



# Miniflex FM

*Ultrasonic Programmable Level Controller  
For Liquids and Simple Solids*

## Installation and Operation Instruction Manual

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## SAFTEY SUMMARY

The following specific warnings and cautions should be observed at all times when installing, commissioning and operating this equipment.



### **WARNING**

An operating procedure, practice or condition which may result in injury, death, damage to equipment or process if not carefully observed or followed.

**WARNING:** Take the process loop off line and put it into manual mode before viewing parameters or entering the program mode.

**WARNING:** Do not service before disconnecting the power supply. Electrical injury can occur.

**WARNING:** FMRC or ATEX approved transducers must be installed and wired in accordance with the appropriate National Standards concerning installation in hazardous environments.

**WARNING:** Teflon faced flanged transducer are not pressure rated and therefore should not be used on pressurised vessels.

**WARNING:** The Miniflex FM is placed in the programing mode and a key is not pressed for 30 seconds, the instrument will automatically return to the RUN mode.

**WARNING:** The Miniflex FM is an Electro Static Discharge (ESD) sensitive instrument. Use proper ESD protective equipmant and proeedures when servicing this instrument. Failure to comply with ESD proeedures when handling and servicing this instrument can result in circuit damage.

**WARNING:** Do not use excessive force when tightening flange bolts to avoid distortion.

**WARNING:** For flange mounted transducer customers must supply the flange gasket in a material which is appropriate for the vessel and application in hand.

**WARNING:** Temperature compensated transducers use a unique thermistor network which is not a standard RTD. The temperature compensated transducers temperature accuracy is not suitable for process control and should not be used as such.

**WARNING:** When programing do not enter values lower than the default value without prior consultation with Hycontrol.

**WARNING:** Do not run power cables in the same conduit as transducers or signal cables. If installed on a cable tray ensure they are a minimum of 6 inches apart.

**WARNING:** Inspection, adjustment, installation and maintenance of this instument must be carried out by suitably qualified personnel.

## **MINIFLEX FM ULTRASONIC PROGRAMMABLE LEVEL CONTROLLER**

### **INSTALLATION INSTRUCTIONS**

**REFER TO DRG. DK4390 FOR HAZARDOUS AREA INSTALLATION GUIDELINES**

#### **DESCRIPTION**

Miniflex FM is a programmable multi-purpose level measurement instrument suitable for use on liquid or slurries in vessels up to 20 feet deep.

Miniflex FM is capable of measuring level or distance and will display in feet, metres or percentage of programmed span.

Miniflex FM has 2 fully programmable relays to operate pumps or alarms and gives a 4-20mA output proportional to the programmed span. Red lights illuminate on the front panel when the relays are energised

Miniflex consists of two elements, a wall mounted transceiver and a transducer which can be located up to 330 feet apart; the transducer must be mounted directly above the surface to be monitored .

Ultrasonic pulses are transmitted by the transducer to the surface being monitored and are reflected back to the transducer. The time period between transmission and reception of the sound pulses is directly proportional to the distance between the transducer and the liquid.

A green light on the front panel illuminates when the instrument is processing a good signal.

Since speed of sound through air is affected by changes in temperature, a separate or integrated temperature sensor may be fitted to improve accuracy where significant variations in process temperature are expected.



#### **IMPORTANT INSTALLATION REQUIREMENTS**

- 1: A SWITCH OR CIRCUIT BREAKER SHALL BE INCLUDED IN THE INSTALLATION**
- 2: IT SHALL BE IN CLOSE PROXIMITY TO THE EQUIPMENT AND WITHIN EASY REACH OF THE OPERATOR**
- 3: IT SHALL BE MARKED AS THE DISCONNECTING DEVICE FOR THE EQUIPMENT INSTALLATION**

## Transceiver Mounting

Undo the 4 screws on the front panel and remove the lid to expose the 4 mounting holes moulded in the enclosure.

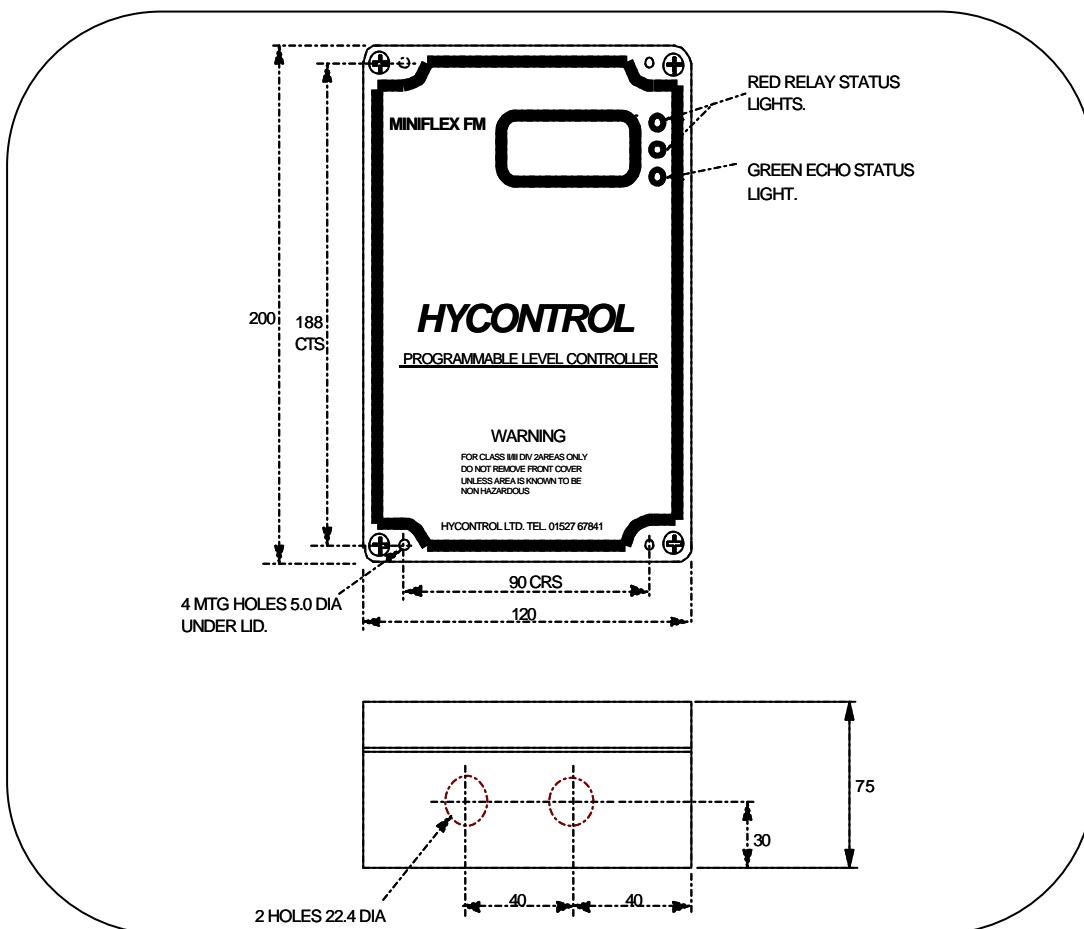


**Mount the unit on a flat surface and secure it via the 4 mounting holes. DO NOT use excessive force when tightening the fixings and avoid any distortion of the enclosure.**

Ensure that the mounting surface is not subject to vibration and is not in close proximity to high voltage cables, contactors or drive controls. The unit should not be mounted in a confined space where temperatures may exceed the normal working temperature. If the unit is mounted outside it must be protected from direct sunlight or severe weather conditions.

Remove the required number of blanking plugs from the bottom of the enclosure and replace them with appropriate conduit hubs or cable glands to maintain the I.P. rating.

**Figure 1:**



**Electrical and Transducer Connections**

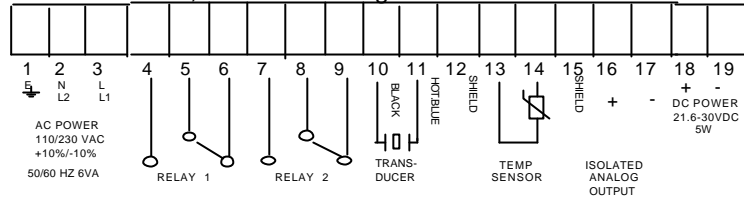
The Miniflex has two-part screw terminals (except 18 & 19); the top part can be removed for ease of connection. It can be powered from either a 110V or 230VAC supply or 24VDC.

**Power Supply**

Remove the internal terminal cover by unscrewing the two knurled screws to expose the terminals shown below.

**Figure 2:  
AC Supply**

The instrument will accept either 110V or 230VAC ±10%, 50Hz or 60Hz, 6VA. A time lag fuse T125mA is fitted.



Select the voltage required using the manual switch situated below the transformer.

For 110V put switch to position 1 - on left hand side. (Marked 110V on PCB)

For 230V put switch to position 2 - on right hand side. (Marked 230V on PCB)

Pass mains cable through cable gland and - Connect:-  
 Earth to terminal 1  
 Neutral to terminal 2  
 Live to terminal 3

**DC Supply** The instrument will accept 21.6 - 30VDC, 5W. A time lag fuse T250mA is fitted.

- Connect :- Positive +ve to terminal 18  
 Negative -ve to terminal 19

**Relays**

**2 SPDT Relays** - rated at 5A/250VAC 5A/30V DC resistive, are connected to terminals 4 to 9, for activating external alarms, contactors, pumps etc..

**Transducer**

**Transducer RFM15** - is connected:-  
 Black to terminal 10  
 Blue to terminal 11  
 Screen to terminal 12

**Temperature compensated transducer RFT15** - is connected:-

Blue to terminal 11  
 Screen to terminal 10  
 Black to terminal 13

**Analogue Output**

**Analogue** - is connected :-  
 Screen to terminal 15  
 Positive +ve to terminal 16  
 Negative -ve to terminal 17

**Separate Temperature Compensation** -

when compensation is provided by a separate temperature sensor, the sensor should be connected with a shielded twisted pair and connected:-

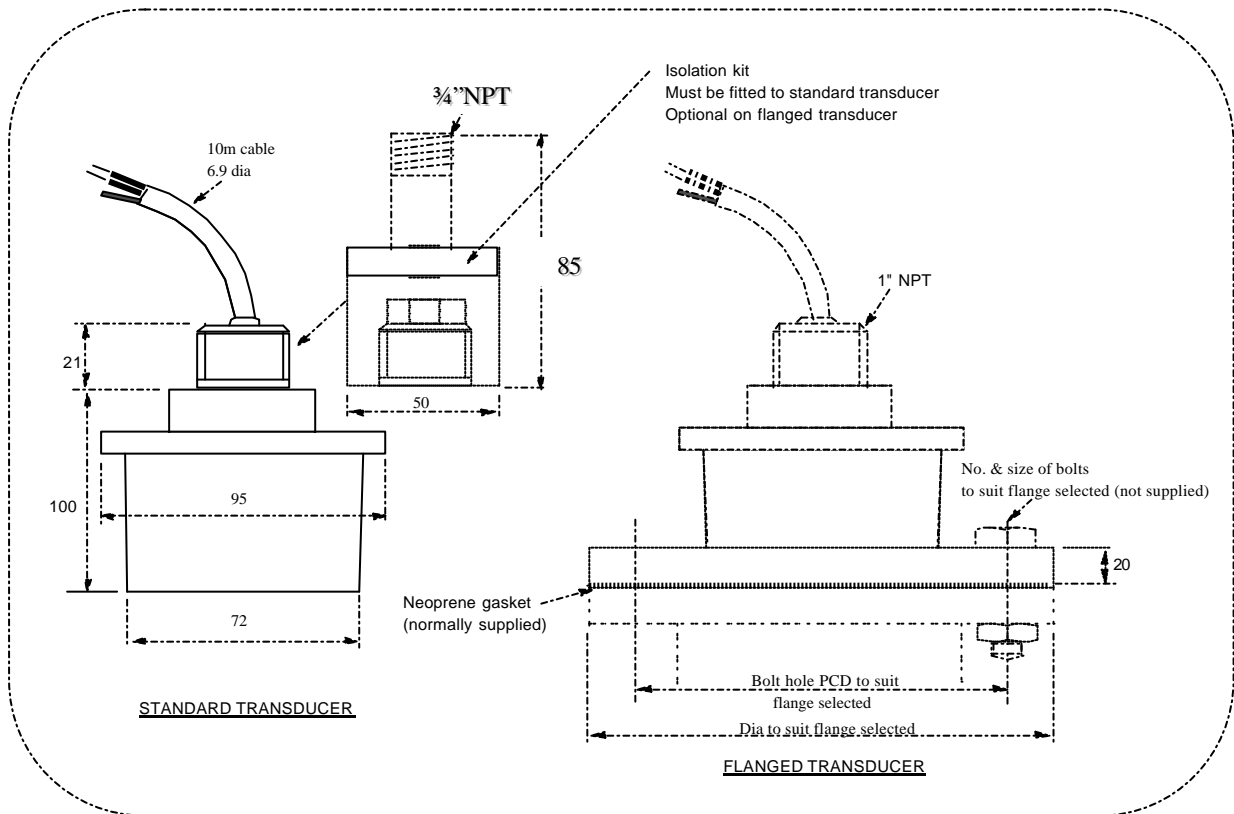
Screen to terminal 12  
 Core\* to terminal 13  
 Core\* to terminal 14

\* The polarity of the cores is unimportant, but it is important that the screen is connected only at the instrument end and not at the sensor end.

## Transducer Mounting

The transducer can be supplied as standard or mounted in a PTFE faced flange for applications requiring chemical compatibility. Figures 3 and 3a show the physical dimensions:

### Figures 3 and 3a:



An isolation kit is provided with each transducer to minimise any ringing transmitted through the mounting structure (this does not apply to flanged transducers)

The transducer must be mounted perpendicular to the monitored surface and, ideally, at least 20 inches above it.

The transducer has a 10° inclusive conical beam angle at 3dB and must be mounted with a clear unobstructed sight of the liquid to be measured over the complete measurement range.

The transducer is provided with 33 feet integral cable which can be extended up to 330 feet using a suitable junction box and RG62AU cable for RFM series transducer.

For temperature compensated transducer RFT series use twin-ax (Beldon 9207 or equal)

Transducer cables and temperature compensation cables can be run together but should be separated from power cables by at least 6" and preferably installed in their own earthed steel conduit..

## Transducer Cable Extensions

Transducer cables may be extended using a junction box as shown in Figure 4

Figure 4:

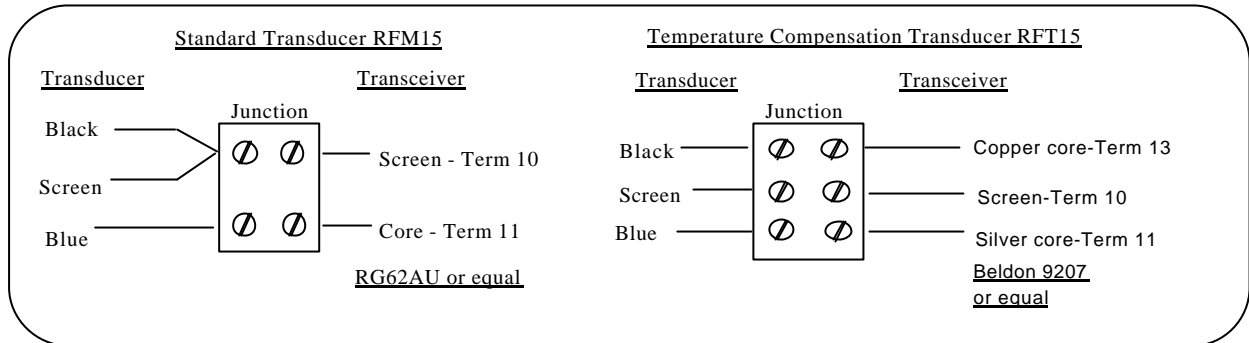
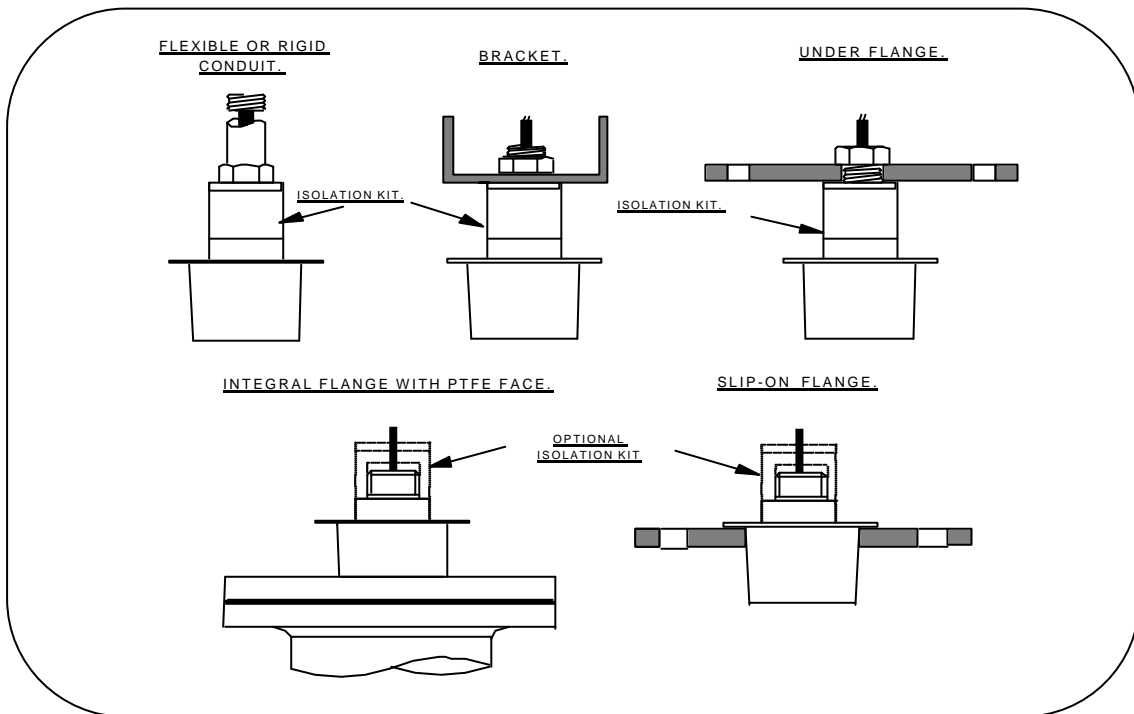


Figure 5: Alternative mounting arrangements for transducers

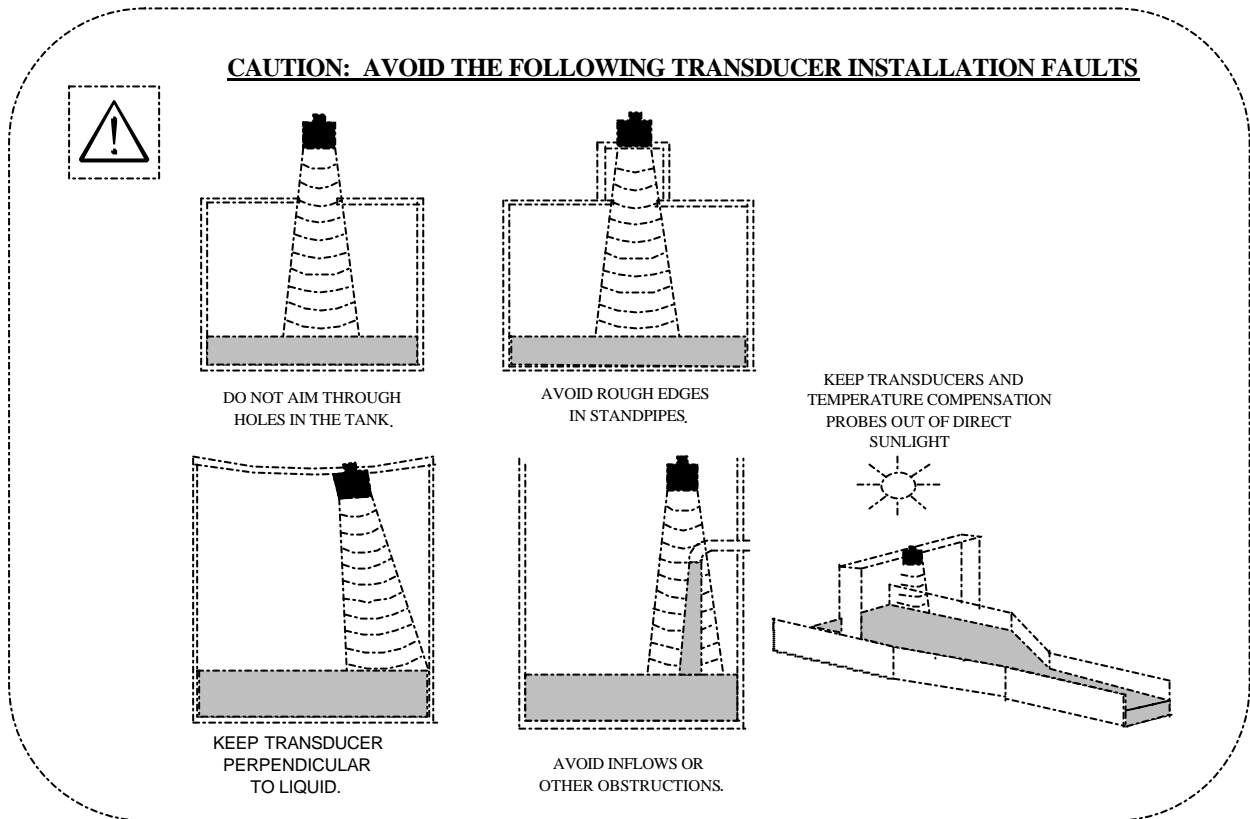


Do not mount transducers incorporating temperature compensation in direct sunlight. Do not over-tighten the bolts on flange construction transducers. Flange transducers are not pressure rated and are suitable only for atmospheric pressure.



**FMRC** approved transducers must be installed and wired in accordance with the appropriate National Standards concerning installation in hazardous environments.

**Figure 6:**



**Standpipe Installations**

In many applications access to a vessel must be made via a standpipe. However, it is necessary to observe some basic rules when fitting transducers into standpipes.

**BLANKING:** Parameter 5 should always be set at least 6" longer than the length of the standpipe.

**STANDPIPE DIMENSIONS:** Should be in accordance with the following table

<u>Flange size and minimum bore of Standpipe</u>	<u>Maximum length of Standpipe</u>
3" ( 80mm)	300mm
4" (100mm)	300mm
6" (150mm)	400mm
8" (200mm)	600mm
12" (300mm)	600mm

e.g. Using a 4" flanged transducer would require the standpipe length to be no more than 12" and Pr.5 set at 1.5ft minimum.

**The inside of the pipe and joint with vessel top must be clean and free of any obstructions, seams or welds.**

**PROGRAMMING INSTRUCTIONS AND PARAMETER LISTING**

Miniflex is programmed by entering values for each of the following Parameters.

## Parameter Definitions

Pr. No	Description	Acceptable Values	Default Value
Pr. 1	<u>Application</u> <b>NOTE:</b> - Changing entry will default Pr.3 - Pr.10.	1 - Level 2 - Distance	1
Pr. 2	<u>Display Units</u> <b>NOTE:</b> - Changing entry will default Pr.3 - Pr.10.	1 - Metre 2 - % Metre 3 - Feet 4 - % Feet	3
Pr. 3	<u>Empty Distance</u> The distance from the face of the transducer to the furthest point away, usually the bottom of the container or channel.	0.330 to 6.000 Metre 1.0 to 20.0 Feet	20.00
Pr. 4	<u>Span</u> The distance between the furthest and the nearest points over which measurement is required.	0.030 to 6.000 Metre 0.1 to 20.0 Feet	20.00
Pr. 5	<u>Blanking Distance</u> The distance in front of the transducer within which the liquid should not enter, and within which no return echoes will be processed.	0.300 to 6.000 Metre 1.0 to 20.0 Feet	1.64
Pr. 6	<u>Rate of Change</u> This value should be as small as possible, but greater than the maximum fill or empty rate.	0.100 to 9.999 Mtr/Min 1.0 to 30.0 Feet	3.28
Pr. 7	<u>Relay 1_Set</u> (On) Energise	{ As Pr. 4	0.00
Pr. 8	<u>Relay 1_Reset</u> (Off) De-energise	{ Providing both	0.00
Pr. 9	<u>Relay 2_Set</u> (On) Energise	{ Set and Reset are	0.00
Pr.10	<u>Relay 2_Reset</u> (Off) De-energise	{ within the span Pr.4	0.00

Relays energise on increasing display values.i.e. increasing level or distance according to Pr.1

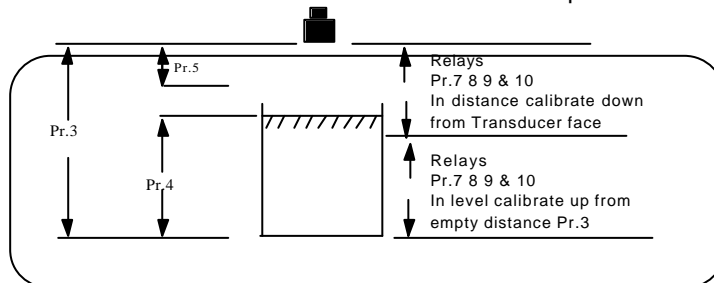
In level calibrate relay in metres or feet measured up from the empty distance Pr.3.

In distance calibrate relays in metres or feet measured from the transducer face.

A red relay status light will illuminate when the relay is energised, indicating the set point is reached or exceeded.

To avoid relay chatter the set and reset distances must not be too close together.

**Note:-** Calibration is in measurement units selected in Pr.2 even when percent is selected for the display.



**Loss Of Echo Failsafe (L.O.E)**

If the instrument loses signal for any reason the green echo light will go off after 10secs. The instrument will continue to display the last valid level or distance obtained for a period of 2 minutes, whilst the search for a valid echo continues. If no echo is found after 2 minutes the instrument will display LOSt.

The relays and analogue mA output can be designated for alarm or failsafe condition.

To programme a relay for L.O.E select one of the following codes by scrolling through the left hand digit of parameter 7 for relay 1 and / or parameter 9 for relay 2.

**Code Definitions**

<b>L.O.E 1-</b>	Normal operation - L.O.E -	Relay energised Relay de-energised Analogue output	- Red LED OFF - Red LED ON - <b>HIGH</b> (22mA)
<b>L.O.E 2 -</b>	Normal operation - L.O.E. -	Relay energised Relay de-energised Analogue output	- Red LED OFF - Red LED ON - <b>LOW</b> (0mA)
<b>L.O.E 3 -</b>	Normal operation - L.O.E -	Relay energised Relay de energised Analogue output	- Red LED OFF - Red LED ON - <b>HOLD VALUE</b>

If no failsafe condition is selected any energised relays will de-energise on Loss of Echo and the analogue output will be forced HIGH (22mA).

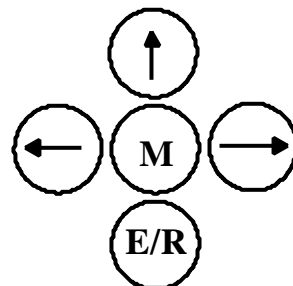
**Programming**

Parameters are displayed and programmed using the 5 keys shown below which are accessed by removing the transceiver's front cover.

**Do not remove the terminal protection cover whilst programming. You may expose live conductors.**

**Key Definition**

- M** = Mode Key - to go from "RUN" to "Prog" Mode  
- or to go from Parameter Number to Parameter Value
- E/R** = ENTER/RUN - to enter a value change  
- or to return from "Prog" to "RUN" Mode.
- ? = Increase a Parameter No. or Value
- ? = Moves cursor Left
- ? = Moves cursor right



**1) To Enter Programme**

- Press M - Display will show "Prog"
- Press ? Immediately - Display will show Pr.1 and its value alternately

## 2) To Select a Parameter Number or to view the Values in each Pr. No.

Continue to press ? - Display will progress from Pr.1 to Pr.10 with each press. Pause after each press to read the Pr. value.

## 3) To Change the value of a selected Parameter

Press M again - Display will now show only the value of the selected Pr. number, cursor will flash in place of first digit.

Press ? - To increase value of flashing digit between 0 and 9. It will then roll over to its minimum and start again.

Press ? - To move the cursor right and select the next digit to be changed, then Press to change its value as above.

Press ? - To move the cursor to the left and then Press to change its value as above.

Press E/R (Ent) - To enter the new value. The display will then show the Pr. Number and the new value alternately.

## 4) To select another Pr. - and change its value

Press ? - Proceed as 2 and 3 above.

## 5) To complete Programming and return to RUN mode

Press E/R - The display will show "RUN" and then the measured value in the selected units.

## 6) To Reset all Parameters to Factory Default

Press M - Displays "Prog".

Press ? - To Display Pr.1

Press both ? and ? simultaneously - To display "PrES" and then Pr.1

## 7) Alternative Key Functions

The 4 peripheral keys have secondary functions which can be viewed without interrupting the instrument's operation.

In the normal "RUN" mode:-

Press ? - Display will show "dEgC" and the operating temperature if using a temperature compensated transducer or 20°C with standard transducer.

Press ? - Display will show "GAIN" and then a number from 0.1 to 100 which represents strength of echo. Low numbers mean strong echo.

Press E/R - Display will show "dISt" and measured distance from transducer face regardless of whether programme is in distance, level or percent.

Press ? - Display will show "AnA" and then the mA output.

### MINIFLEX FM SPECIFICATION

<b>Measurement</b>	:	Level or Distance or Percent
<b>Range</b>	:	20 ft (6 metre) maximum
<b>Blanking</b>	:	1.64 ft (0.5 metre) - adjustable
<b>Transducer</b>	:	RFM std / RFT with temperature comp. PTFE faced / flanged options.
<b>Accuracy of change in level</b>	:	1% of measured distance at 20°C
<b>Resolution of analogue output</b>	:	2mm or 0.1% of empty distance whichever is the greater
<b>Power Supply</b>	:	110/230Vac +/- 10% 50/60Hz 6VA 24Vdc - 10% +25% 5W Manual selection
<b>Relays</b>	:	2 SPDT relays, rated 5A/250Vac 5A/30Vdc resistive.
<b>Analogue Output</b>	:	4-20mA into 750 ohms, 16 bit, short circuit protected. Non isolated. -ve to ground. Fixed to span and Pr.1

	<u>LEVEL</u>	<u>DISTANCE</u>
Closest to Transducer	<b>20mA</b>	<b>4mA</b>
Furthest from Transducer	<b>4mA</b>	<b>20mA</b>

<b>Ambient Temperature</b>	:	-40 to +70°C
<b>Indication</b>	:	4 digit 12mm LCD 2 red leds for relay status 1 green led for echo status
<b>Key Functions</b>	:	5 Push Buttons M - Prog and DISP ? - Increase Pr. or digit ? - Move left ? - Move right E/R - Enter/Run
<b>FM Approvals - Miniflex FM</b>	:	CL. I, II, III, DIV 2 GROUPS A, B, C, D, F & G
<b>FM Approvals - Transducers RFM/RFT15</b>	:	CL. I, II, III, DIV 1, 2 GROUPS A, B, C, D, E, F & G

## MINIFLEX FM PARAMETER LIST

Pr #	DESCRIPTION	DEFAULT	USER	S/ENG
1	Basic Application	1		
2	Calibration Units	3		
3	Empty Distance	20.00		
4	Operational Span	20.00		
5	Dead Zone (Blanking)	1.64		
6	Rate Of Change	3.28		
7	Relay One Set Point	0.00		
8	Relay One Re Set Point	0.00		
9	Relay Two Set Point	0.00		
10	Relay Two Re Set Point	0.00		
	Miniflex FM Serial Number			
	Miniflex FM Software Revision Number			
	Transducer Model Number			
	Transducer Serial Number			