

Installation and operating manual

KMS-2 Exia Magnetostrictive Level Transmitter

Please retain for future use



KMS-2/Exia Transmitter

Installation and Operating Manual



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Symbols Used

The following symbols are used in these operating instructions:



Warning: If ignored injury or damage to property can occur.

Danger: If ignored serious injury or damage to property can occur.

Caution: Failing to comply with these instructions can lead to malfunction of or damage to the Level Transmitter.



Ex Applications

Instructions which must be complied with when the unit is used in potentially explosive environments and to meet the requirements of the EC type examination certificate.



Information

Facts and information concerning proper operation of the KMS-2 Level Transmitters



Instructions for electrical installation

Information on proper electrical installation.



Safety information

Read these instructions before installation and putting into operation.

Installation commissioning and maintenance should only be carried out by suitably qualified personnel in conjunction with these instructions.

Comply with the relevant safety regulations when using the equipment.

The transmitter must not be modified as this will invalidate the warranty and or the product certification.

Measures must be taken to prevent risks to persons and property in the event of a defect.

Do not operate the Level Transmitters in the immediate vicinity of strong electromagnetic fields (minimum distance: 1 m) as this may give rise to incorrect readings.

Comply with the maximum current and voltage ratings as stated in the technical data section.

For intrinsically safe applications installation of this unit must be in compliance with the applicable National requirements i.e. EN60079-14.

Introduction

A 4-20mA loop powered transmitter for measuring the level of liquid in a vessel either directly (immersion application) with an annular float, or indirectly by mounting on a magnetic level gauge. The Exia intrinsically safe version can be used in all hazardous area zones when connected through an approved isolation barrier.

The transmitter consists of a stainless steel tube, containing the Magnetostrictive measuring element, and an stainless housing containing the electronic circuit boards.

The unit operates by sending an electrical pulse down the sensing element; the resulting magnetic field reacts with the field from the magnetic float to produce a return signal. The time taken for the return signal to be detected enables a level measurement to be made since the precise velocity of the return signal along the sensing element is known.

Outputs

LCD Indicator: When fitted the display provides local indication dependent on the display mode as shown in table 1

Mode	Function	Display Mode* ¹		
		% Range	mA	PV (mm)
NORMAL	Measuring	0.00/100.00	4.00-20.00	Actual distance in mm from reference point
Fixed Output	Zero	0.00	4.00	Distance to Zero point
	Span	100.00	20.00	Distance to Span point
CALIBRATION	Start	CAL	12.00	CAL
	Zero set	CAL	12.00	CAL
	Span set	CAL	12.00	CAL
Fault signalling current setting	Downscale Set	AL.Lo ^{*2}	3.58 ^{*2}	AL.Lo ^{*2}
	Upscale Set	AL.hi ^{*2}	22.00 ^{*2}	AL.hi ^{*2}
Alarm	Low Level^{*3}	ERR.L ^{*3}	3.8 ^{*3}	ERR.L ^{*3}
	Downscale^{*4}	AL.LO	3.58	AL.LO
	Upscale^{*4}	AL.HI	22.00	AL.HI

Table 1
LCD indication

*¹ The standard display mode is % range, alternate modes available on request

*² Analogue output remains at last measurement value during setting (Rev 5 Onwards)

*³ When enabled by front panel switch, else will remain at 4mA until float no longer sensed.

*⁴ Alarm action, set as required (Default upscale).

Analogue Output: The process variable and error status are transmitted over the current loop with values as shown in table 2.

LED's: Provide local indication during calibration when the optional LCD is not fitted.

Mode	Function	Outputs		
		ANALOGUE	Zero LED	Span LED
NORMAL	Measuring	4-20mA	Off	Off
Fixed Output	Zero	4mA	On	Off
	Span	20mA	Off	On
Fault Signalling Current Setting	Downscale	4-20mA	Flash	Off
	Upscale		Off	Flash
CALIBRATION	Start	12mA	Flash	Flash
	Zero set	12mA	On	Off
	Span set	12mA	Off	On
Alarm	Low level	3.8mA	Off	Off
	Downscale	3.58mA	Off	Off
	Upscale	22mA	Off	Off

Table 2
Instrument output status indication



The Low Level alarm must be enabled as shown in the configuration section. When set the output signal will change to 3.8mA if the float drops more than 13mm below Zero point.

Installation General

Magnetic Level Gauge Applications

The unit should be fitted to the level gauge with reference to Fig1 using the mounting clips and insulation (if required) supplied. The unit should be positioned such that the XXXX marks around the circumference align with the upper and lower vessel connection points.

Ensure that the sensing tube is not distorted or strained during installation

The fixing clips should be spaced evenly along the length of the tube with a maximum centre distance 1000mm



If it is required to remove the transmitter for maintenance work ensure that any insulation is correctly fitted during reassembly to ensure operating temperatures are maintained within the range specified on the EC type approval certificate.

Immersion or in tank installation

The transmitter should be fitted to the tank with reference to Fig.2. The distance between the tank connection and electronic housing will vary dependent on temperature and for a weld on connection be factory set.



Caution

When using an adjustable sealing gland ensure that the maximum ambient temperature for the electronic housing is not exceeded. (See technical data section).

Dependent on the length of the sensor tube an anchor point may be required at the bottom of the tank.



Where the transmitter is supplied with an adjustable gland care must be taken to ensure that the electronic housing temperature is maintained within that specified on the EC type examination certificate. Please consult the sales office

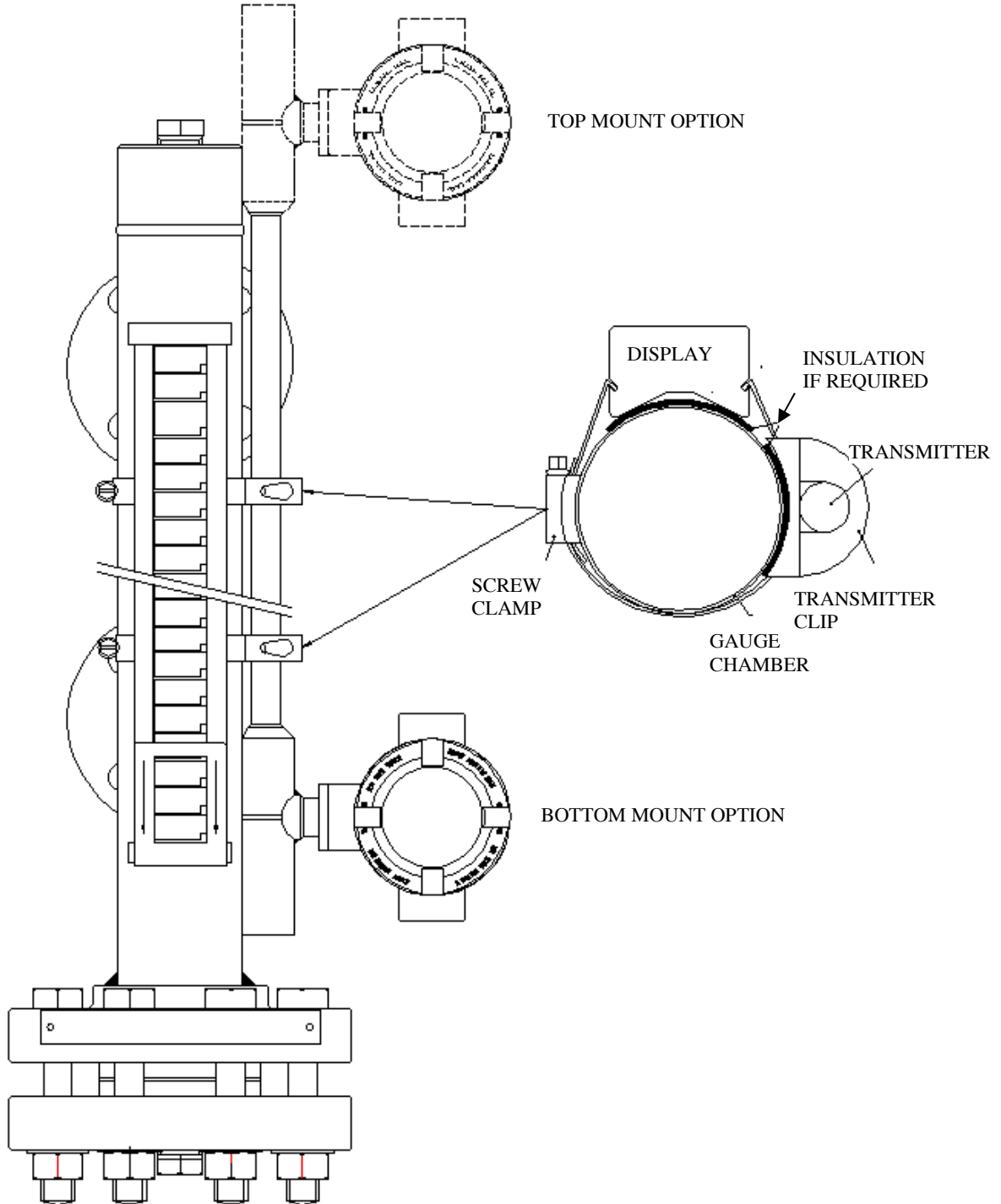
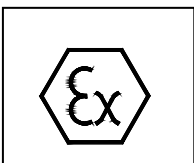
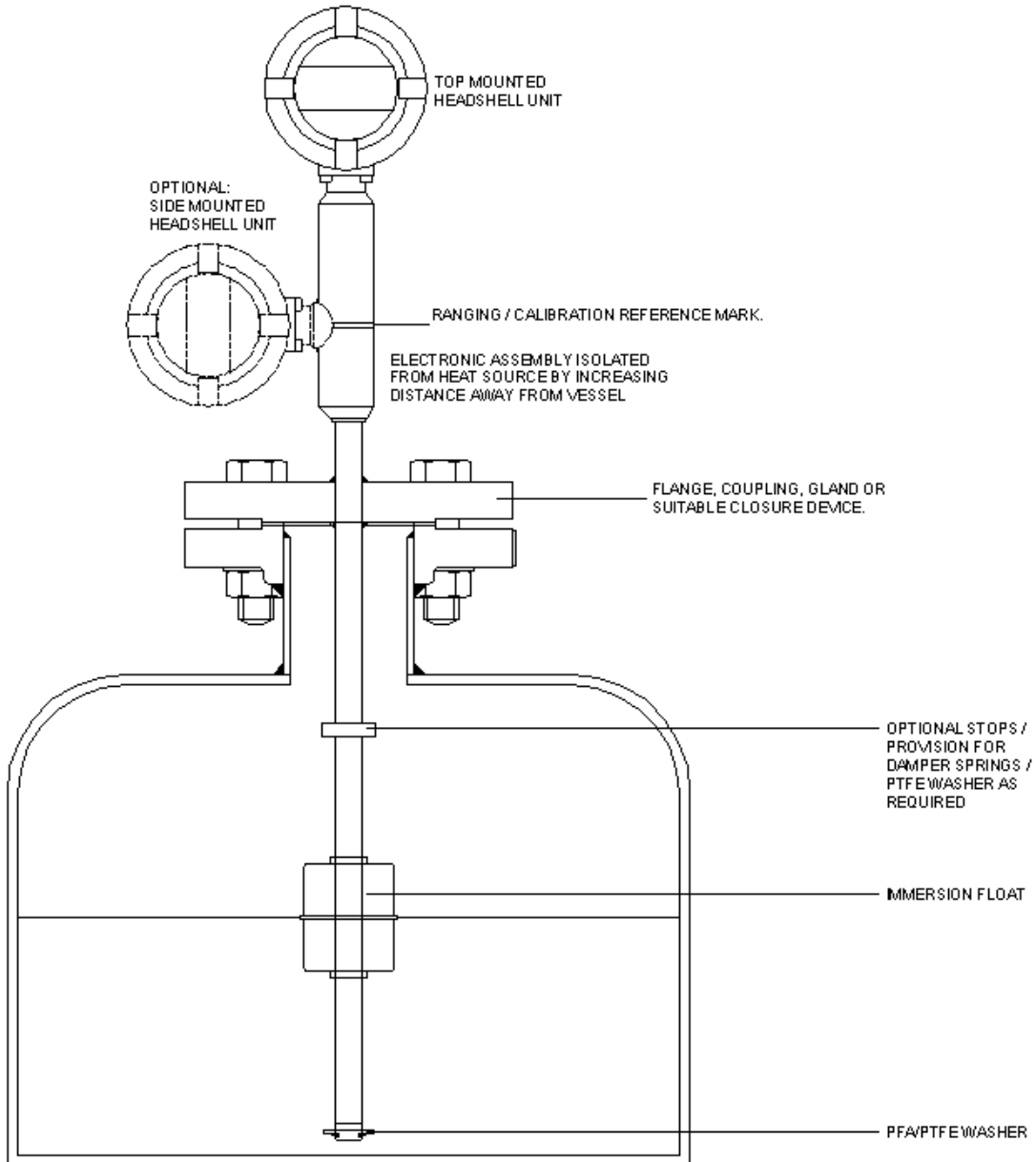


Fig 1
 Typical Installation When Fitted to Magnetic Level Gauge



Ensure that the PFA/PTFE washer is correctly fitted to prevent the risk of sparking if the float was to hit the stop.

Ensure that the electronic assembly is maintained within the certified ambient temperature range consult sales office to determine correct offset.

Electrical Connections

Unscrew the lid to gain access to the rear terminal enclosure; the terminal block can then be removed to facilitate connections.
 Select the correct cable entry point dependent on the orientation of the sensor. The connection cable should be bought in through an M20 gland suitable to maintain the required IP rating, and then connected to the + and – terminals.
 To prevent the risk of moisture ingress ensures that the connection cable is led downward in front of the cable gland

Cable Selection

The connection cable should be a twisted pair type suitable for the expected ambient conditions.
 When a screened cable is used, the screen should be connected to the internal earth connection provided.



Hazardous area Installation

The installation of this unit must be in compliance with the applicable national requirements
 i.e. EN60079-14.

Intrinsically Safe Circuits

The connection cable shall be identified to prevent confusion with non-intrinsically safe circuits where a colour code is used it should be light blue.
 The total inductance and capacitance of the cable shall not exceed the values stated on the intrinsically safe control device for the required gas group.
 The connection cable should be bought in through the M20 cable entry via a suitable gland as necessary to maintain the required IP rating (minimum IP54).

When refitting the lid ensure that the sealing gasket is correctly fitted into the lid recess.

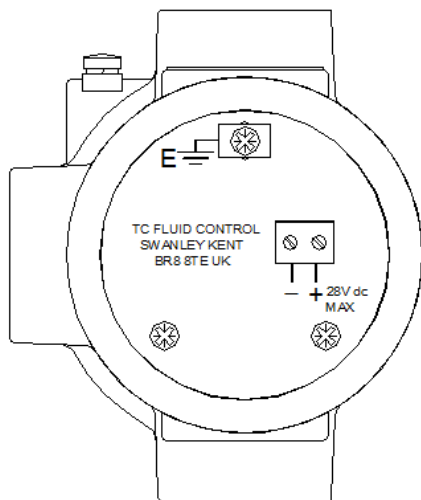


Fig 3 Cable entry via M20 Gland

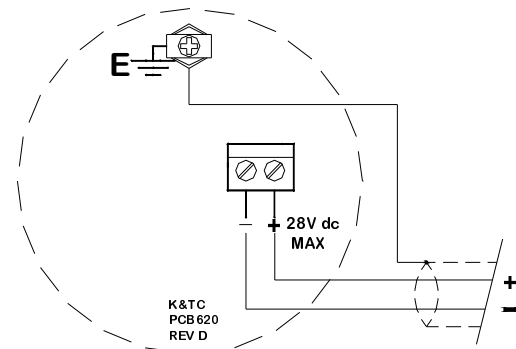


Fig 4 Connection Details

Adjustment and Configuration: (See also Flowchart Page 10)

The unit is normally set at the factory to the required specification:

- Range adjustment and output inversion (To customer requirements)
- Low Level Alarm Select (off)
- Fault Current Output (22mA)

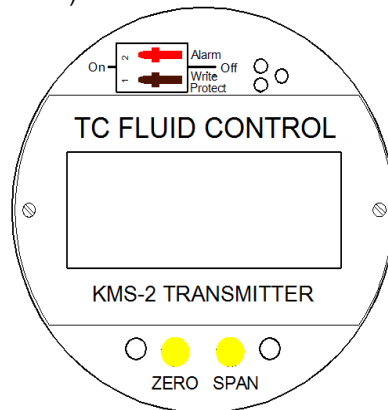


Fig 5
Internal layout of case showing
Local Display and calibration switches

Range Adjustment

The measuring range of the unit is set at the factory.

If the default range is unsuitable or adjustment is required the following procedure should be followed. With reference to Fig. 5

1. Set the float to the minimum level
2. Press the 'Span' and 'Zero' buttons until both LED,s flash alternatively (output 12mA)
3. Release buttons
4. Press the 'Zero' button until the 'Zero' LED stays on
5. Wait until the 'Zero' LED extinguishes. (output 4mA)
6. Set the float to the maximum level.
7. Press the 'Span' and 'Zero' buttons until both LED,s flash alternatively (output 12mA)
8. Release buttons
9. Press the 'Span' button until the 'Span' LED stays on
10. Wait until the 'Span' LED extinguishes. (output 20mA)



If the optional LCD is fitted the display will read 'CAL' during the setting process. The measuring range can be set within the factory limits with a maximum turndown of 50%. If an error is detected during the ranging process the unit will default to the previously saved values the relevant LED will flash if ranging failed.

Inverse output

The output is normally set so that the 20mA point is at the Head shell end. If it is required to mount the head shell at the bottom the output can be inverted by following procedure.

1. Move the float to approximately 50% of range
2. Set the 'Zero' level as 2-5 above
3. Move the float to the required maximum level
4. Set the 'Span level as 7-9 above,
5. Move the float to the required minimum level zero level.
6. Set the 'Zero level as 2-5 above.

The unit will then automatically invert the output.



Caution

The float failure and write protect switches should be set to the 'OFF' position before adjustment to the ranging are made, and reinstated as necessary afterwards. It is important that the float is kept stationary for approximately 10 seconds before and after operation of the calibration buttons to ensure that the output signal has stabilised to the correct value.

Fault signalling Current (Rev 5 Onwards)

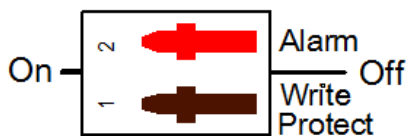
When the magnetic field from the float is not detected the default output level is set Upscale (22mA). To change to Downscale (3.5mA)

1. Press and release the span & zero buttons
2. Setting is indicated on LCD display and or respective LED
3. To change, press and release respective button
 - a) Zero button (Downscale 3.5mA)*
 - b) Span button (Upscale 22mA)*
4. Relevant LED will flash to signify save to memory
5. When complete display will revert to normal measurement mode.

*If change not required wait 20 Seconds unit will return to "Measurement Mode"

Low level alarm

The Low Level alarm output signal will change the output to 3.8mA if the float drops more than 13mm below zero point. When off the output will remain at 4mA below the zero point until the return signal is lost i.e. the sensor is no longer sensing the magnetic field then output will change to either 3.5mA (Downscale or 22mA (Upscale).



- 1) Write Protect
 - On: Range setting inhibited
 - Off
- 2) Alarm Function
 - On: Low Level (3.8mA)
 - Off: No Alarm Output Remains at 4mA

Fig. 6
Configuration switches



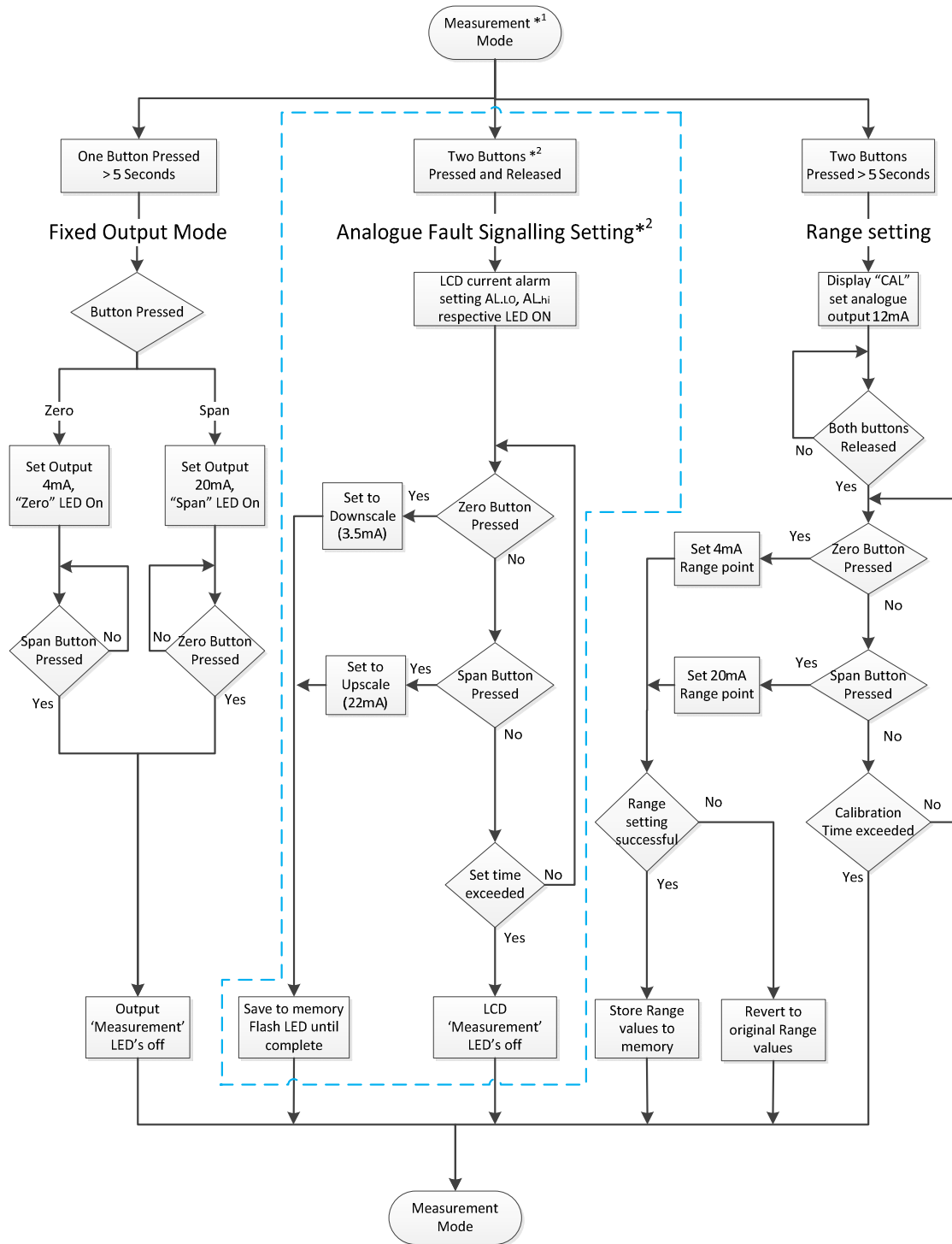
Caution

Turn power off before changing alarm switch settings to prevent unexpected changes in loop current. Ensure that the write protect is set to 'ON' after changes to range adjustments.

Fixed Output

To allow for loop calibration the transmitter output can be fixed to either 4 or 20mA. The zero or span button should be depressed until the respective LED lights, the output will then remain static. To reset to normal operation either depress the opposite button or cycle the power.

Transmitter Front Panel Settings Flowchart



*1 Transmitter must be detecting float before settings can be changed

*2 Analogue fault signalling setting Rev5 onwards (Displayed during startup *Init.5*)

Certification

Certificate No's. Baseefa 06 ATEX 0159, IECEx BAS 06.0038

Explosion protection Type: Ex ia

Gas Group: IIC

ATEX Approval Type:  II 1G Exia IIC T2 ... T6 Ga or II 1G Exia IIB T2 ... T6 Ga

Notified Body No. CE 1180

Input Parameters Conn1 Terminal + w.r.t -
 $U_i = 28V$, $I_i = 93mA$, $P_i = 0.65W$, $C_i = 0$, $L_i = 30uH$.

Temperature Class

The relationship between the temperature class and maximum process temperature for the ambient temperature range is as shown in the following table.

Temperature Class	Process Temperature	Ambient Temperature Range
T2	$\leq 250^{\circ}C$	$-50^{\circ}C \leq T_a \leq 60^{\circ}C$
T3	$\leq 195^{\circ}C$	
T4	$\leq 130^{\circ}C$	
T5	$\leq 95^{\circ}C$	
T6	$\leq 80^{\circ}C$	$-50^{\circ}C \leq T_a \leq 40^{\circ}C$

Table 2
Relationship between Temperature class,
process temperature, and ambient temperature

In accordance to EN50020:2002 clause 6.4.12 this apparatus is capable of withstanding a 500V isolation test.

EMC

In accordance to EC council directive 89/336/EEC

Emissions EN 61326:2004 (Class B)

STANDARD	DESCRIPTION	PORT	RESULT
EN 61326	Radiated Emissions	Enclosure	Pass
EN 61326	Conducted Emissions	Not applicable	Not Tested

Immunity tests to EN 61326: 2004 A1, A2, A3

STANDARD	DESCRIPTION	PORT	RESULT
61000-4-2	Electrostatic Discharge	Enclosure	Pass
61000-4-3	RF Electromagnetic Field	Enclosure	Pass
61000-4-4	EFT/ Burst	DC Port	Pass
61000-4-5	Surge	DC Port	Pass
61000-4-6	Conducted RF	DC Port	Pass
61000-4-8	Magnetic Field	Enclosure	Not Tested
61000-4-11	Voltage Dip/ interruptions	Not applicable	Not Tested

Fault analysis Sheet

Problem	Possible Fault	Action
Zero current eg. 0mA	Supply Voltage to low < 8V	Check voltage and adjust accordingly
	Supply Connections reversed	Swap supply cables
	Cables/Connecting circuit faulty	Rectify as required
	Faulty Unit	Consult Factory.
Current Greater than 22mA	Supply voltage to high > 28V	Adjust voltage to less than 28V
Output at 3.8mA (Low level)	Float damaged (sunk)	Fit new float
	Chamber empty	Open check valves
Continual reading of either 3.58mA Downscale 22mA Upscale	Float magnetic field not being sensed	Check gap distance between chamber and transmitter
	Float Under magnetised	Check with spare float if available
Output static at a particular level	Float stuck or damaged	Check against visual display if fitted. Check float condition
	Residual magnetic interference	Run magnet along full length of probe, Consult Factory.
	External magnetic interference	Check for external magnetic devices in vicinity.
4-20mA not proportional to liquid level	“XXXX” marks not in line with vessel connections	Realign transmitter marks correctly
	S.G range of float incorrect for media type	Check S.G etched on float against media S.G

Table 3
Fault Analysis

Maintenance

The unit contains no user serviceable parts; therefore no routine maintenance is required.

Dependent on model or application:

For coated options:

- Where the case of the device may be subjected to impact or friction, periodic examination is required to ensure that the integrity of the stove enamelled finish is maintained.

For Immersion Applications

- The sensor tube must be kept clean to prevent the float “sticking”.

Technical Data

Materials

Measuring probe: - 316L Stainless steel
Housing: - 316L Stainless steel

Cable entry

Thread Size: - M20x1.5mm
Connection conductor size: - 0.5mm² - 2.5mm²

Supply voltage (Nominal 24VDC)

Minimum 12V
Maximum 28V

Current Output

Measured Current range: - 4-20mA ± 0.1%

Fault Current: -

Upscale* 22mA
Downscale 3.5mA
Low level (When enabled) 3.8mA

* Default Factory setting

Fixed Output (For loop calibration) 4 or 20mA ± 0.1%

Operating Temperatures

(See certification section for details when used in a potentially explosive atmosphere)

Ambient range: - -50 °C / + 60 °C (-5 °C / +60 °C When LCD Fitted)
Process range: - -50 °C/ +250 °C

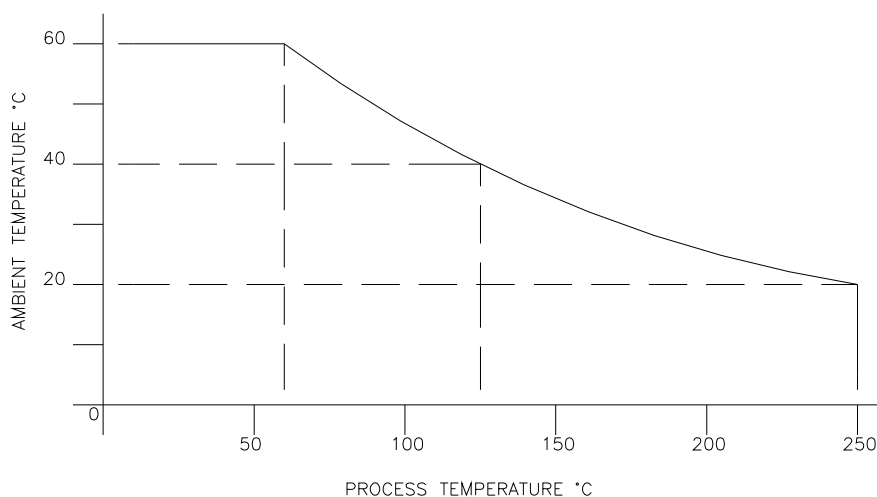


Fig 7

Ambient verses process temperature for standard transmitter

Where ambient conditions are outside this range additional insulation or shielding will be required please consult sales office.



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