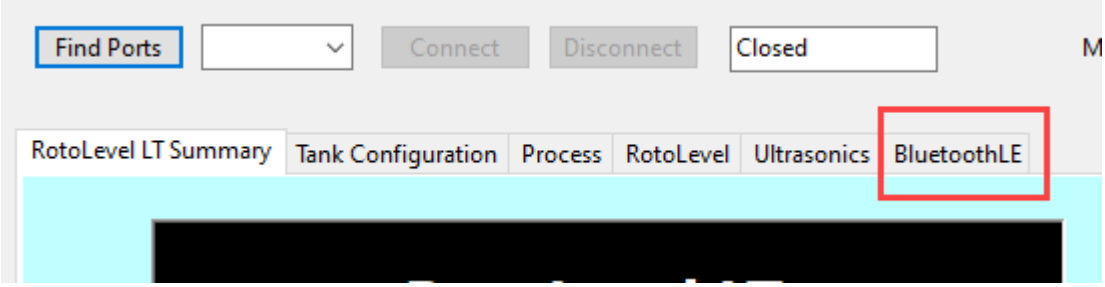
Click on the Find Ports button on the top left hand corner of the program, select the associated Coms Port in the drop down list and click on the Connect button. Select the modbus ID from the scroll list. The default Modbus Address will be 99 when supplied from the factory, if the instrument has been previously commissioned the Modbus address will be set in the range of 21 to 30 and can be seen in the top left hand corner of the RotoLevel. Click on the communications Start button, when a connection is established the status indicator will flash Green, a flashing Red indicator signifies that a connection can not be established, check the following.

- The correct Modbus address has been selected
- Try swapping the RS485 + & - connections
- The correct COM port is selected

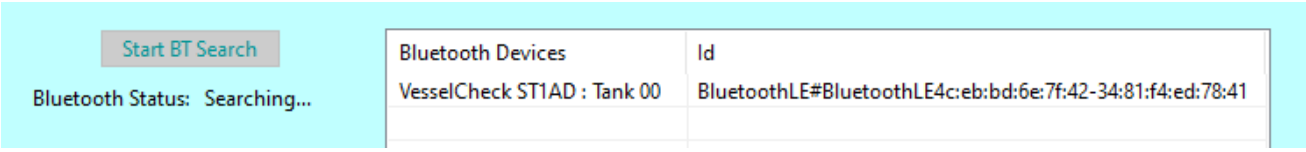


4.2 Bluetooth LT Connection

Select the Bluetooth LT Tab



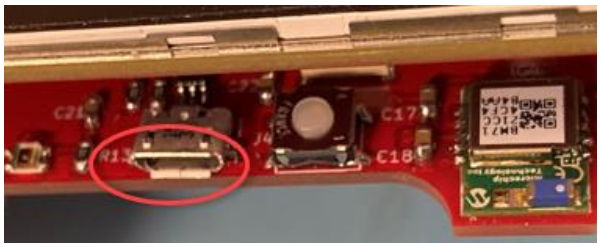
Click on the Start BT Search Button, when a device has been found it will be shown in the table shown.

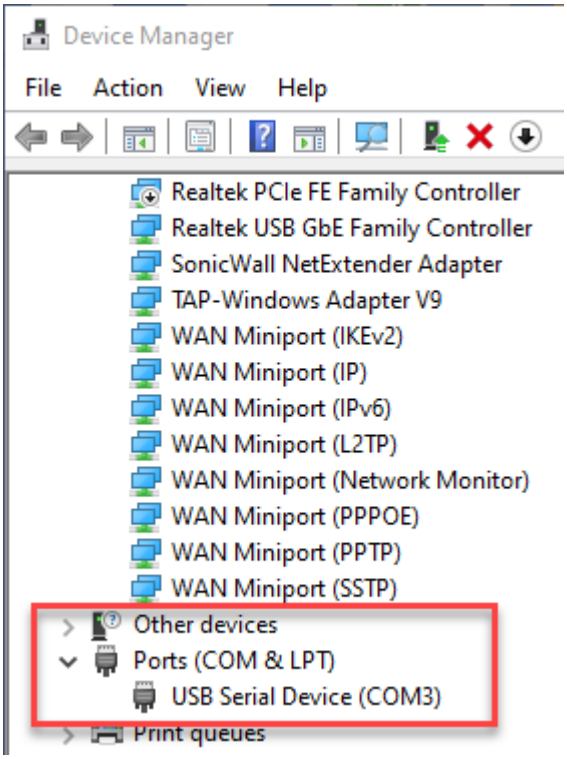


Double click on the require device to activate the connection, once the connection has been established click on the Start communications button.

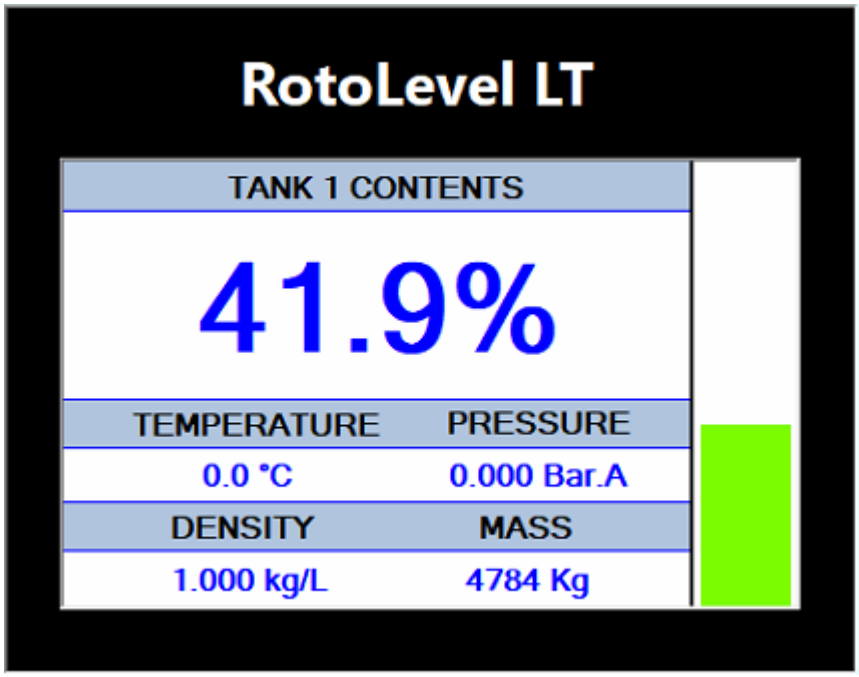
4.3 MICRO USB B Connection

Connect the MICRO USB B cable to the port shown, select the associated USB COM port, the COM port is defined in Windows Device Manager. Click on the Connect button and Start the communications

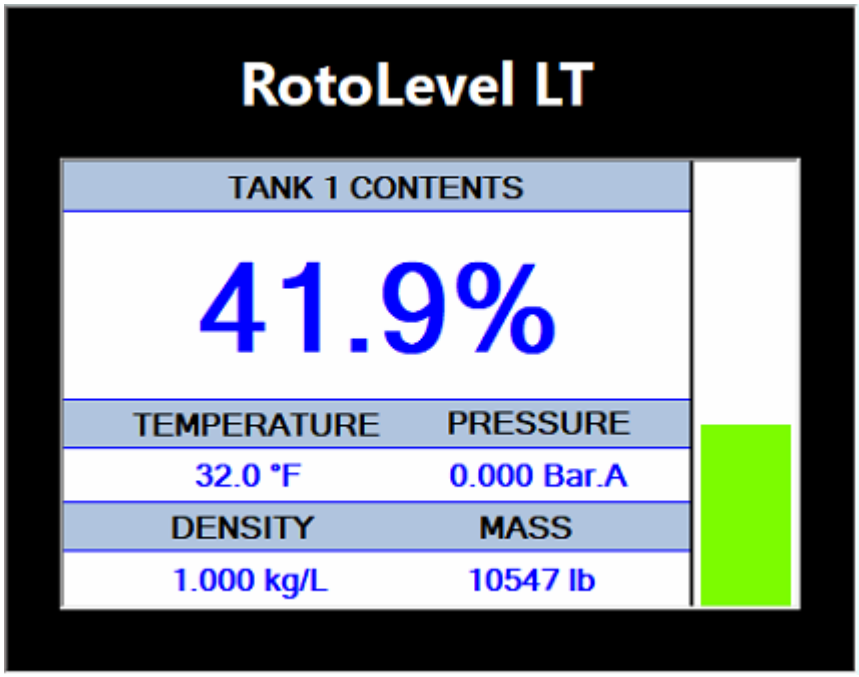




4.4 Main Screen (Metric Units)

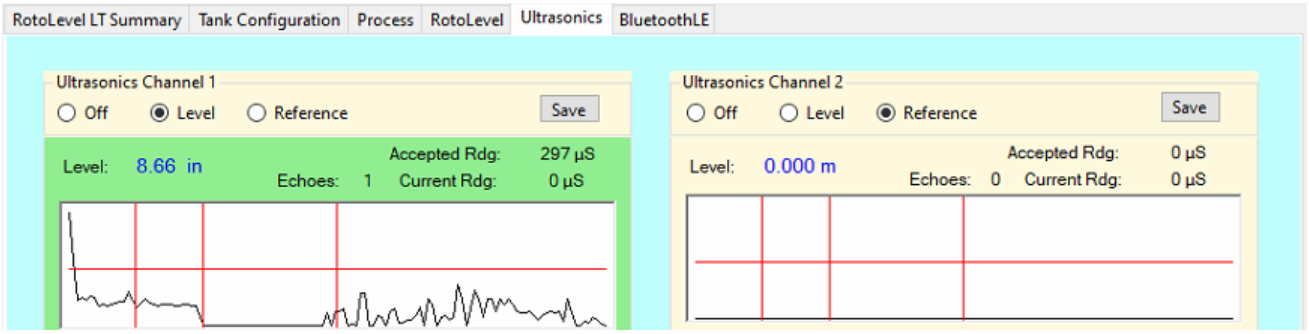


4.5 Main Screen (Imperial Units)

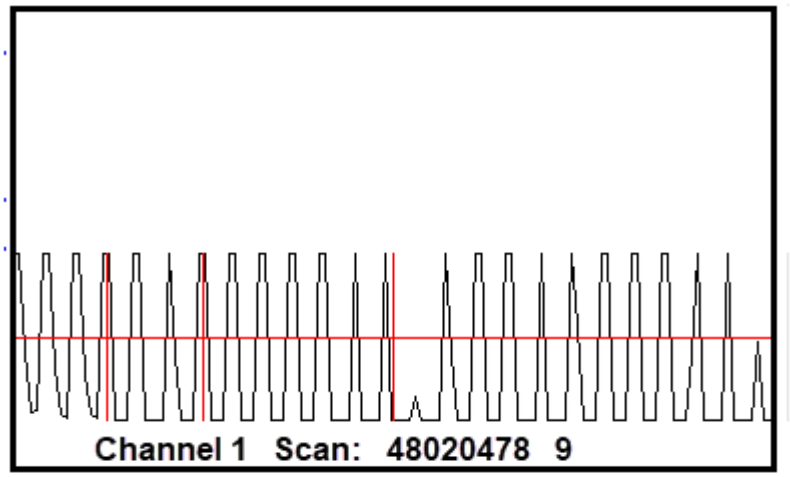


4.6 Frequency Scan

Once the sensor has been fitted a frequency scan MUST be preformed to match the sensor to the tank wall. Select the Ultrasonics Tab, select the required ultrasonic sensor and click on the Frequency Scan button, confirm the operation by clicking Yes. When the frequency scan is in progress the RotoLevel screen will display a signal graph, as shown below. When complete the RotoLevel screen will return to the Main Screen as shown in earlier.

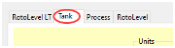


Sensor Selection

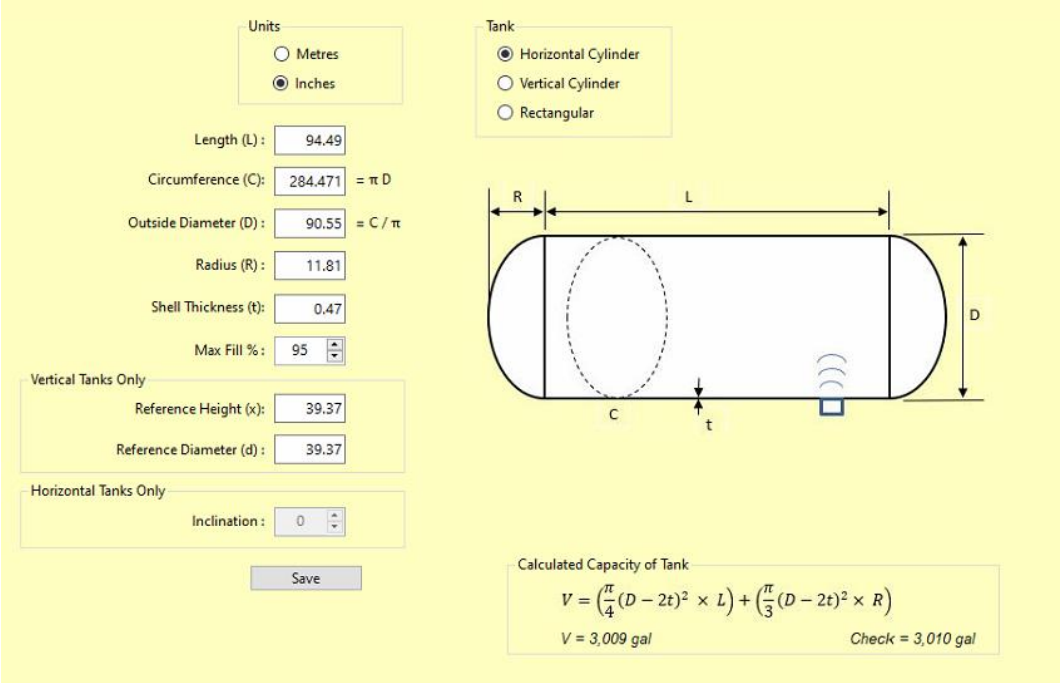


Frequency Scan

4.7 Tank Configuration Tab

With a successful connection, select the Tank Tab. 

- Select the Orientation
- Select the Units of Measurement
- Enter the tank dimensions in the appropriate units
- Click on the Save Button



If metric units (Meters) are selected, the main screen will display:

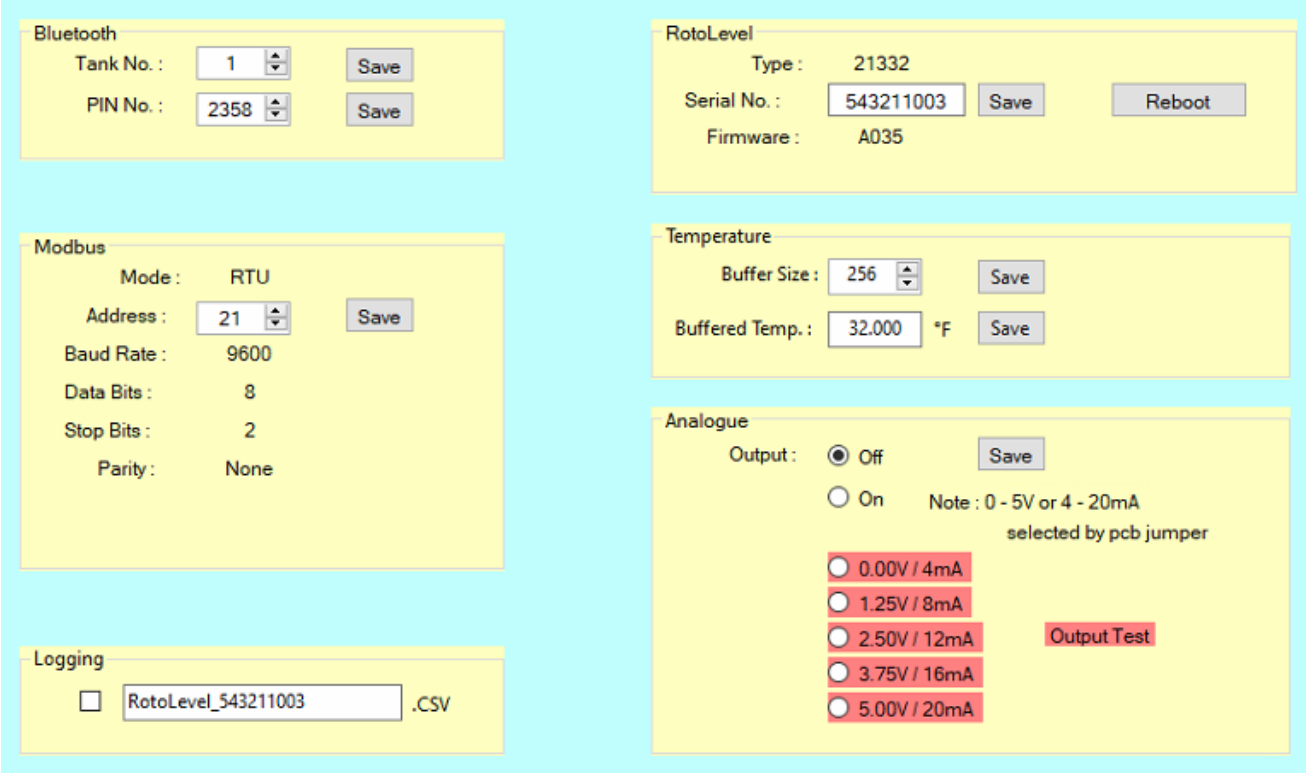
- Height in Meters
- Volume in Litres
- Weight in KG
- Temperature in Centigrade

If imperial units (Inches) are selected, the main screen will display:

- Height in Inches
- Volume in US Gallons
- Weight in Pounds
- Temperature in Fahrenheit

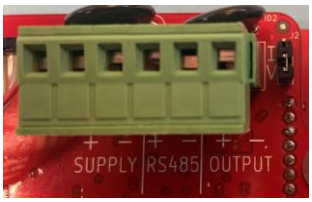
4.8 RotoLevel Configuration Tab

The analogue output, Modbus Address and Temperature Buffer are setup in this screen.



4.8.1 Analogue Output Configuration

The analogue output can be either 4..20mA or 0..5V, selected by jumper J2 on the CT118 Card (I = 4 to 20mA and V = 0..5 VDC). 0% = 4mA or 0V, 100% = 20mA or 5V. The output function is activated by selecting the On radio button and saving the change.



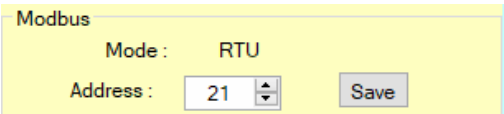
4.8.2 Analogue Output Simulation

The analogue output can be simulated by selecting the appropriate radio button and clicking on the Save button.

NOTE: Once the test has been completed the On Radio Button <u>MUST</u> be selected and <u>Saved</u> to disable the test.

4.8.3 Modbus Address

The Modbus address can be altered under the RotoLevel Tab, select the required address and save the change.



NOTE: No other port connection can be altered.

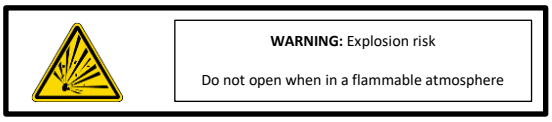
WARNING: The Modbus address must be unique, no other instruments on the RS485 link may have the same address.

5 Maintenance

5.1 General Safety

Maintenance should only be carried out by competent individuals. If maintenance of a certified enclosure is required contact Rototherm before attempting repair or replacement of parts.

Secure arrangements must be made to ensure that an electrical supply cannot be connected to the circuits feeding into or from the RotoLevel LT during any period when the front cover or electrical entry glands are not fully secured.



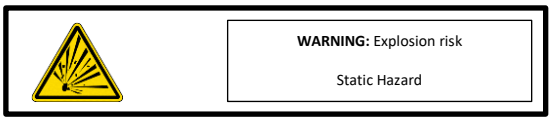
DO NOT OPEN THE ROTOLEVEL LT ENCLOSURE IF A FLAMMABLE ATMOSPHERE IS PRESENT.

5.2 Periodic Inspection

Periodic inspection of apparatus used in potentially explosive atmospheres should be carried out to ensure that equipment is free from corrosion, damage or contamination that would affect certification.

5.3 Sensor Cleaning

To avoid the potential of electrostatic charging hazard the sensor should only be wiped with a damp anti static cloth.



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5.4 Sensor Regreasing

If the sensor grease has dried, then both surfaces must be cleaned thoroughly before refitting as detailed in the installation section.