

Flexilevel 2/Flexicap System
Installation & Setting up Instructions

Comprising

Flexilevel 2 Indicator/Controller
Flexicap Level Sensing Electrode



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This product has been designed and complies to the relevant standards as listed in its certificate of conformity
The installer/user must ensure system compliance.
The Crossed-out bin symbol, placed on the product, reminds you of the need to dispose of the product correctly at the end of its life.

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1.0 Overview of the System

The Flexilevel 2 indicator/controller when used with the Flexicap Electrode fitted with a Capacitance Transmitter Module will provide Digital Indication of level with four control/alarm relays programmable over the range being measured. Isolated Retransmission Current and voltage signals are also available to drive additional digital and analogue indicators or for input to PLC and BMS systems. A fifth relay to indicate system failure is fitted for use if required.

The Flexicap Electrode houses a plug-in Capacitance Transmitter Module within the terminating head. Mounted vertically in the vessel, the electrical capacitance of the Electrode increases as liquid rises up the Electrode, this is converted to a milliamp signal by the Capacitance transmitter Module. A two core screened cable connection to the Flexilevel 2 powers the module and conveys the milliamp signal back to the controller.

1.1 The Four Basic Electrode Types.

FCP2

Insulated Electrode for conducting liquids such as water etc., Max Length = 3metres

FCP3

Concentric Electrode with bare inner Electrode for low viscosity non-conducting liquids such as oil etc., Max Length = 3 metres

FCP4

Concentric Electrode with insulated inner Electrode for clean low viscosity conducting liquids. Max length = 3 metres

FCP201

Insulated cable Electrode with weight for conducting liquids. Max length 10 metres

The Electrodes

Electrodes are supplied to a specified length which must not be altered without referring to Hawker Electronics.

Electrodes are despatched carefully packed. If damage is discovered please report it to us right away. Handle the electrode carefully paying particular attention not to damage the plastic sheath of insulated electrodes. Do not bend.

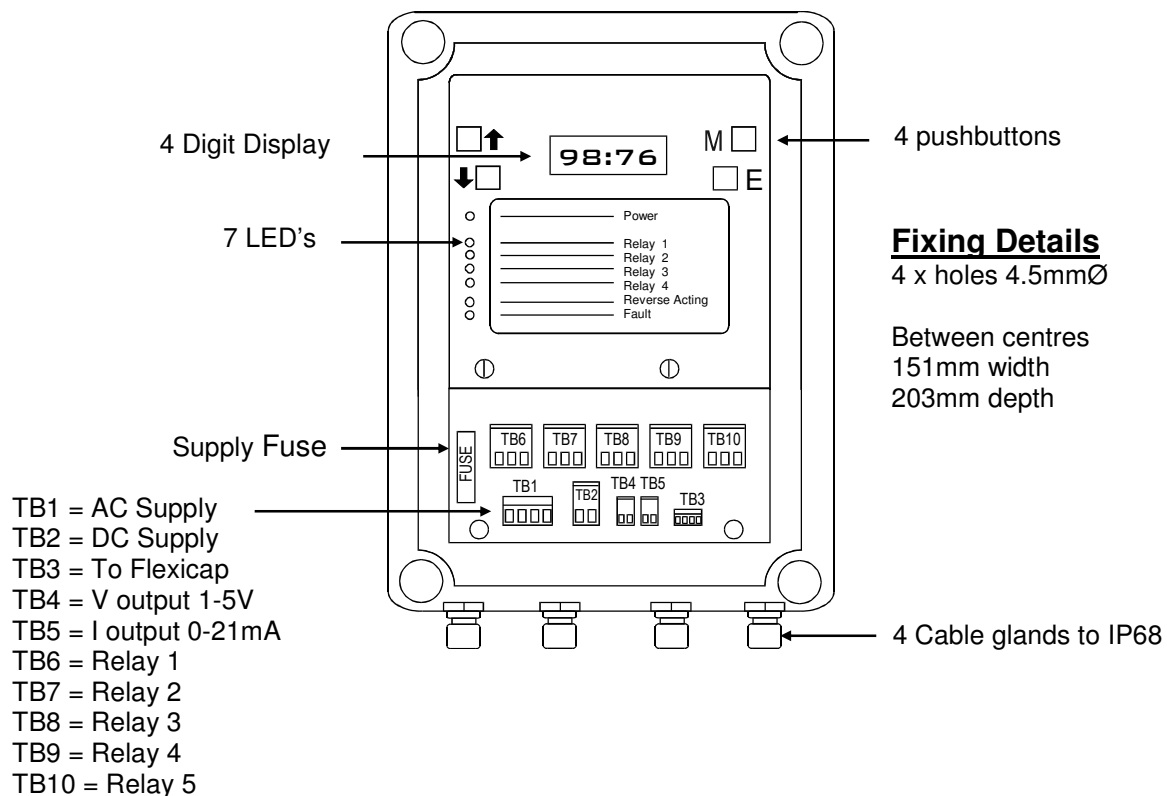
2.0 General Specification - Flexilevel 2 Indicator/Controller

Technical Data

Display	4 digit 9mm LCD Configurable between 0.100 and 9999. The decimal point can be positioned to suit
Input	Within the range 0-25mA (min span 2mA). Input circuit fully isolated.
Input resistance	12 – 54 ohms depending on range
Zero Suppression	A live zero can be set anywhere within the range
Accuracy	Better than 1% for 4-20mA input
Resolution	0.1%
Input supply	110v/230v, 50Hz or nominal 24vDC

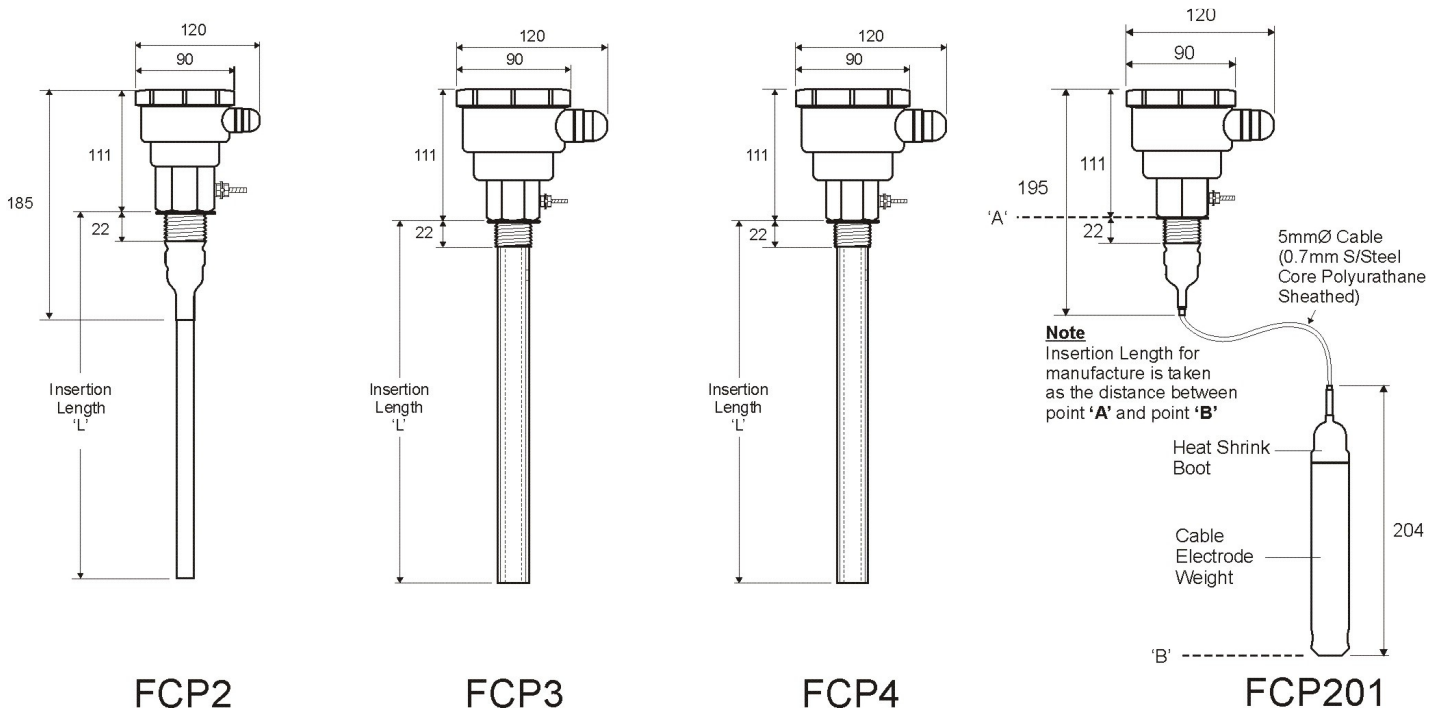
Outputs

Sensor supply	Nominal 24vDC for loop powered transducer fully isolated from the input and supply. Current limiting at 30mA
Four Control Relays	Volt free changeover rated 5A resistive @240vAC. Each having fully adjustable hysteresis with programmable fail to safe action.
One Failure relay	Volt free changeover rated 5A resistive @240vAC. De-energized on loss of, or excess current in a loop-powered system.
L.E.D.'s	4 x 'Relay energized' 1 x 'Supply On' 1 x 'Reverse Acting' retransmission 1 x 'Fault' (flashing on failure condition)
Re-transmission	Programmable within 0-21mA. Max loop resistance 1000 ohms. Voltage output 1-5V when set for 4-20mA. Outputs fully isolated from input & supply
Enclosure	Weather resistant to IP66 Clear polycarbonate fascia 254(H) x 190(w) x 84(D) mm.



3.0 General Specification – Flexicap Probes

Flexicap FCP	2	3	4	201
Measuring Range	0.5 – 3m	1 – 3m	0.5 – 3m	3m – 10m
Process Pressure	100psi	300psi	100psi	100psi
Supply	From Flexilevel 2			
Output	To Flexilevel 2 (Approx 3 – 23mA)			
Combined non Linearity hysteresis & repeatability	+/- 1.5% Full Scale BSL			
Temperature Compensation	Over the range			
Operating temperature	- 20 to 60 degrees C			
Max Process Temperature	100 degrees C			
Weatherproof	IP66			
Gland thread	M20			
Connection	1 inch BSP			
Material of Construction	Polypropylene housing Polypropylene for insulated electrodes Stainless steel 316L for bare electrodes Polyolefin shroud & polyurethane cable for FCP201 Polyolefin heatshrink sleeving & PTFE spacers on FCP3 & 4			
Connecting cable	2 core cable 16/0.2 screened cable			



4.0 Installation of Equipment

4.1 Electrodes should be mounted vertically in the vessel. Where the mounting point is metal, there must be a good electrical connection to the electrode mounting boss

4.2 Where the vessel contents are Electrically Non-Conducting such as fuel or lubricating oils, hydrocarbons etc. the FCP3 Concentric Electrode is normally supplied. This may be mounted anywhere in the vessel avoiding incoming flow and excessive turbulence.

4.3 Where the vessel contents are Electrically Conducting such as most water based liquids the FCP2 Electrode must be mounted clear of the vessel side and away from any incoming flow and turbulence. A stainless steel bracket is available for fixing to the vessel wall holding the electrode 150mm from the side. Drawing No 2657 refers.

4.4 The mounting boss of Electrodes FCP2 and FCP201 must have good electrical contact with the vessel in order to provide the reliable 'earthy' reference necessary for capacitance operated systems. This can be achieved using one of the following methods:

4.5 Mounting the electrode directly to a metal vessel. (see diagram 4.11)

4.6 Connecting the 'earth stud' of the mounting boss to existing metal in the vessel providing it extends down below the tip of the electrode. This may be a metal pipe or ladder etc. (see diagram 4.12)

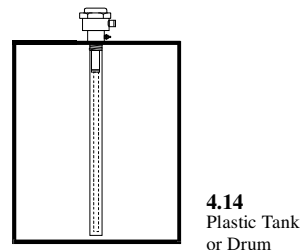
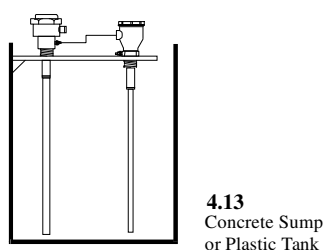
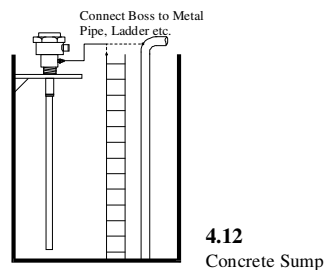
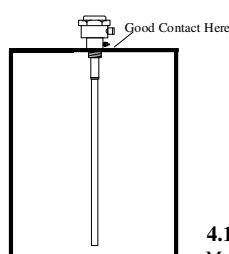
4.7 Install an 'earthing' electrode such as Hawker HPE7 having a bare stainless steel electrode rod. (see diagram 4.13).

4.8 Type FCP3 and FCP4 Concentric Electrodes have an outer metal sleeve extending from the mounting boss which provides the 'earthy' conductor and are therefore complete in themselves. (see diagram 4.14).

4.9 When installing the FCP201 Cable electrode care must be taken to avoid a position where it could tangle with cables or pipework, or perhaps be drawn into a pump suction. The weight of the cable electrode has a 6mm diameter hole to which can be fitted an anchoring strap or, additional weight if thought necessary.

4.10 For turbulent conditions it may be necessary to mount the Electrode within a stilling pipe, particularly the Cable Electrode FCP201. If the pipe is metal it must be connected to the electrode mounting boss. If the pipe is plastic an earthing wire must be connected to the mounting boss, extending down within the pipe a stainless steel wire with weight can be supplied for this.

Examples for obtaining the 'earthy reference (see 4.1).



5.0 Electrical Connections

The Capacitance Transmitter Module plugs into the electrode within the terminating head. The Electrode is normally despatched with the module in place and the 'B' terminal connected to the internal green wire providing connection to the electrode mounting boss.

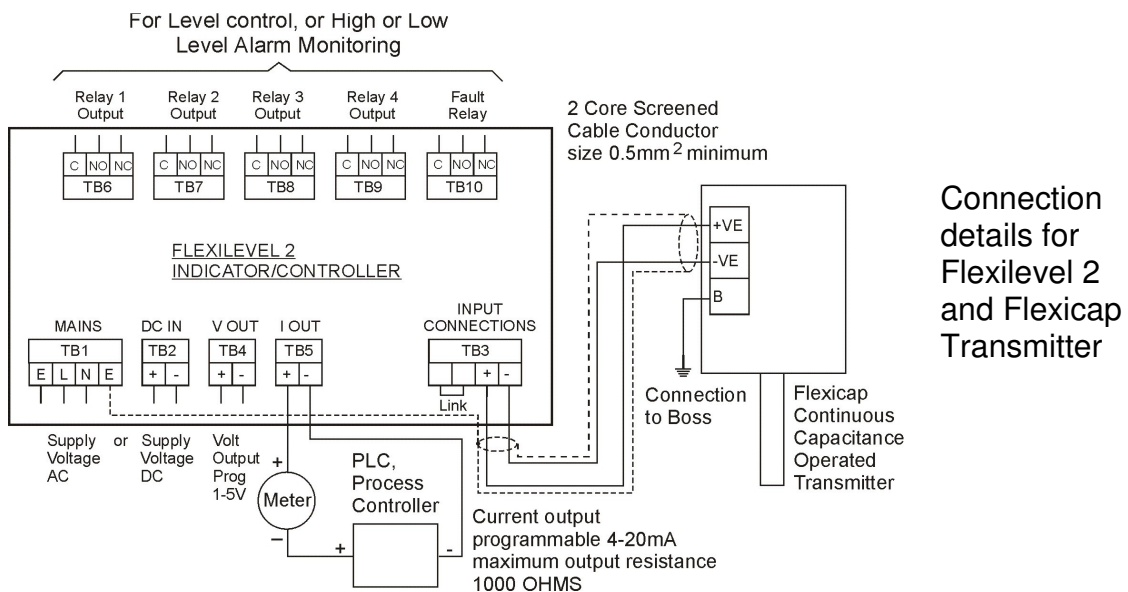
Connection should be made to the Flexilevel 2 using two core screened cable from V- and V+ observing polarity. Suitable conductor size being 16/0.2mm (0.5mm²). The cable screen is not connected at the Transmitter Module. The 20mm cable entry must be correctly glanded to provide a watertight seal to IP67 or better. No adjustments are required at the electrode.

The standard Flexilevel 2 enclosure is weatherproof to IP66. If mounting outside additional protection should be provided bearing in mind that setting up requires the enclosure to be opened. The enclosure has four 15mm holes fitted with cable glands. Any unused glands must be sealed.

Check the operating voltage on the label is compatible with the available supply. Mount the Flexilevel 2 using 4mm screws through the lid fixing holes in order to maintain the IP66 protection. AC supplies connect to terminal TB1 and should be fed preferably via an isolator or fuse. Use the left hand 'E' terminal for the earth connection. The right hand 'E' terminal can be used for the screen of the transmitter cable, connecting the two inner conductors to terminal block TB3 observing polarity. All units are suitable for operation from 24vDC using terminal block TB2.

Connect the relay volt free contacts as required for control and/or alarm purposes using N/C or N/O contacts to suit the required fail to safe action. Where contactors are being controlled it is advisable to fit them with transient suppressors to prevent damage to the contacts of the PCB mounted relays.

6.0 Setting up the System



Switch the power on to the Flexilevel 2 controller and allow the system to stabilise for two minutes. Unless the Flexilevel 2 has been set up previously the Display will be erroneous, however a flashing colon should be seen.

Vessel Empty (ILo?) and vessel Full (IHi ?) conditions are required for accurate setting. A part full condition can be used providing the level in percentage is noted when entering the IHi?.

To access the Setting up, Press M, the colon should stop flashing. Follow on pressing ↑↓↑↓. Note that if more than 3 minutes elapse during the setting up procedure before pressing a key, the Flexilevel 2 returns to normal operation and the sequence will have to be repeated in order to access the programme again.

7.0 Programming the System.

7.1 Setting the Tank Empty (Ilo?)

This procedure must be undertaken with the tank empty and the Flexicap Electrode installed in the empty vessel.

Operation	Display	Notes
Press M	Number freezes	Colon stops flashing
Press ↑↓↑↓	I L o ?	This is the Tank Empty signal
Press E	XXXX	This number is not important
Press E	donE I L o ?	You have now stored the Tank Empty signal from the Flexicap.
Press M	X.X : XX	Flashing Colon. System is running

As it is likely that the it will take longer than 3 minutes to obtain the Full condition, the system has been returned to Normal operation by pressing M in order to register the Empty setting.

7.2 Setting the Tank Full (IHi?)

Ideally this should be undertaken with the tank full. Should vessel be part full, note the percentage of level.

Operation	Display	Notes
Press M	Number freezes	Colon stops flashing
Press ↑↓↑↓	I L o ?	
Press ↑	I H i ?	This is the Tank Full signal
Press E	XXXX	This number is not important
Press E	donE I H i ?	You have now stored the Tank Full input signal from the Flexicap.

N.B. Once set you should never enter these settings again unless you need to change them.

7.3 Setting the Percentage

Operation	Display	Notes
Press ↑	P E r C	
Press E		Using the ↑↓ set to 100% or the percentage of level noted
Press E	d o n E P e r C	

7.4 Setting the Display

There are two settings – the position of the decimal point and the maximum reading when the tank is full. The maximum reading can be the level, volume or a percentage of the depth.

Operation	Display	Notes
Press ↑	F S d	Position for decimal point
Press E	d E C . P	Position the Decimal point using the arrow keys. Scroll ↑↓
Press E	X.XXX	Shows the chosen position of decimal point Scroll ↑↓ to display the required indication when the vessel is full. i.e. 100.0 for percentage or the number of litres, gallons etc can be set to 9999
Press E	d o n E F S d	You have now stored the display reading for maximum depth

7.5 Setting Relays Operating Level (As a percentage of level)

Operation	Display	Notes
Press ↑	r L 1	First relay set point
Press E	O n	Set the on position
Press E	XX.X	Scroll ↑↓ to select the ON position , or Energise level
Press E	O F F	Scroll ↑↓ to select the OFF position , or De-energise level Note. If the ON level is set higher than the OFF level the Relay will have Fail to Safe <u>LOW</u> action. If the ON level is set lower than the OFF level the relay will have Fail to Safe <u>HIGH</u> action. A guide to the use of Fail to Safe action is in section 6.7
Press E	XX.X	Scroll ↑↓ to select the OFF position as a percentage of depth
Press E	d o n E r L 1	First relay has now been set
Press ↑	r L 2	Second relay set point. Repeat as above
Press M	X.X : XX	Flashing Colon. System is running

7.6 Setting the Fault Relay

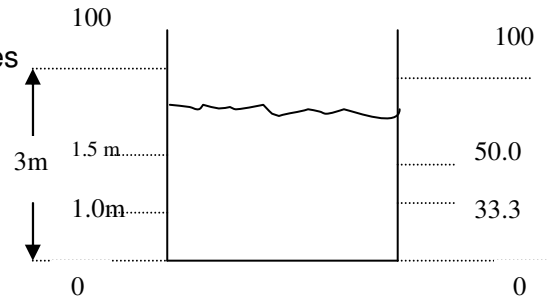
There is no programming for the fault Relay. TB10 is a volt free changeover contact. For an external alarm connect between the common (c) and normally open (NO) contacts.

7.7 Examples of setting up a relay as a percentage of depth

If we assume the depth is 3 metres.
You want to set a relay to come ON at 1.5 metres
and go OFF at 1.0 metres

$$\text{To set the ON} = \frac{1.5 \times 100}{3.0} = 50$$

$$\text{to set the OFF} = \frac{1.0 \times 100}{3.0} = 33.3$$



In this example the ON point is above the OFF point so the relay is set to fail to safe Low

If we assume a depth of 6 metres
The ON point is 1.2m
The OFF point is 2.3m

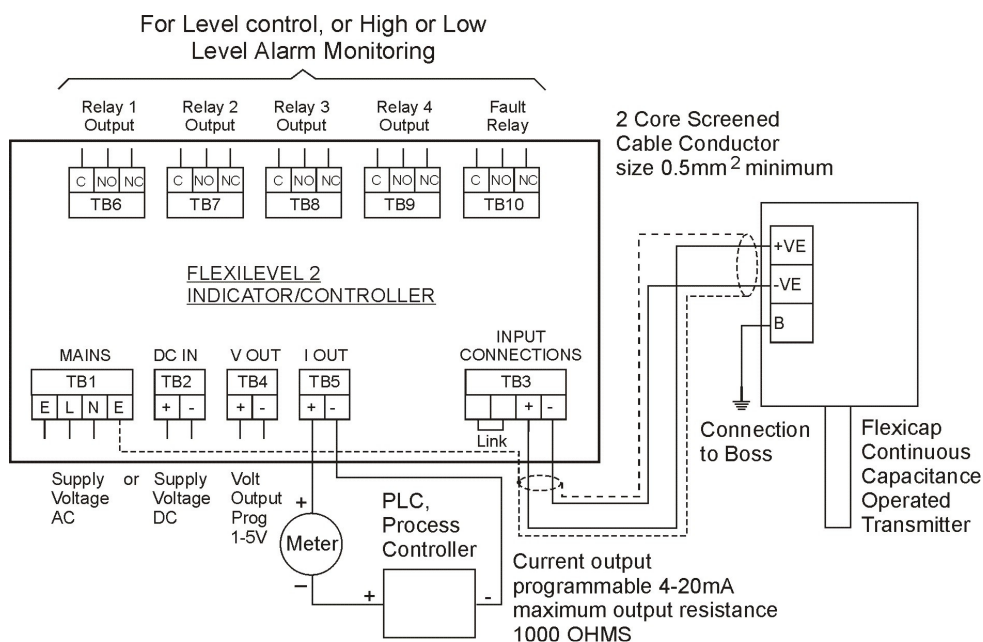
$$\frac{1.2 \times 100}{6.0} = 20.0$$

$$\frac{2.3 \times 100}{6.0} = 38.3$$

In this example the ON point is below the OFF point and the relay is set to fail to Safe High

7.8 Setting the re-Transmission 4-20mA output signal

Connect a Multi-meter to TB5 to monitor the output current.



The Current output can be set within the range 0 – 21mA. The ideal range of 4 – 20mA makes best use of the diagnostic facilities of the Flexilevel 2 with the Flexicap.

Operation	Display	Notes
Press M	X.X : XX	Colon stops flashing
Press ↑↓↑↓	I L o ?	This is the Tank Empty input signal
Press ↑	I H i ?	This is the Tank Full input signal
Press ↑	P E r C	Percentage of tank full.
Press ↑	F S d	Position of decimal point
Press ↑	r L 1	First relay set point
Press ↑	r L 2	Second relay set point
Press ↑	r L 3	Third relay set point
Press ↑	r L 4	Fourth relay set point
Press ↑	4 n A	Set the 4mA output
Press E	X X X X	Scroll ↑↓ using the arrow keys so you get a 4mA reading on the multi-meter
Press E	d o n E 4 n A	You have stored the 4mA output signal
Press ↑	20 n A	Set the 20mA output
Press E	X X X X	Scroll ↑↓ using the arrow keys so you get a 20mA reading on the multi-meter
Press E	d o n E 20 n A	You have stored the 20mA output signal
Press M	X.X : XX	Flashing Colon. System is running

7.8.1 Inverting the 4-20mA re-transmission signal

Operation	Display	Notes
Press M	X.X : XX	Colon stops flashing
Press ↑↓↑↓	I L o ?	
Press ↓	r E v ?	This is the Reverse current output option
Press E	F o r	Forward acting (normal)
Press ↑	R E v	Reverse acting (inverted output)
Press ↑	F o r	You have returned to your first option. Make your selection
Press E	d o n E r E v ?	Forward acting option chosen in this example
Press M	X.X : XX	Flashing Colon. System is running

With the tank at maximum level the Flexilevel 2 should be displaying maximum depth and the current source showing 20mA. If the tank is not full then the current reading should be linear to the display

E.g. If the tank is half full. The normal depth would be 3 metres

Display reading = 50% of 3 metres = 1.5m

Current output = (50 % of 16mA) + 4mA = 12mA

8.0 Fault finding

Possible causes of spurious results:

'Wet coating' due to rag, paper or weed wrapping round the electrode or forming a coating on it.

Viscous products clinging to the electrode. This may sometimes be overcome by using P.T.F.E. coated electrodes.

Fluids with low conductivity (such as distilled water) where variations in the conductivity and temperature can be problematical.

Acids having varying water content and where the conductivity and temperature varies.

Foam if dense, which can coat the electrodes as in (5.1) above.

Note that the presence of steam and condensate are not usually problems.

8.1 System does not work

Check power input to the Flexilevel.

Check continuity of cables between Flexicap and Flexilevel and that all connections are good.

Unplug the transmitter from the Flexicap electrode. Check that the output across terminals '+V' and '-V' is approximately 28-30v D.C.

Measure the current between the '-V' terminal of the Flexilevel 2 and the transmitter. This should be between 1.5mA and 3mA.

Connect a 1000pF capacitor between terminal 'B' of the transmitter and its jack plug. Check the current should have increased to between 18 and 22mA.

