KROHNE

05/99

Level-Sonic
Non contact level gauging using ultrasonic waves

Installation and operating instructions

BM90/BM90L
BM90E/BM90LE

BM90 / L

BM 90 E / LE Panel mounted

KROHNE S.A.
CERTIFIED
ISO 9001

LEVEL-SONIC BM90 SERIES

Contents Page

1. Introduction

1.1. Level-Sonic BM90

The KROHNE S.A. Level-Sonic BM90/BM90E is a multipurpose liquid level measurement and flow control instrument. The KROHNE S.A. Level-Sonic BM90L/BM90LE is also available for powder and granulate level.

It consists of two main elements, a microprocessor based transceiver and a high-efficiency transducer.

Ultrasonic pulses are transmitted by the transducer to the surface of the material to be monitored and, within millisec-onds, are reflected back to the transducer. The time period between transmission and reception of the pulses is directly proportional to the distance between the transducer and the material.

The Level-Sonic BM90 microprocessor computes this time period continuously for all echoes received and analyses which is the correct reflection from the surface being monitored. It uses this data as the basis for giving control outputs and displays, in useable engineering units.

Level-Sonic BM90 is capable of the following functions :

a) Level Measurement

b) Volume Measurement

c) Distance Measurement

d) Pump Control

e) Differential Level Measurement

f) Open Channel Flow Measurement

WARNING

DO NOT OPEN THE ELECTRICAL COVER WHEN THE POWER IS ON TO THE SUPPLY OR RELAY TERMINALS.

NOTE : There is no need to remove the upper cover. If you need to access to the RS232 or RS485 terminal for the BM90L then you have to open it.

IN THIS EVENTUALLITY, PLEASE REMOVE IT GENTLY, A FLAT CABLE IS ATTACHED TO THE COVER. TAKE CARE NOT TO DESTROY IT.

1.2. Initial start up Level-Sonic

The Level-Sonic BM90 system requires programming by the operator to obtain the required measurements and control. To become familiar with the use of the system, it is suggested that the following QUICK START GUIDE is used before the instrument is installed.

Quick Start Guide :

1. Connect power and transducer cables as defined on the instrument.

ac Power Supply				Transducer			dc Power Supply	
[1]	[2]	[3]	Terminal Nos:	[19]	[20]	[21]	[27]	[28]
E	N	L		Black	Blue	Screen	+ve	-ve

2. The instrument is supplied factory set on initial power up to work in distance measurement up to 10 metres from the transducer on the Level-Sonic BM90/E and 15 metres on the Level-Sonic BM90L/LE.

3. Hold the transducer approximately 1.5 metres from a flat surface and switch on.

After a short period, the display will show the distance (e.g. 1.50) between the transducer and the surface.

If the transducer is now moved slowly towards the surface, the reading should decrease. This shows that the unit is correctly wired and is operating as expected in response to the reduction in distance.

If the reading increases as the transducer is moved towards the surface, it indicates that the unit has been previously programmed to read level not distance.

1.2.1. How to view parameters

The operational program for Level-Sonic BM90 is contained within the parameters listed on Page 17 . Each parameter instructs the unit to carry out a specific function. To look at the complete list of parameters, please refer to chapter 3 but as an intitial guide proceed as follows :

Press 'MODE', the display will show 'PROG'. (there may be a delay of up to 6 seconds if the instrument is busy). Press '1' immediately to obtain a display of Pr.01 or the previous parameter number used.

It is now possible to key in any parameter number, via the keypad. To display its value press 'DSP'. To return to the parameter number press 'DSP' again.

To view a sequence of parameter numbers, enter the first one that is of interest and then press 's' to increase the parameter number or 't' to decrease the parameter number.

Similarly, if a parameter value is displayed then pressing 's' or 't' key will momentarily flash the next parameter number and then display that parameter value.

If a key is not pressed for a period of 30 seconds the unit will automatically return to the run mode.

Press 'MODE' to return Level-Sonic BM90 to the 'RUN' mode.

1.2.2. How to change parameters

Press 'MODE' to display 'prog'.
Whilst 'prog' is displayed press '1' and the display will show either Pr.01 or previous Pr. number. If not Pr. 01 then press '1' to obtain display of Pr.01.

Press 'DSP' to display the value of Pr.01.

Press 'ENT' and the display will show 'COdE' requesting that a security code is entered.

Press '9753' to enter the factory set security code. (see page 16 to change code)

Press 'ENT' and the display will blink and show either the default value of Pr.01 which is 2, or any other value previously programmed into it.

The unit is now ready to be programmed.

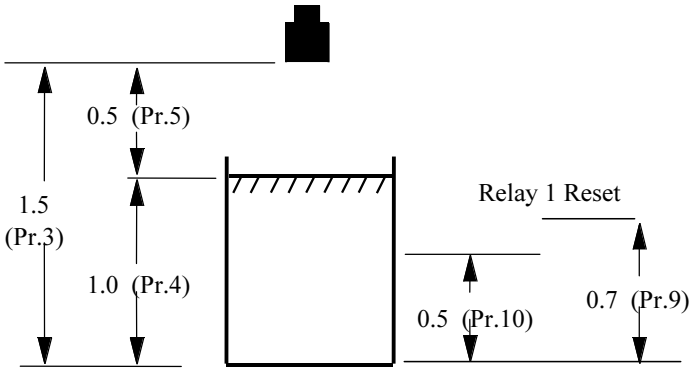
Note : Whenever 'COdE' is displayed, re-enter the security code.

The display should now beshowing the value entered in 'Pr.01' which is 2.

To change the value of this or any other parameter press the new number required and 'ENT'. For our example press 1 and 'ENT' and the value of Pr.01 will change to 1 which means it is in level mode i.e. measuring liquid height above datum.

Then using the 's' key move to the other parameters that require changing.

To change the value of any other parameter either use the 's' key to move to higher Pr numbers, or press 'DSP' and then enter the Pr number required and press 'DSP' again to display its value.



1.2.3. Programming example

The following example shows how Level-Sonic BM90 should be programmed for a simple level application including setting a high alarm.

Having changed the value in Pr.01 to = 1 (level

Press

's'	Display	Pr.02 = 2	(units in meters)
's'	Change	Pr.03 = 1.5	(empty distance)
's'	Change	Pr.04 = 1.0	(operational span)
's'	Change	Pr. 05 = 0.5	(blanking distance)
's'	Display	Pr.06 = 1	(rate of change of level in metres)
Press Pr.08	Change	Pr.08 = 1	(relay 1 designated normally energised)
's'	Change	Pr.09 = 0.7	(relay 1 set)
's'	Change	Pr.10 = 0.5	(relay 1 re-set)
	MODE	to return to normal running	

For a full description of parameter options, please refer to chapter 3.

Note : The display does not show the decimal point until the first decimal figure is keyed in.

1.3. Program checking

To check that the previous program functions properly, hold the transducer approximately 1.5 m above a surface and press 'MODE' to return to the run condition.

The display will read approximately zero.

If it displays LOST it is because the transducer is more than the 1.5 metre (distance to furthest point) from your target. Go closer and wait for LOST to change to 0.000 and then a level.

By slowly moving the transducer towards the surface, the display will increase simulating a rising level. When the display exceeds 0.7 the relay will switch, as indicated by the light on relay 1, and if the transducer is then raised, the display will decrease and the relay will reset below 0.5.

1.3.1. Program correction or resetting factory defaults

If at any time you feel that a mistake has been made, the following routine clears the program back to the known starting position of the factory set values shown on page 26. It is also advisable to return to the factory default values before building a program for a new application. This is achieved as follows :

Press

'MODE'	to display PROG .
1	immediately to display a Pr number
'99'	to display Pr.99.
DSP	to show ====
'CE'	to clear the display.
'ENT'	to display COdE requesting the security code.
'9753'	
'ENT'	the display will now show 't.rES' followed by 'P.rES' and finally '====' .
'DSP'	to display 'Pr.99' and now the new program can be entered.

The above is a brief introduction.

Nota : To understand programming completely it is necessary to read the detailed section describing Programming, Section 3, along with the parameter descriptions, Section 4, and the examples, Section 5, before continuing.

2. Installation

The installation of the Level-Sonic BM90 unit is straight forward, providing the guidelines in this chapter are followed.

2.1. Converter

The BM90 / L unit (Fig 1) must be mounted on a flat surface secured by the 3 mounting holes.
For the BM90 E/LE, see panel cut out figure 5.
When mounting the unit avoid vibration or close proximity to high voltage cables, contactors and drive controls. The unit should not be mounted in direct sunlight or in a confined space where temperatures may exceed the normal working temperature. If the unit is mounted outside it must be protected from severe weather conditions.

Note : Electrical Connection

Converter instrument has 2 covers, the bottom one with 2 screws is protecting terminals. See Fig. 6 for the wiring diagram. Replace cover after completion of wiring.

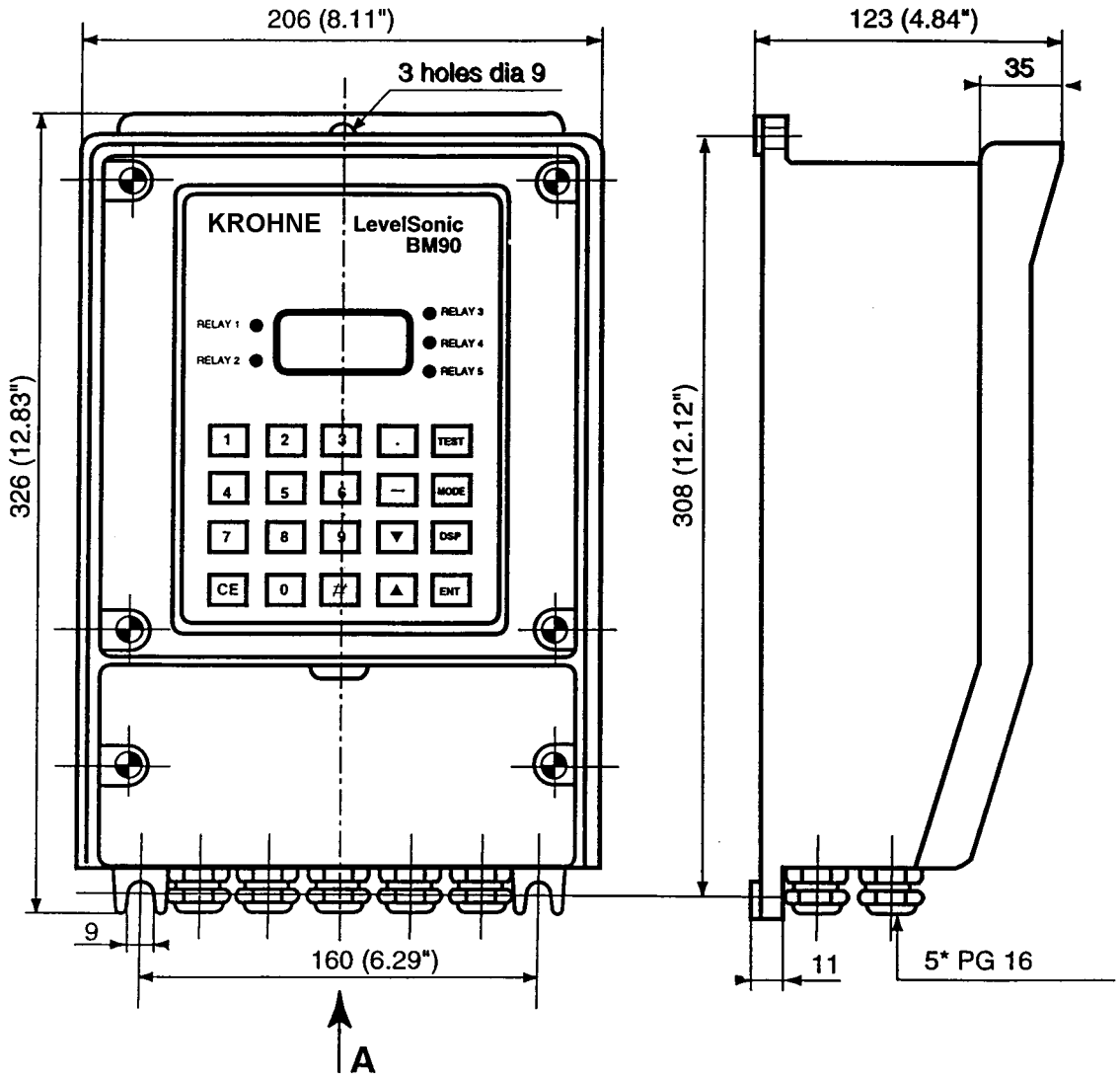
Note : Select the correct working voltages for AC

On converter instrument the voltage selector switch is on the left hand side of the bottom PCB.

Note : If DC power supply is required, instruments will be marked accordingly.

2.1.1 BM90 / L Wall mounted converter

Fig 1:



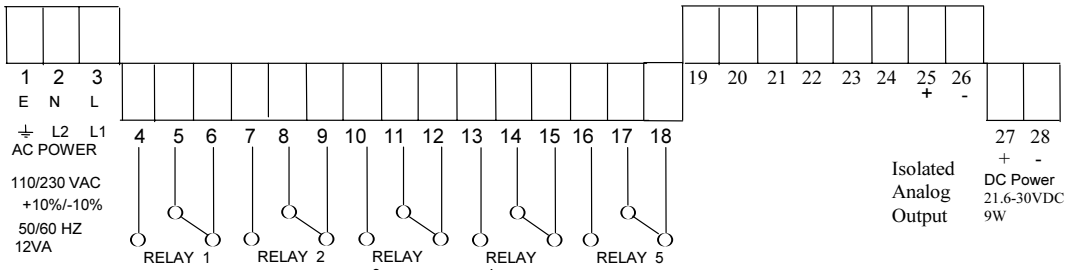
NOTE : There is no need to remove the upper cover. If you need to access to the RS232 or RS485 terminal for the BM90E then you have to open it.

IN THIS EVENTUALLITY, PLEASE REMOVE IT GENTLY, A FLAT CABLE IS ATTACHED TO THE COVER. TAKE CARE NOT TO DESTROY IT.

2.1.2. Transducer Wiring for BM90 / L

The wall mount instrument has two-part screw terminals. It can be powered from either an AC or DC supply.

Figure 2:



AC power supply - connected:

Earth	to terminal 1
Neutral	to terminal 2
Live	to terminal 3

The instrument will automatically accept either 110V or 230V AC –10%, 50Hz or 60Hz, 12VA. A time lag fuse T160mA is fitted.

DC power supply - connected :

Positive +ve	to terminal 27
Negative -ve	to terminal 28

The instrument will accept 24V DC + 25%, - 10%. 9W. A time lag fuse T315mA is fitted.

5 SPDT Relays - rated 8A/250V AC/30V DC resistive, with gold contacts for lower power switching, are connected to terminals 4 to 18, for activating external alarms, contactors, pumps etc..

Transducer RZV15 - is connected:

Black	to terminal 19
Blue	to terminal 20
Screen	to terminal 21

Temperature compensated transducer RZT15 - is connected:

	(Screen	to terminal 19
Must enable Pr.37	(Blue	to terminal 20
	(Black	to terminal 22

Isolated Analogue - is connected :

Screen	to terminal 24
Positive +ve	to terminal 25
Negative -ve	to terminal 26.

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 21
Must enable Pr.37	(Core*	to terminal 22
	(Core*	to terminal 23

* 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 temperature sensor end.

Simultaneous AC & DC powering can be done through an external relay which switch on the other power when the main one is off. The relay contact will be released when main power is off. Ask for scheme if necessary.

2.1.3. Transducer Cable Extensions for BM90 / L

Transducer cables may be extended using junction boxes as shown below in Figure 3:

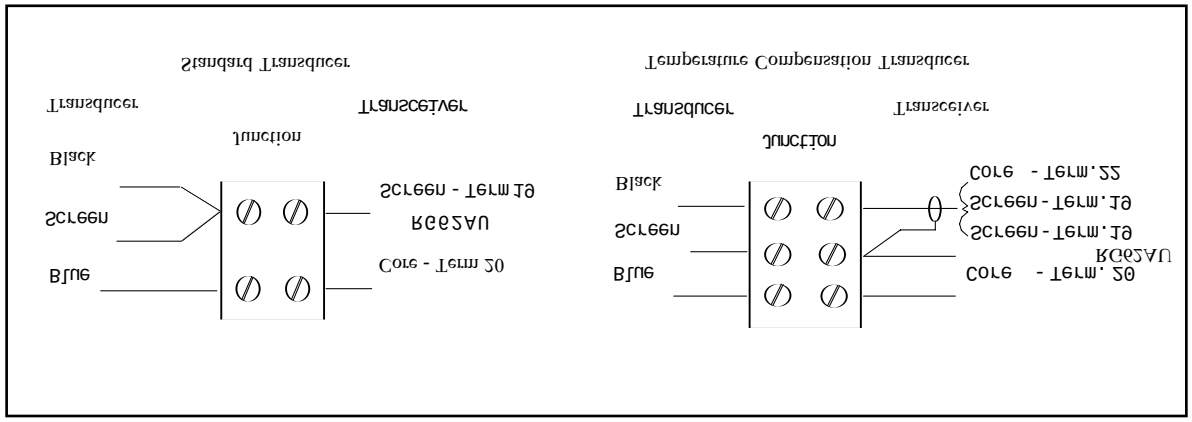
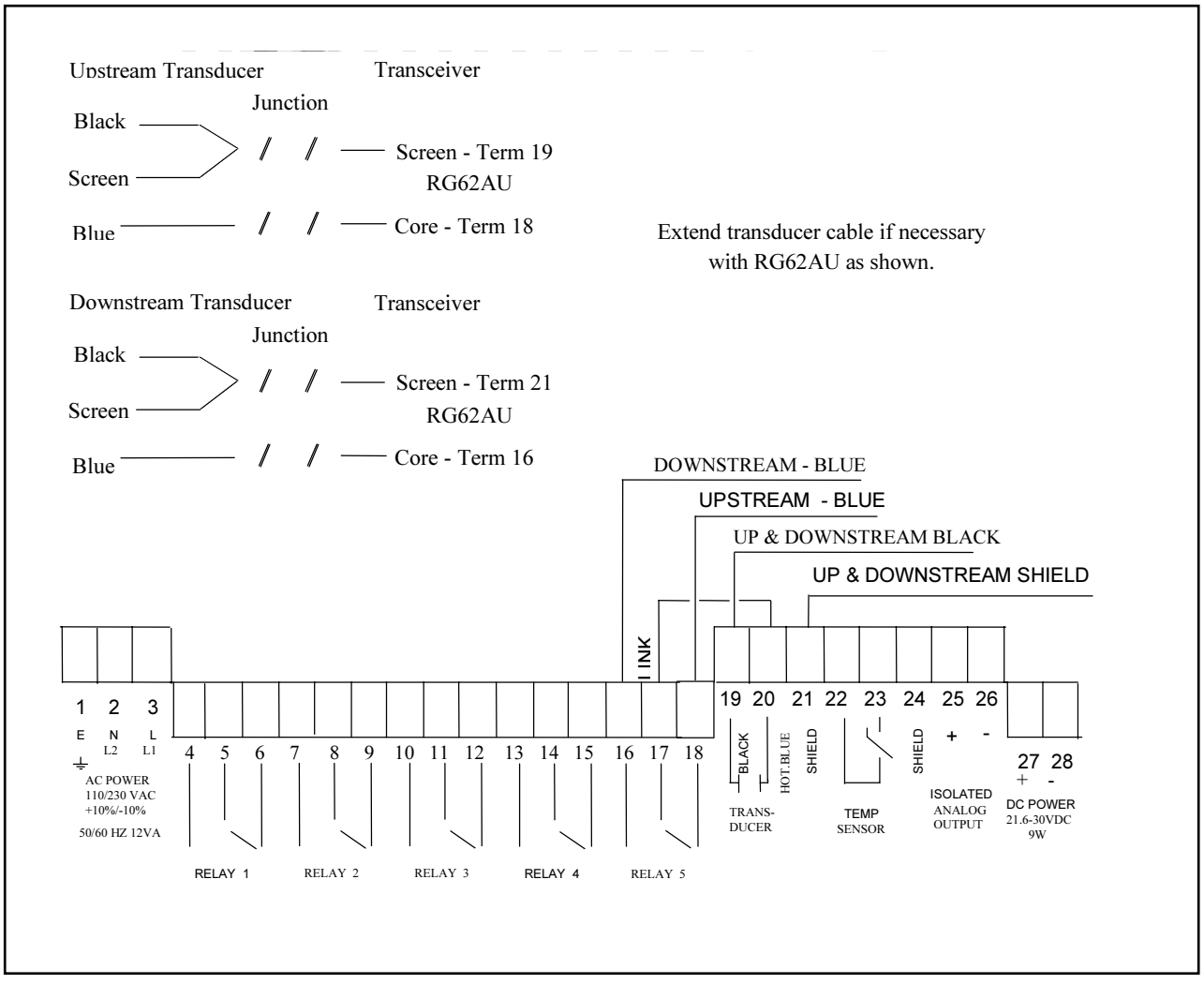


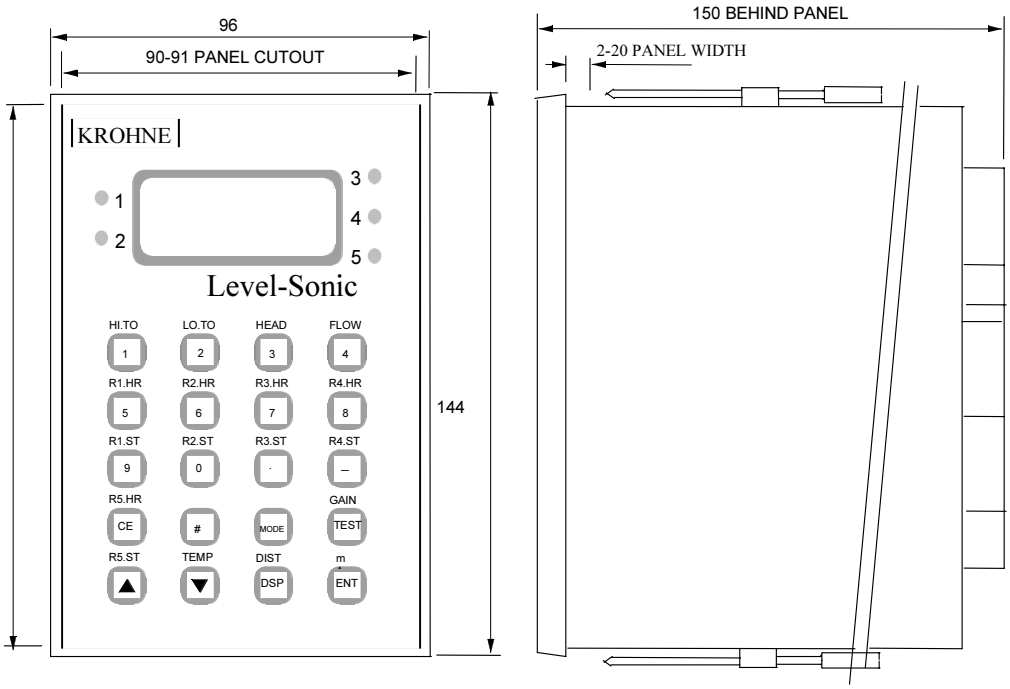
Figure 4:Transducer Wiring for Differential Mode



2.1.4. BM90 E/LE Panel mounted converter

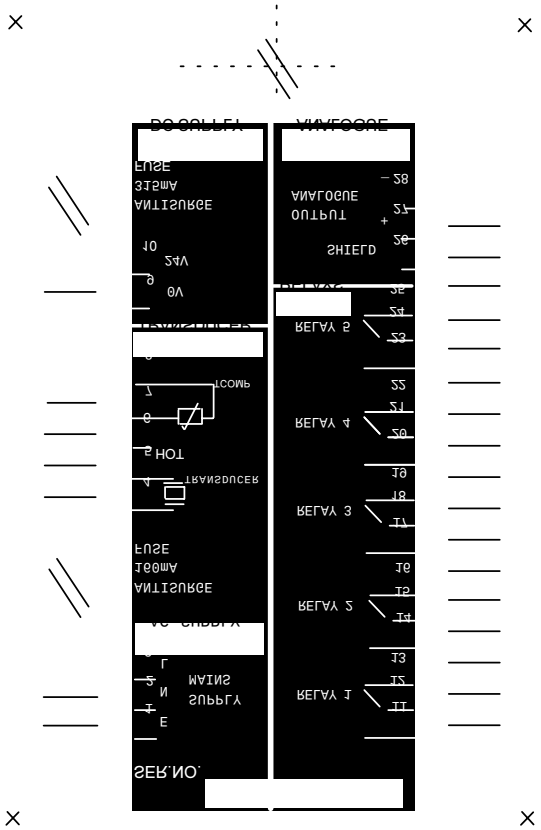
The panel mount instrument has two rear screw terminals. There is no serial commnucation connector even on the BM90 LE

fig 5



2.1.5. Transducer wiring for BM90E / LE

fig 6



2.1.6 Transducer Electrical Connections For BM90 E /LE - Figure 7 below

The panel mount instrument has two-part screw terminals. It can be powered from either an AC or DC supply.

AC power supply - connected: Earth to terminal 1
Neutral to terminal 2
Live to terminal 3
The instrument will automatically accept either 110V or 230V AC –10%, 50Hz or 60Hz, 12VA. A time lag fuse T160mA is fitted.

DC power supply - connected :
Positive +ve to terminal 10
Negative -ve to terminal 0v
The instrument will accept 24V DC + 25%, - 10%. 9W. A time lag fuse T315mA is fitted.

5 SPDT Relays - rated 8A/250V AC/30V DC resistive, with gold contacts for lower power switching, are connected to terminals 11 to 25, for activating external alarms, contactors, pumps etc..

Transducers:
The Level-Sonic BM90 uses RZV15 series transducer.
The Level-Sonic BM90L uses RXV15 series transducer.

Transducer RZV15 and RXV15 - are connected:
Black to terminal 4
Blue to terminal 5
Screen to terminal 6

Temperature compensated transducer RZT15 and RXT15 - are connected:
(Screen to terminal 4
Must enable Pr.37 (Blue to terminal 5
(Black to terminal 8

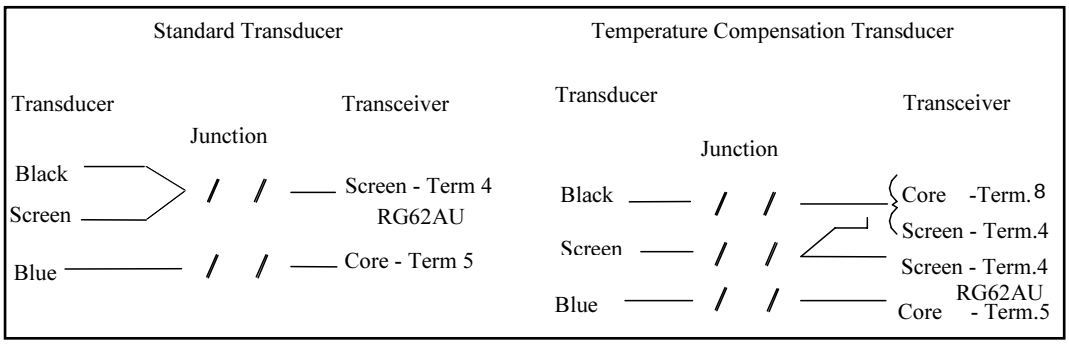
Isolated Analogue - is connected :-
Screen to terminal 26
Positive +ve to terminal 27
Negative -ve to terminal 28

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 6
Must enable Pr.37 (Core* to terminal 7
(Core* to terminal 8
* 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 temperature sensor end.

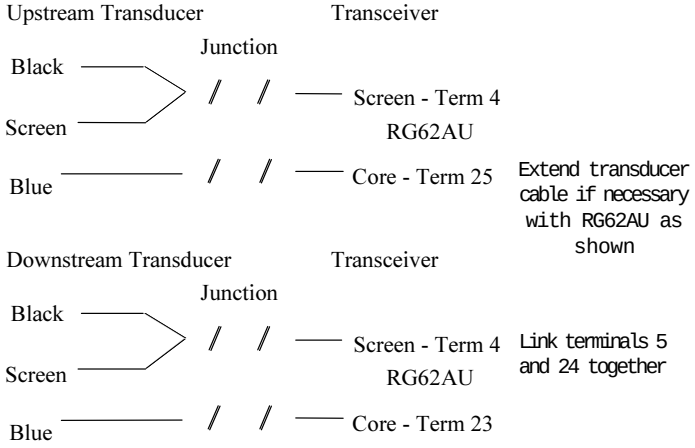
2.1.7 Transducer Cable Extensions for BM90 E / LE

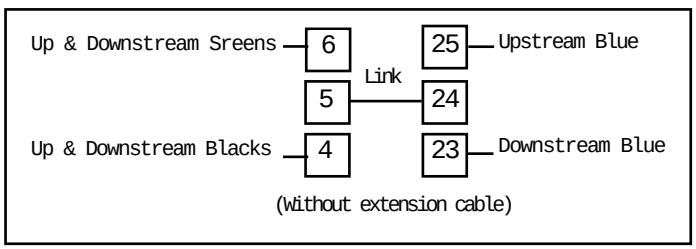
Transducer cables may be extended using junction boxes as shown in Figure 7 below

fig 7



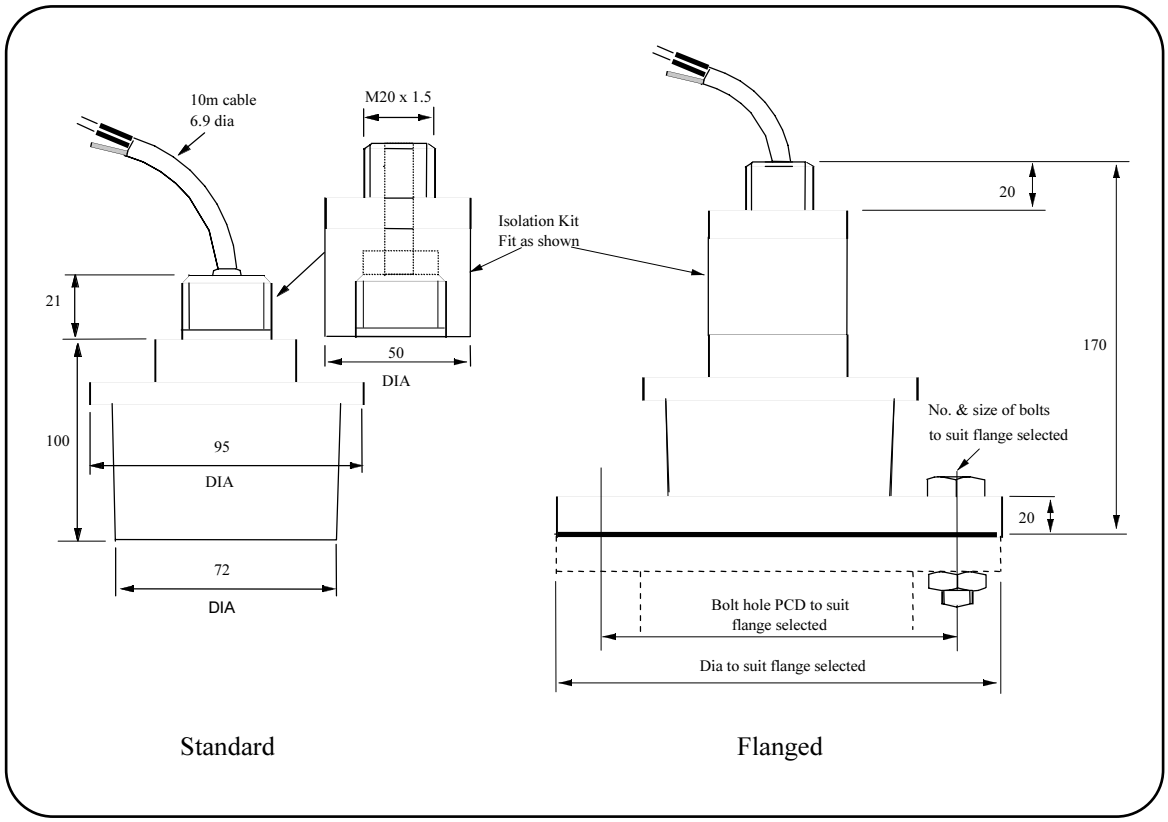
Transducer wiring for Differential Mode - fig 8





2.2. Transducer Mounting

The transducer can be supplied as 'standard' or mounted in a Teflon faced flange for applications requiring chemical compatibility. The figure below shows the dimensions:



An isolation kit is provided with each transducer to minimise any ringing transmitted through the mounting structure.

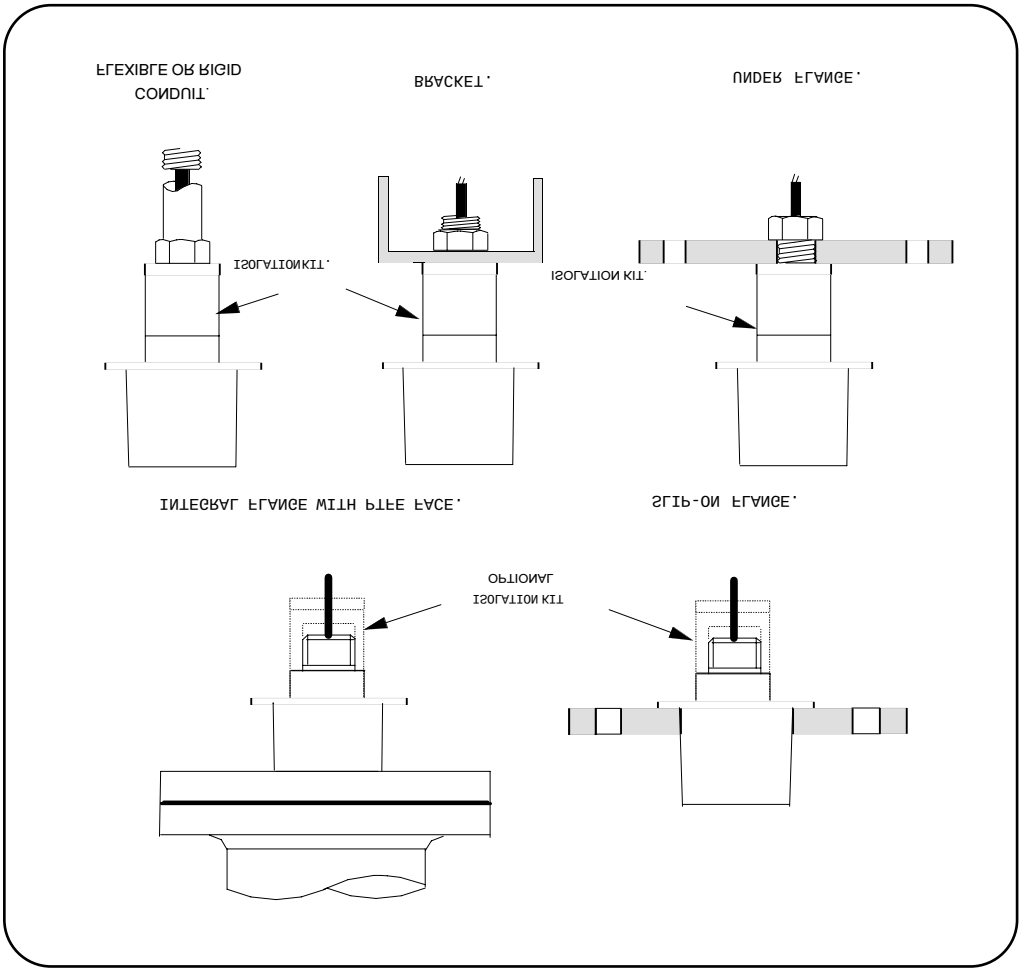
The transducer must be mounted perpendicular to the monitored surface and, ideally, at least 0.5 metres above it.

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 integral cable which can be extended up to 300 metres using a suitable junction box and RG62AU cable. The temperature compensated transducer requires an additional single core screen extension.
The extended cable should then be terminated directly into the instrument.

Transducer cables and temperature compensation cables can be run together but should be separated from power cables by at least 150mm and preferably installed in their own earthed steel conduit.

2.2.1. Alternative mounting arrangements for transducer



Do not mount transducers incorporating temperature compensation in direct sunlight.

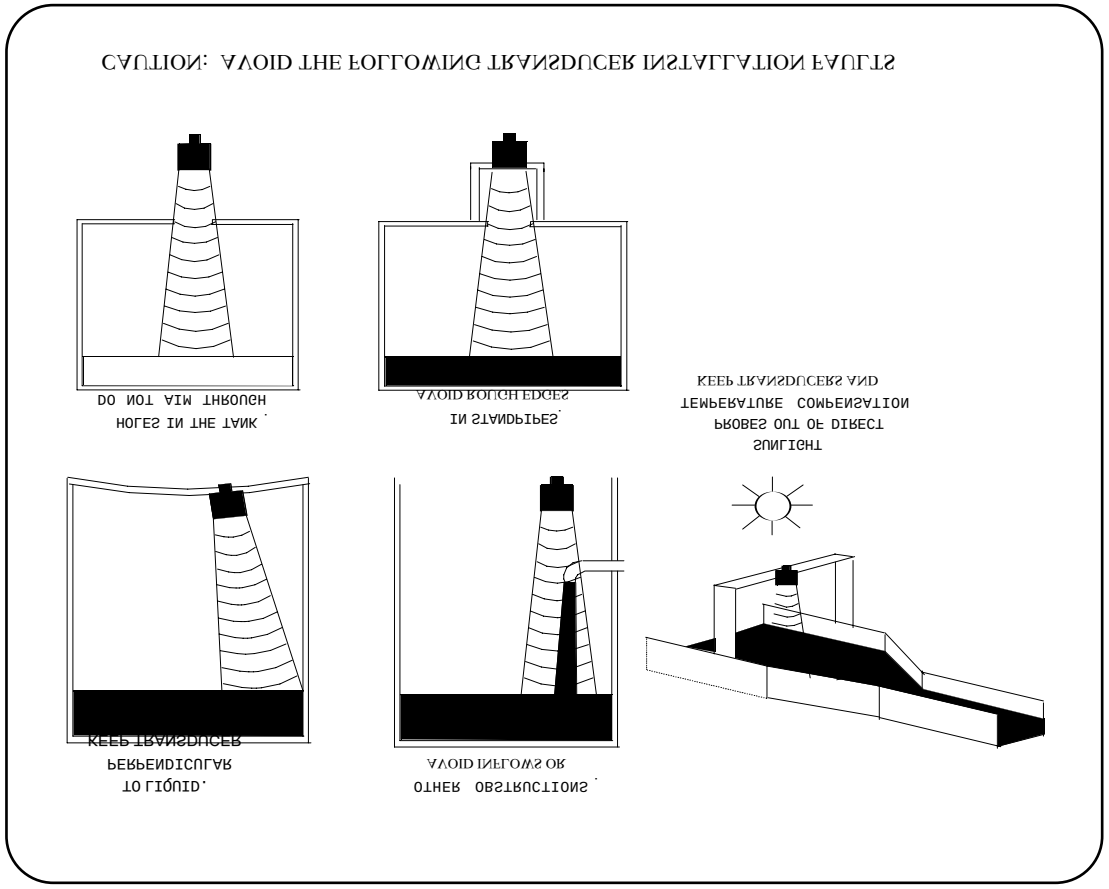
Do not over-tighten the bolts on flange construction transducers.

Flange transducers are not pressure rated and are suitable only for atmospheric pressure.

CENELEC approved transducers must be mounted and wired in accordance with the appropriate National Standards concerning installation in hazardous environments.

For differential applications mount both transducers at the same height above the zero datum point.

For open channel flow applications the transducer must be mounted upstream of the flume or weir as detailed in BS3680 (usually 3 or 4 times maximum head).



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 stand-pipes.

BLANKING: Parameter 5 should always be set at least 150 mm longer than the length of the standpipe.

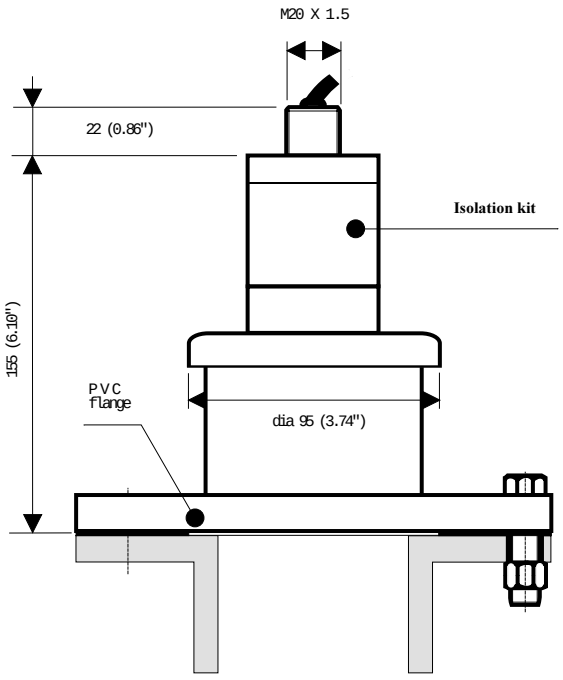
STANDPIPE should be in accordance with the follo-wing table

DIMENSIONS:

Flange size and minimum bore of Standpipe	Maximum length of Standpipe
3" (75mm)	300mm
4" (100mm)	300mm
6" (150mm)	400mm
8" (200mm)	600mm
12" (300mm)	600mm

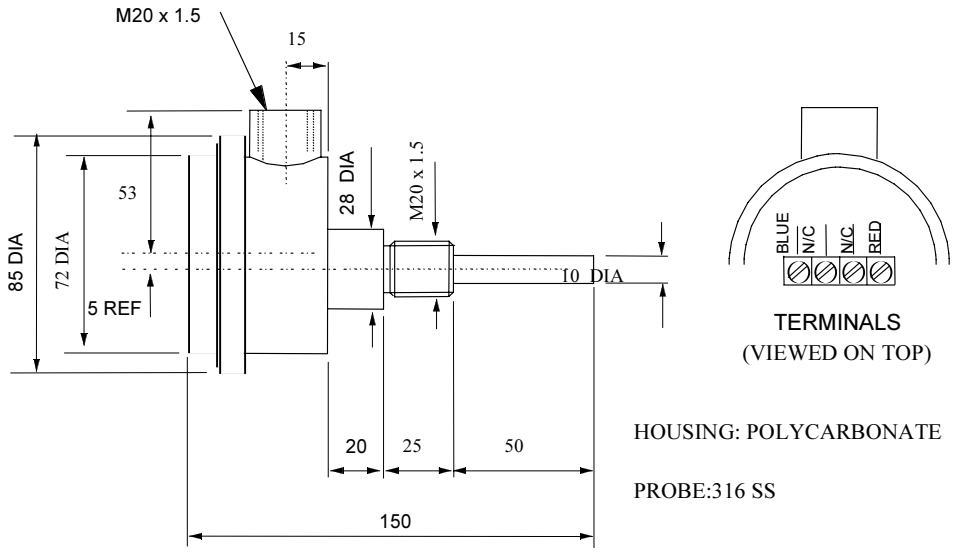
e.g. : Using a 4" flanged transducer would require the standpipe length to be no more than 300mm and Pr.5 set at 450 mm minimum.

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

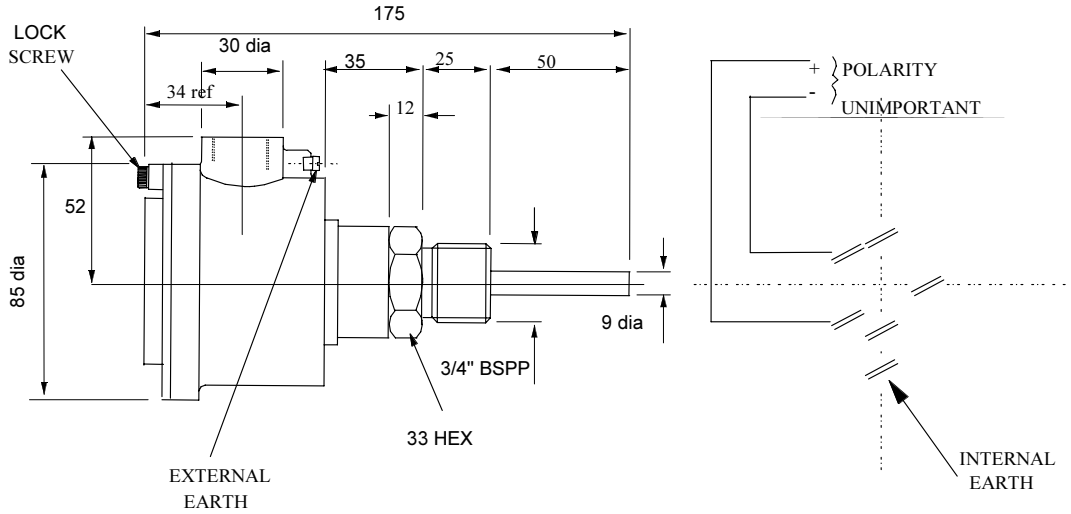


2.3. Temperature Sensor

If a separate temperature sensor is to be used it must be mounted where it will monitor temperature changes of the air between the transducer and the liquid. This is usually adjacent to the transducer, but should not be in direct sunlight and should be protected from wind chill.



TEMPERATURE SENSOR RTS 2



HOUSING: CAST IRON BLACK EPOXY PAINT
CLASSIFICATION EEx e II T6/IP 65

PROBE: 316ST. STEEL

TEMPERATURE SENSOR RTS 2B

3. Programming

The Level-Sonic BM90 has two modes :

a) RUN (normal operating)
b) PROG (programming)

In the 'RUN' mode, the instrument is monitoring the target, displaying values and setting outputs as programmed by the operator.
In the 'PROG' mode, the operator uses the keypad in conjunction with the display to adjust the settings and to test that the unit is programmed correctly.

3.1. Keypad definitions

The keypad consists of 20 keys which are used to control the operation of the converter.These keys also have secondary functions indicated above them (See Figure 5) enabling the operator to view the results being obtained by the instrument during its normal 'RUN' cycle.

Primary Key Functions

0 - 9	Numerical Values
.	Decimal Point
-	Negative value (also used to slow down simulation)
CE	Clear Entry (also used to leave test functions Pr.75 to Pr.78.)
#	Returns display to normal 'RUN' mode after viewing secondary functions (also speeds up simulation Pr.78)
MODE	Alternates between 'RUN' and 'PROG' mode.
TEST	Displays gain in 'RUN' mode and allows parameter interrogation and simulation hold in 'PROG' mode.
's'	Increase parameter number (also control of simulation direction).
't'	Decrease parameter number (also control of simulation direction)
DSP	Display parameter number/value alternately.
ENT	Enter a new value or initiate a system test under Pr.75 to Pr.78

Active Secondary Key Functions
During normal 'RUN' mode it is possible for an operator to obtain the data defined as secondary function without interrupting normal operation, by pressing the appropriate key, i.e.

Keys 1 - 4	Show high totaliser, low totaliser, head and flow when in the OCM mode. Head will always show level.
Key 5	Relay 1. Hours energised.
Key 6	Relay 2. Hours energised.
Key 7	Relay 3. Hours energised.
Key 8	Relay 4. Hours energised.
CE	Relay 5. Hours energised.
Key 9	Relay 1. Number of times energised.
Key 0	Relay 2. Number of times energised.
.	Relay 3. Number of times energised.
_	Relay 4. Number of times energised.
's'	Relay 5. Number of times energised.
Test	Displays gain
ENT	Displays mA output.
DSP	Displays distance from the transducer face.
't'	Displays temperature.

3.2. Display Descriptions

The following display codes are used :

PROG	Precedes program mode
RUN	Precedes run mode
Pr.XX	Parameter number
CodE	Security code request
====	No value
FULL	Numerical overflow of display i.e. value too large to display
-FUL	Negative numerical overflow Check taht Pr.43 is correct
P.rES	Resetting to factory parameters
t.rES	Resetting totalizer
LOSt	Loss of echo
tESt	System performing a requested test
gAIN	Gain value being displayed
HEAd	Head
FLO	Flow
HI.tO	Totaliser high 4 digits 9999 (----)
LO.tO	Totaliser low 4 digits (----) 9999
deG.C	Temperature C
dISt	Distance
An.OP	Analogue output

3.3. Security code

The Level-Sonic BM90 programme includes security code protection. Any operator can display the value of a parameter, but any attempt to enter a new value or perform a test will result in the security code being requested.
The security code is requested by the prompt of 'COdE', if the code is not entered correctly this prompt is re-displayed.
Once the code has been input correctly, it will not be required again whilst the system remains in the 'PROG' mode. The factory set value is 9753.
A new "customer's" security code, comprising 4 numerical digits, can be entered via Pr.96, providing the operator is in programme mode. The range of acceptable values is 1000 to 9999. If an invalid code is entered, the instrument will default to a code number 9753.
The code number is scrambled immediately on entry.
If you forget your security code ring your supplier for advice quoting the number stored in Pr.96..

3.4. Application programming

The programming of Level Sonic BM90 is controlled by the parameters summarised and listed later in this chapter. Programming is easy to follow because the parameters available to the programmer fall into distinct groups:-

Pr. 1 - Pr.6	Basic set up
Pr. 8 - Pr.22	Relays 1 to 5 designation and settings
Pr.23 - Pr.29	Failsafe operation
Pr.30 - Pr.34	Set the analogue output
Pr.37 - Pr.39	Temperature compensation
Pr.40 - Pr.44	Volume conversion
Pr.45 - Pr.50	Open Channel Flow Metering
Pr.51 - Pr.57	Specialised Pump Control
Pr.68 - Pr.70	Select echo detection and processing
Pr.71 - Pr.74	Miscellaneous
Pr.75 - Pr.78	Test Parameters
Pr.95 - Pr.96	Number Stores
Pr.97 - Pr.99	Resets

It can be seen from the above which distinct groups of parameters need to be considered for a particular application. For instance, in an application to measure level, it may be necessary to consider only Pr.1 to Pr.29 which are relative to basic set-up, relays and failsafe.

It is good practice to carry out a programme reset on a new application before starting programming as this will return all parameters to factory defaults and any parameters which are not required for the new application will remain at default, ensuring that the programme runs correctly.

Default values for each parameter are shown in the parameter definition , Section 3, and in the Parameter Setting table, Page 43.

3.5. Programming

The following is the programming sequence to set up a unit for operation. If you have not done this before, refer back to chapter 1 "Initial start up Level-Sonic BM90".

1. Calculate the correct values
   From the information contained within this manual and the knowledge of the application, produce on paper the correct values for the parameters required (use page 36 Programming sheet).
   To help you with this, see the examples on pages 27 to 32. Details of all the parameter options are listed on pages18 to 26.
2. Sequence to enter a new program or modify the existing one
   Press 'MODE'. When display shows "Prog" press '1' and then press 'DSP' followed by 'ENT'.
   Display will show COdE and security code must be entered (factory default is 9753. For a new code see chapter 3.3).
   The display will now show the value of Pr.01 or the last Pr. number used indicating that the correct security code has been entered.

If the unit is being programmed for a new application it is recommended that all parameters are reset to the factory programmed values as follows :

1. Display Pr.99
2. Press 'DSP' to show '===='
3. Press 'CE' to obtain a clear display
4. Press 'ENT' and the display will show 'P.rES', then 't.rES' and then '===='
5. Press 'DSP' and enter Pr.01
6. Press 'DSP' to display the value of Pr.01.

If a modification is being made to an existing program then the sequence re-commences here.

The new values for any parameter should be input, checking that the value is stored correctly. The parameters can be accessed in series using 's' and 't' keys or individually by entering the required parameter number.
Before entering the 'RUN' mode, the program can be checked by pressing Pr.78, then DSP , then 'ENT'. Level-Sonic BM90 will now simulate the operating program providing display, analogue output and relay functions.

CAUTION :

All Level-Sonic BM90 outputs will work under simulation, so ensure that external connections will not cause damage.

Press 'CE' to leave simulation.
Press 'TEST' to freeze and unfreeze simulation.
When the program is complete and does not require further modification press 'MODE' to return to the 'RUN' condition.

3.5.1. Parameter index Level-Sonic BM90

Basic Set-up
- Pr.1 Application
- Pr.2 Units
- Pr.3 Empty Distance
- Pr.4 Operational Span
- Pr.5 Blanking Distance
- Pr.6 Rate of change

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- Pr.8 Relay 1
- Pr.9 Relay 1 Set
- Pr.10 Relay 1 Reset
- Pr.11 Relay 2
- Pr.12 Relay 2 Set
- Pr.13 Relay 2 Reset
- Pr.14 Relay 3
- Pr.15 Relay 3 Set
- Pr.16 Relay 3 Reset
- Pr.17 Relay 4
- Pr.18 Relay 4 Set
- Pr.19 Relay 4 Reset
- Pr.20 Relay 5
- Pr.21 Relay 5 Set
- Pr.22 Relay 5 Reset

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- Pr.23 Failsafe R1
- Pr.24 Failsafe R2
- Pr.25 Failsafe R3
- Pr.26 Failsafe R4
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- Pr.28 Failsafe Analogue
- Pr.29 Failsafe Time Delay

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- Pr.30 Analogue Output
- Pr.31 Analogue Value Options
- Pr.32 Analogue Datum
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- Pr.37 Probe Enable
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- Pr.40 Vessel Shape
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- Pr.45 Flow Exponent
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- Pr.51 Pump Sequence
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- Pr.77 Transmitter Test
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Number Store
- Pr.95 Serial Number Store
- Pr.96 Security Code Store

Reset
- Pr.97 Relay Hours/Starts Totaliser Reset
- Pr.98 OCM Totaliser Reset
- Pr.99 Full System Reset

NOTE: All other parameters are unused and should not be changed.

3.5.2. Parameter definitions

The parameters define all the options that are available to the operator of a Level-Sonic BM90. It may be easier to read these in conjuction with the application examples on pages 27 to 32.
Note : (D=) factory default entry for that parameter.

Pr. 1 Basic Application (D=2)

Enter
- 1 Liquid Level Measurement
- 2 Distance Measurement
- 3 Differential Level Measurement (DLD)
- 4 Open Channel Flow Metering (OCM)

Pr. 2 Calibration / Display units (D=2)

Enter one of the following codes :

1	Feet	
2	Metres	To display in percent of
3	Inches	span, set Pr. 40 to 1
4	Centimeters	

The system will be set to work in the specified units but the display can be made to display a percentage, a converted value or a volume (Pr.40).

Note : Any subsequent change of units in Pr.2 (i.e. Pr.2 = 1-4) will reset parameters Pr.3 to Pr.6 to new units and all other parameters will default to factory resets.

Pr. 3 Empty Distance (D=10.00) / BM90L (D=15.00)

The distance from the face of transducer to the furthest point away, usually the bottom of the container or channel. Enter the distance in the units selected in Pr.2.
NOTE:- We reccomend setting the unit to factory defaults and let it measure the empty distance.
Enable Pr.37 if using temperature compensation.

Resolution is a function of this parameter.

Pr. 4 Operational Span (D=10.00) / BM90L (D=15.00)

The distance between the furthest and nearest points over which measurement is required.
Enter distance in the units selected in Pr.2. For differential applications, the value required is the maximum difference in the levels to be measured.

Pr. 5 Blocking or blanking distance (D= 0.50)

The distance in front of the transducer, within which the liquid should not enter and within which no return echoes will be processed.
Enter in the units selected in Pr.2 (not %).

IMPORTANT : PLEASE DO NOT REDUCE THE FACTORY SET VALUE WITHOUT REFERENCE TO KROHNE S.A.

Pr. 6 Rate of Change (D=1.00)

This value should be as small as possible but greater than the maximum rate of change of level. Do not change this value unless you know that the rate of change is greater than 1.0m/min or that the system continually 'tracks' a level lower than the actual level.

If it is necessary to change the value, enter the new value in units per minute selected in Pr.2. The suggested range of values is 0.1 to 10 metres/min or the equivalent.

Pr. 7 Decimal Display (D=2)

0 = No decimal places allowed.
1 = Up to 1 decimal place allowed.
2 = Up to 2 decimal places allowed.
3.= Up to 3 decimal places allowed

Relays
The 5 relays can be assigned to various functions depending on the application, as shown below:

Hysteresis is fully adjustable, so for most functions it is necessary to enter both "set" and "reset" values.

The relay state under normal operating conditions is defined as:-

(e) = normally energised. De-energise when "set" value is reached.
(d) = normally de-energised. Energise when "set" value is reached.

"Failsafe" functions are detailed in Pr.23 - 27.

The relays can be programmed to give both high and low alarm or control levels.

e.g. High alarm Set: 2.0m Low Alarm Reset: 0.5m
Reset: 1.8m Set: 0.2m

The system will automatically configure itself as high or low alarm depending on which of the set and reset entries has the higher value.

Note that on distance measurement only (Pr.1 = 2), the highest value is furthest from the transducer.

Defaults are 0 for relay designations 8, 11, 14, 17 and 20. Defaults are 0.00 for relay settings 9 & 10, 12 & 13, 15 & 16, 18 & 19, and 21 & 22.

The relays are controlled from parameters 8-22 as follows:

	Relay 1	Relay 2	Relay 3	Relay 4	Relay 5
Designation	Pr. 8	Pr.11	Pr.14	Pr.17	Pr.20
Set (l.e.d. on)	Pr. 9	Pr.12	Pr.15	Pr.18	Pr.21
Reset (l.e.d. off)	Pr.10	Pr.13	Pr.16	Pr.19	Pr.22

The application - relay function options are shown on the following tables : (D = 0 or 0.00 for all)

Pr. 8 Basic Application - Relay Function 1 - 2

Relay 1 Designation		Pr. 1 = 1 / Pr.1 = 2 Level / Distance		Pr. 1 = 3 Differential		Pr. 1 = 4 Open Channel Flow	
Enter	0	Off		Off		Off	
	1	Level Alarm	(e)	Level Alarm on either transducer	(e)	Level Alarm	(e)
	2	Level Control	(d)	Differential Alarm	(e)	Level Control	(d)
	3	Off		Differential Control	(d)	Flow Alarm	(e)
	4	Off		Downstream Level Alarm	(e)	Off	
	5	Off		Upstream Level Alarm	(e)	Off	
	6	Temperature Alarm	(e)	Temperature Alarm	(e)	Temperature Alarm	(e)
	7	Loss of Echo	(e)	Loss of Echo	(e)	Loss of Echo	(e)
	8	Run / Prog	(e)	Run / Prog	(e)	Run / Prog	(e)

(e) normally energised de-energised to alarm

(d) normally de-energised energise to start (motor)

Pr. 9 Relay 1 Set

Pr. 10 Relay 1 Reset

Level/Differential	Enter values in display unit as selected Pr. 2.
Flow	Enter values in unit selected at Pr.46
Temperature	Enter values in C (only valid if probe fitted)
Loss of Echo or run/prog	No set/Reset entries are required

Pr. 11 Relay 2 Designation

Identical to Pr. 8.

Pr. 12 Relay 2 Set

Identical to Pr. 9.

Pr. 13 Relay 2 Reset

Identical to Pr. 10.

Pr. 14 Relay 3 Designation

Identical to Pr. 8.

Pr. 15 Relay 3 Set

Identical to Pr. 9.

Pr. 16 Relay 3 Reset

Identical to Pr. 10.

Pr. 17 Relay 4 Designation

Identical to Pr. 8.

Pr. 18 Relay 4 Set

Identical to Pr.9.

Pr. 19 Relay 4 Reset

Identical to Pr.10.

Pr. 20 Relay 5 Designation - Basic Application - Relay Function

Relay 5 Designation	Pr. 1 = 1 / Pr.1 = 2 Level / Distance	Pr. 1 = 3 Differential	Pr. 1 = 4 Open Channel Flow
Enter 0	Off	N / A	Off
1	Level Alarm (e)	N / A	Level Alarm (e)
2	Level Control (d)	N / A	Level Control (d)
3	Off	N / A	Flow Alarm (e)
4	Off	N / A	Off
5	Off	N /A	Totalizer Drive (d)
6	Temperature Alarm (e)	N / A	Temp. Alarm (e)
7	Loss of Echo (e)	N / A	Loss of Echo (e)
8	Run / Prog (e)	N / A	Run / Prog (e)

(e) normally energised
de-energised to alarm

(d) normally de-energised
energise to start (motor)

Pr. 21 Relay 5 Set

Pr. 22 Relay 5 Reset

Level/Differential	Enter values in display unit as selected Pr. 2.
Flow	Enter values in unit selected at Pr.46
Temperature	Enter values in C (only valid if probe fitted)
Sampler	Enter value in hours (no reset needed)
Totalizer	Refer to Pr.49
Loss of Echo or run/prog	No set/Reset entries are required

Pr.23 to 27 Failsafe (D=3 for all)

On loss of power all relays will de-energise.
For other fault conditions e.g. damaged transducer, the failsafe relay state (after time delay selected at Pr. 29) is selectable.

Pr. 23 Relay 1 Failsafe)
Pr. 24 Relay 2 Failsafe)
Pr. 25 Relay 3 Failsafe)
Pr. 26 Relay 4 Failsafe)
Pr. 27 Relay 5 Failsafe)

Enter 1 Energise
2 De-energise
3 Hold-state
one option for each relay

Note : Relay designated LOSS-OF-ECHO will always de-energise.
Relay 5 Failsafe is not applicable in differential or OCM mode.

Pr. 28 Analogue and Display Failsafe (D=3)

Enter 1 Low
2 High
3 Hold Value

Pr. 29 Failsafe Time Delay (D=120)

Enter value (in seconds) before unit goes to selected fail-safe positions.Minimum value is 30 seconds.

Pr. 30 Analogue Output (D=1)

Pr. 1 Entry	Application	Output Proportional To
1.00	Liquid Level	a) Liquid Level b) Liquid volume if Pr.40 is used
2.00	Distance	a) Target distance b) Space volume if Pr.40 is used
3.00	Differential (DLD)	Differential level. (The unit can differentiate between positive and negative differentials. (See Pr.31)
4.00	Open Channel Meter (OCM)	a) If Pr.31 = 1 output proportional to head b) If Pr.31 = 2 output proportional to flow

NOTE: Refer to Pr.34 for output test.

Enter 1 - 4-20mA)
2 - 20-4mA) > related to span (Pr.4)
3 - 0-20mA) or Pr.33
4 - 20-0mA)
5 - 4-20mA) > will over-range 0-24mA if normal span
6 - 0-20mA) (Pr.4) is exceeded

The output represents different variables depending on the application mode selected at Pr.1

Limits are defined by Pr.4

Pr. 31 Analogue Value Options (D=1)

In differential mode (Pr.1 = 3)
Enter 1 - difference of two levels
- Pr.4 represents maximum differential in levels

2 - upstream level
- Pr.4 represents the difference between upstream empty distance Pr.3 and maximum upstream level.

3 - downstream level
- Pr.4 represents the difference between downstream empty distance Pr.3 and maximum downstream level.

In OCM mode (Pr.1 = 4)
Enter 1 - for measured head (depth of liquid)
2 - for calculated flow

Pr. 32 Analogue Datum (D=0.00)

If an analogue output is required with a zero different from the measurement zero (Pr.3) then an offset defined as a percentage of the measurement span/flow/volume etc., can be entered here.

Pr. 33 Analogue Span (D=100)

If an analogue output is required with a span different to that defined for the measurement (Pr.4) then an alternative value defined as a percentage of the measurement span/flow/volume etc., can be entered here. A value of zero is ignored.

Pr. 34 Analogue Output Test (D=0)

This parameter can be used to examine the last analogue output value set up by the instrument. Also any value in the analogue output range can be entered for loading to the current output, and can be measured at the output terminals, to test the external analogue circuitry.

Pr. 37 Temperature Sensor Enable (D=1)

1 = No sensor attached
2 = Senor attached

Pr. 38 Compensating Temperature (D=20 C)

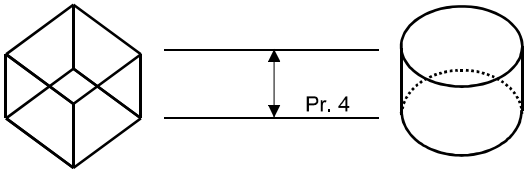
If no probe is fitted the vessel temperature may b entered here.

Pr. 39 Temperature Probe test (D=0)

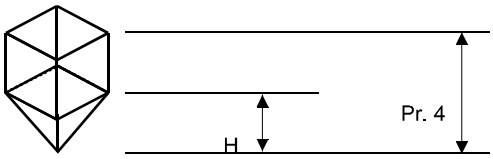
Displays the sensor resistance in K Ohms. Typically 9.5 at 20 C.
If value shows '0.00' after switching 'Off' and 'On' then either no sensor is connected, or there is a short circuit or open circuit in the system.

Pr. 40 Vessel Shape (D=0)

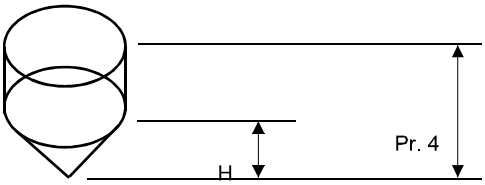
0 = no volume conversion
1 = flat bottomed vessel and percentage of span
2 - 7 = standard shapes as shown below
8 = vessel linearisation (see Pr.44)



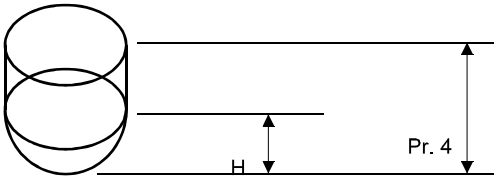
Enter 1
Flat
bottom



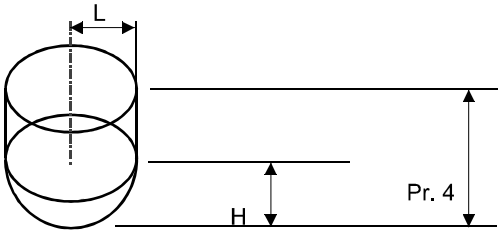
Enter 2
Pyramid
bottom



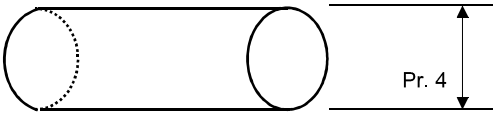
Enter 3
Conical
bottom



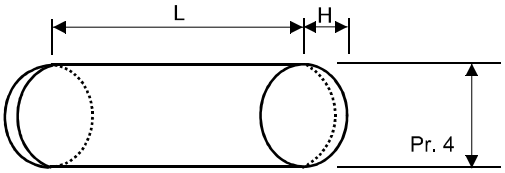
Enter 4
Half
sphere
bottom



Enter 5
Parabolic
bottom



Enter 6
Flat
ends



Enter 7
parabolic
ends

Pr. 41 Vessel Dimension H (D=0)

Enter H where indicated above in units selected at Pr.2.

Pr. 42 Vessel Dimension L (D=0)

Enter L where indicated above in units selected at Pr.2.

Pr. 43 Display Conversion (D=1)

If Pr.40 entry is between 1 - 8 then enter - full scale display ÷ 100
e.g. if 100% = 2000 litres and display required in litres then set Pr.43 to 2000 , 100 = 20.

To display in any unit enter any value from '0.001' to '9999'

NOTE:
Display cannot be more than 4 digits. If it is necessary to measure 20,000 gallons, then display in thousands of litres (or cubic metres) by dividing 20 by 100 = 0.2.

Pr. 44 Linearisation (D= ═══)

This function allows non-standard flumes and vessels to be characterised. For full details please refer to Appendix 1, pages 39 to 40.

Pr. 45 Flow exponent (D=1)

Enter the required value for open channel flow device being used.

e.g.	Flow Device	Enter
	Unity	1
	Rect. flume 3/2	2
	Rect. weir 3/2	2
	V-notch weir 5/2	3
	Special	4 (Refer to Pr.44)
	Parshall Flumes	5-14

The OCM flow exponent (Pr.45) has been expanded to include 10 Parshall flume profiles. The data for the selected flume is loaded into the flume mapping system (Pr.44) from tables held in memory.

Size		Exponent	
5:	1,2,3,24	inches	1.550
6:	6	inches	1.580
7:	9	inches	1.530
8:	12	inches	1.522
9:	18	inches	1.538
10:	36	inches	1.566
11:	48	inches	1.578
12:	72	inches	1.595
13:	96	inches	1.606
14:	10,12,15,20, 25,30,40,50	feet	1.600

Maximum head is entered in Pr.4 and the associated maximum flow in Pr.46. If one of the values is known, the other can be found in the flume tables or by calculation from

$$Q = KHn \text{ GPM},$$

where H = Inches, Q = US GPM and
K = Constant for flume size
(for imperial gallon multiply K factor by 0.8).

Flume Size-Inches	K Factor for US GPM	Flume Size-Feet	K Factor for US GPM
1	3.22	10	331.60
2	6.45	12	393.70
3	9.46	15	486.90
6	18.20	20	642.10
9	30.80	30	797.40
12	40.90	40	1263.00
18	58.90	50	1574.00
24	76.30		
36	110.00		
48	142.00		
72	204.70		
96	256.60		

Pr. 46 Maximum Flow Rate (D=0)

Enter the maximum flow rate in units per second, per minute, per hour or per day, corresponding to maximum head, set at Pr.4 and then define the time base at Pr.47.

Pr. 47 Time Base of Maximum Flow Rate (D=1)

Enter the value corresponding to the flow rate time base.

Enter 1 = units per second
2 = units per minute
3 = units per hour
4 = units per day

Pr. 48 Totalizer Display Conversion (D=0)

Used to totalise on the display in flow units larger than those entered at Pr.46 (max. flow rate)

Enter
0 Multiples by 1
1 Multiples by 0.1
2 Multiples by 0.01
3 Multiples by 0.001
4 Multiples by 0.0001
5 Multiples by 0.00001
6 Multiples by 0.000001
7 Multiples by 0.0000001

e.g. If Pr.46 is entered as litres, at Pr.48 enter '3' to totalize the flow in cubic meters.

Pr.49 Control External Counter (D=0.00)

If Pr.20 is set to 5, "Totaliser Drive", then enter the amount which each relay trip is to represent in totalised units. See example 5 on page 39.

e.g. If "litres" entered at Pr.46 and Pr.48 is '0' then to totalise in cubic metres enter 1000.

If an entry is made at Pr.48 for the internal totaliser then to use the same unit for an external counter enter '1'.

After making entries in Pr.49, go to Pr.98 to clear and initiate totaliser.

Pr. 50 Penstock Control (D=1)

Enter 1 - No drive
2 - Penstock control

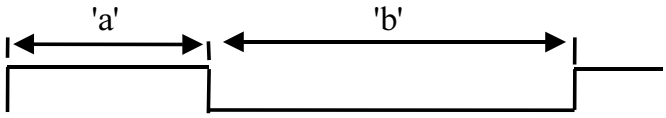
The control system uses relays 1 and 2 to drive a penstock up and down respectively to maintain the flow in a channel within certain limits.

The designations for relays 1 and 2 are ignored, but the following values have to be set.

Pr.9 : Top flow limit) In units defined by
Pr.10 : Bottom flow limit) Pr.46 entry
Pr.12 : Width of drive pulse (seconds)
Pr.13 : Time between drive pulses (seconds)

See example 4.6 on page 32.

The penstock drive consists of a pulse train of variable time base which drives the penstock up and down.



The time 'a' is set by Pr.12 and 'b' is set by Pr.13 in seconds, this allows any shape drive train to be defined.

The control will maintain the flow between two limits, a high limit set by Pr.9 and a low limit set by Pr.10.

If the flow exceeds the value in Pr.9 relay 2 drives the penstock down. If the flow is below the value in Pr.10 relay 1 drives the penstock up. See Example 6.

Pr. 51 Pump Sequencing (D=1)

In order to even out the wear of pumps it is possible to alternate the sequence in which pumps are used. (Pr.52 must be set to 1).

Enter
1 Sequence by set points (i.e. no alternation)
2 Alternate RL1 and RL2
3 Alternate RL1, RL2 and RL3
4 Alternate RL1, RL2, RL3 and RL4
5 Alternate RL1, RL2, RL3, RL4 and RL5

Pr. 52 Duty/Assist/Standby Pump Control (D=1)

Duty assist is where pumps are switched on by set point, and kept on to assist earlier pumps. Duty standby is where only one of the pumps specified for duty can be on at a time, i.e. when the set point for the second pump is reached and it switches on, the first pump will switch off.

Enter 1 - Duty/assist operation
2 - Duty/standby on pumps 1 and 2
3 - Duty/standby on pumps 1, 2 and 3
4 - Duty/standby on pumps 1, 2, 3 and 4
5 - Duty/standby on pumps 1, 2, 3, 4, and 5

The turn-off points for the pumps can all be the same, or they can be different depending on the chosen "Set" and "Reset" values for each relay.

Pr.53 Pump Exerciser (D=1)

To use this facility, first select alternating duty options 2 to 5 in Pr.51, depending on the number of pumps installed.

Enter the number of starts assigned to Pump 1 before the sequence switches to allow the other pumps to be exercised in turn.

Pr. 54 Pump Tolerance (D=1)

In applications where a greasy topped liquid is being pumped, problems may occur due to build-up of grease at the levels where pumping starts. It is usually necessary for this to be cleared manually. To avoid this, varying the "turn on" point for the pumps by – 10% of the set point value causes the build-up to occur over a larger area, significantly reducing the maintenance problem.
Enter 1 - No tolerance applied to pumps
2 - Tolerance applied to all pumps

NOTE: The pump 'reset' points must be outside the tolerance band of the set points and blanking.

Pr. 55 Pump Maintenance Dropout (D=0)

The removal of one pump for maintenance can necessitate a great deal of readjustment to ensure correct control. Pr.55 removes this need by allowing one pump to be removed without affecting the control levels. Pumps are re-assigned downwards so that the highest level is not used, therefore, normal control levels are maintained for lower level setting.

Enter

0	All pumps in	3	drop out pump 3
1	drop out pump 1	4	drop out pump 4
2	drop out pump 2	5	drop out pump 5

NOTE:

a. The system assumes that the lower numbered pumps turn on first.

b. CAUTION - A PUMP NOT INCLUDED IN AN ALTERNATING SEQUENCE BUT PROGRAMMED INTO THE FIXED PART OF THE SEQUENCE WILL BE SUBSTITUTED INTO THE ALTERNATING SEQUENCE TO REPLACE A PUMP DROPPED OUT.

c. This feature should not be used if the relays are being used for a mixture of pump control and alarm functions.

Pr. 56 Pump Run-On Interval (D=0)

When submersible pumps are used, it may be necessary to pump down occasionally to clear the sludge from the bottom of the well. This feature is controlled by Pr.56 and Pr.57. Once in every interval defined by Pr.56, the pump will run-on for the time period defined by Pr.57.

Enter the time interval in hours between each run-on cycle.

Pr. 57 Pump Run-On Time (D=0)

Enter the pump running time in seconds. (max. 120 seconds).
Only one run-on cycle occurs per interval as set by Pr.56.

Notes :
a) Caution is required when choosing a value for pump run-on time, as extended pump run-on can lead to CAVITATION, causing AIR LOCK or PUMP DAMAGE.
b) As overflow can occur, do not use pump run-on for pump up operation, set Pr.56 and Pr.57 to zero.
c) Care should be taken if pump sequence and pump run-on are defined together. As pump run-on will be assigned to the last pump to turn off which could be any of those in the sequence.

Pr. 58 to Pr. 61 Unspecified

Pr. 62 BM90E Serial Communication Enable (D=1)

(Channel 1-RS232)

Channel 1 (RS232) 1 = Comminssioning System (default)
2 = Polled data transfer

Channel 2 (RS485) Is permanently enabled for polled data transfer

Pr. 63 BM90E Station Number (D=0)

For plooed date transfer, the unit requires to have a station number assigned to it in the range 1-31, which has to be unique to the unit.

NOTE : Pr.62 & Pr.63 are not available on BM90LE

Pr. 64 to Pr. 67 Unspecified

Pr. 68 Echo Processing Algorithm

Each system has two echo extraction techniques, which are capable of determining the "true" echo for the majority of applications where an echo is present.

For Level-Sonic BM90: (D=2)

Enter 1 = All vessel viewing. This technique continuously looks for echoes over the complete vessel. It is suited to applications that have very rapid level changes but it is more sensitive to parasitic echoes.

Enter 2 = Windows. This technique positions a narrow 'window' around the target it is tracking to enable it to ignore a large amount of spurious noise.

For Level-Sonic BM90E: (D=1)

Enter 1 = For solids applications. This technique looks for the highest level within the transducer view.

Enter 2 = For liquids. This technique positions a narrow 'window' around the target it is tracking to enable it to ignore a large amount of spurious noise.

Pr. 69 Check Search (D=1)

Only available if Pr.68 is set to 2. It enables the instrument to look outside its window at intervals to check that there are no other relevant echoes within the transducers view.

Enter 1 = Not used
2 = Included

Check search should be used where fill rates can sometimes be greater than that entered at Pr.6, or if the transducer is liable to be submerged.

Pr. 70 Echo Velocity

(D=344.1 i.e. speed of sound in air at 20 C)

If operating through any medium other than air, enter the velocity of sound through that medium in metres per second.

Pr. 71 Correction Value (D=0.00)

Both negative and positive values can be input. This value must be entered in the units selected at Pr.2.

This parameter has two uses:

1. It can be used to correct minor reading errors on the display
2. It can be used to prevent loss-of-echo when the target can go further away from the transducer than the desired span.

e.g. a) When a channel floor is lower than the zero point of a "V" notch weir.
b) To set an elevated zero level in a vessel which is not normally completely emptied.

Add the extra depth to Pr.3 and enter minus the extra depth at Pr.71 in the units selected at Pr.2.

Pr.72 Parameter Display (D=0)

The system will display continually the value of:

Gain	-	by entering 67
Temperature	-	by entering 38
Analogue output	-	by entering 34.

It can be used only for commissioning as it will be lost on power down. It cannot be used in OCM mode.

Pr. 73 Software revision number

Displays the revision number of the software (e.g. LA.14).

Pr. 74 Reset Counter

This count value gives the number of times that the system has been powered down or reset since the last time the counter was zeroed. It is useful for checking if the power supply is erratic.

Pr. 75 Digital Outputs (D=0)

To aid commissioning and the testing of external wiring, it is possible to define the status of all five relays when in 'PROG' mode.

Press 'DSP' then:

Enter	0 -	To de-energise all relays
ADD	1 -	To energise relay 1
ADD	2 -	To energise relay 2
ADD	4 -	To energise relay 3
ADD	8 -	To energise relay 4
ADD	16 -	To energise relay 5

e.g. To energise relays 2 and 5 enter '18'

The defined relay state will be maintained until over-written or until 'PROG' mode times out (6 minutes). The time period can be extended by pressing a key during this period to reset the time-out counter.

Pr. 76 Hardware Test

Press 'DSP' then 'ENT' to test LED's/LCD and relays. The LCD will flash all segments, and the LED's will count up in binary. Press 'CE' to end test, or let it time out.

CAUTION: DO NOT USE THIS TEST WHEN CONNECTED TO PUMPS OR RELAYS. USING THIS PARAMETER WILL OPERATE ALL RELAYS AND MIGHT START PUMPS, ALARMS ETC.

Pr. 77 Transmitter Test

Press 'DSP' then 'ENT', the transmitter should pulse continuously, (made visible by the neon). By the use of an oscilloscope the return echo can be observed if required.

Also useful to ascertain if a transducer is correctly connected, as it will 'click' repeatedly. Press 'CE' to end.

Pr. 78 Simulation

The value displayed will depend on the value set in Pr.01.

Press 'ENT' to simulate the operation of the instrument as set up between Blanking and Empty distance. The display will depend on mode set in Pr.01.

Mode	
= 1 (liquid level)	LEVEL
= 2 (distance measurement)	DISTANCE
= 3 (differential)	NO SIMULATION AVAILABLE
= 4 (OCM) -	LEVEL

It will set all LED's/relays and the current output as programmed. Therefore, care must be taken if the instrument is wired into other instruments or controls. The displayed value, on which all relays are operated, is that which is set by the operator.
The initial speed of the simulation is that set into Rate of Change (Pr.6) this can be increased by a factor of 2 by pressing the '#' key and the key can be pressed 6 times (x64). To reduce the speed press the '-' key, the speed cannot be reduced below that defined by Rate of Change, Pr.6.

The direction of the simulation can be changed by using the 's' and 't' keys, which one has to be pressed depends on the set up. The simulation can be stopped and re-started using the 'TEST' key.
Press 'CE' to end.

Pr. 79 to Pr. 94 Unspecified

Pr. 95 Serial Number (Viewable only)

This parameter displays the serial number of the Level-Sonic BM90 unit.

Pr. 96 Security Code Store

A new security code can be entered at this parameter, but after entry it is scrambled. Refer to factory if you forget the security code and quote the number displayed here.

Pr. 97 Relay Hours/Starts Totaliser Reset (D= ═══)

The totalisers are cleared by entering:

Pr.97 and 'DSP'	to show ═══
Press CE	to clear the screen
Press Enter	to request 'CODE'
Enter 9753	
Press Enter	to show 't.rES' and ═══

Pr. 98 Clear the OCM Totaliser i.e. HI.TO and LO.TO

(D= ═══)

The totalisers are cleared by entering:

Pr.98 and 'DSP'	to show ═══
Press CE	to clear the screen
Press Enter	to request 'CODE'
Enter 9753	
Press Enter	to show 't.rES' and ═══

Pr.99 Return to Factory Default Parameter Settings

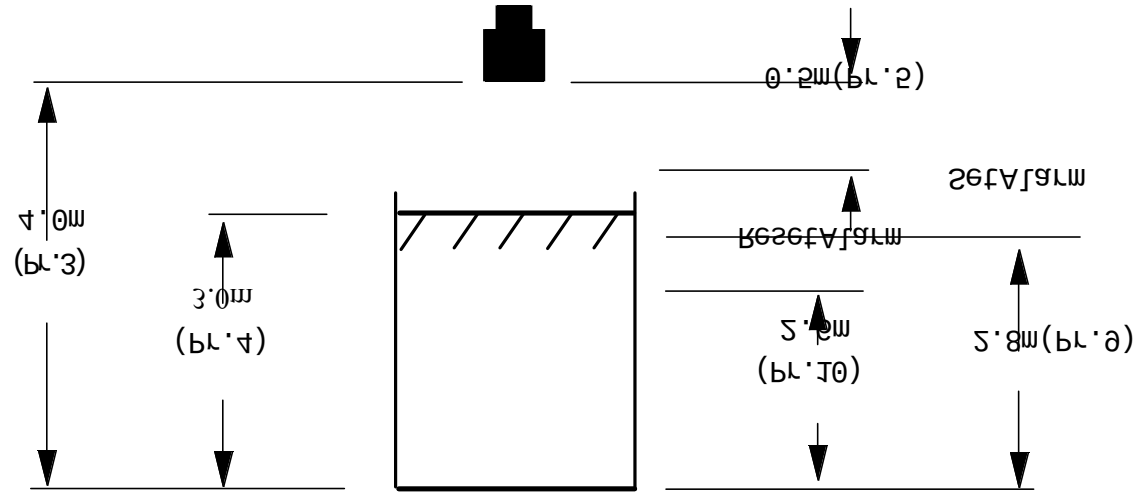
Press	'MODE'	to display 'PROG'
	'1'	immediately to display 'Pr.01' or previous Pr. number.
	'99'	to display Pr.99
	'DSP'	to display
	'CE'	to clear the display
	'ENT'	to display 'CODE' requesting the security code* (see note)
	'9753'	and 'ENT' to display P.rES followed by t.rES, and then ═══
	'DSP'	to display 'Pr.99' and now the new programme can be entered.

NOTE * Enter your own security code number if you have changed it from factory setting of 9753.

4. Examples

4.1 Level measurement mode (Pr.1 = 1)

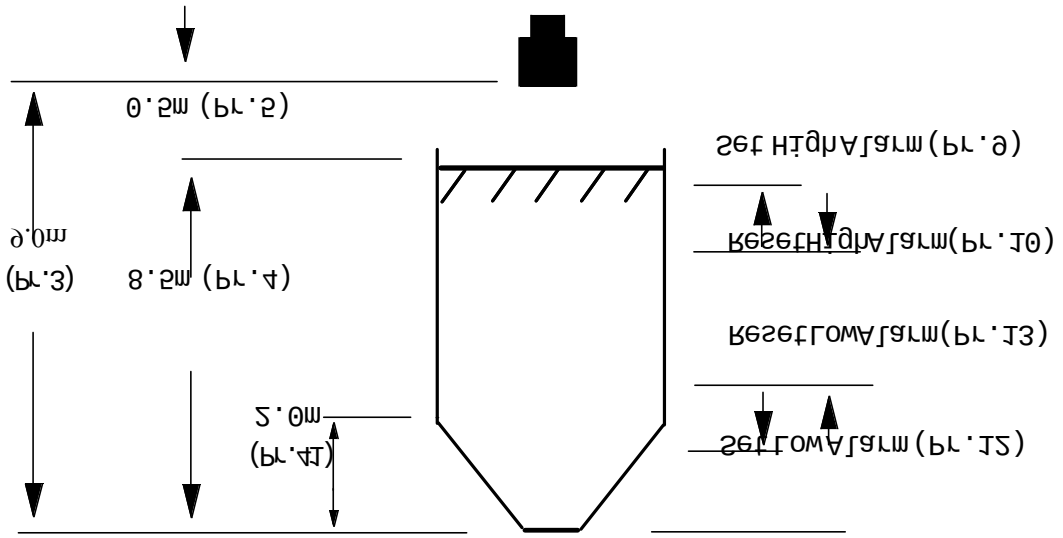
Applications for this mode are Level Measurement, Contents Measurement and Pump Control.



The application : To measure and display the level of liquid in meters
Maximum level 3 m,
Fill rate 0.1 meter/min
Alarm if level exceeds 2.8 m
0-20 mA signal proportional to level

Pr. 1	=	1	Defines level measurement.
Pr. 2	=	2	Programme units are meters.
Pr. 3	=	4	Distance of transducer from the zero level.
Pr. 4	=	3	The span, based on zero level.
Pr. 5	=	0.5	Blanking zone into which level should not rise.
Pr. 6	=	0.1	The maximum rate of change of liquid level in meters/min.
Pr. 8	=	1	Relay 1 to alarm on level (normally energised).
Pr. 9	=	2.8	Relay 1 de-energised at 2.8 m indicates high alarm.
Pr.10	=	2.6	Relay 1 re-energised at 2.6 m to clear the high alarm.
Pr.23	=	3	Hold alarm indication (relay 1) on failsafe.
Pr.28	=	3	Analogue output holds on failsafe.
Pr.30	=	3	0.20 mA output fixed to span (Pr.4).
Pr.78			Simulate the program.

4.2. Measurement with volumetric conversion (Pr.1 = 1)

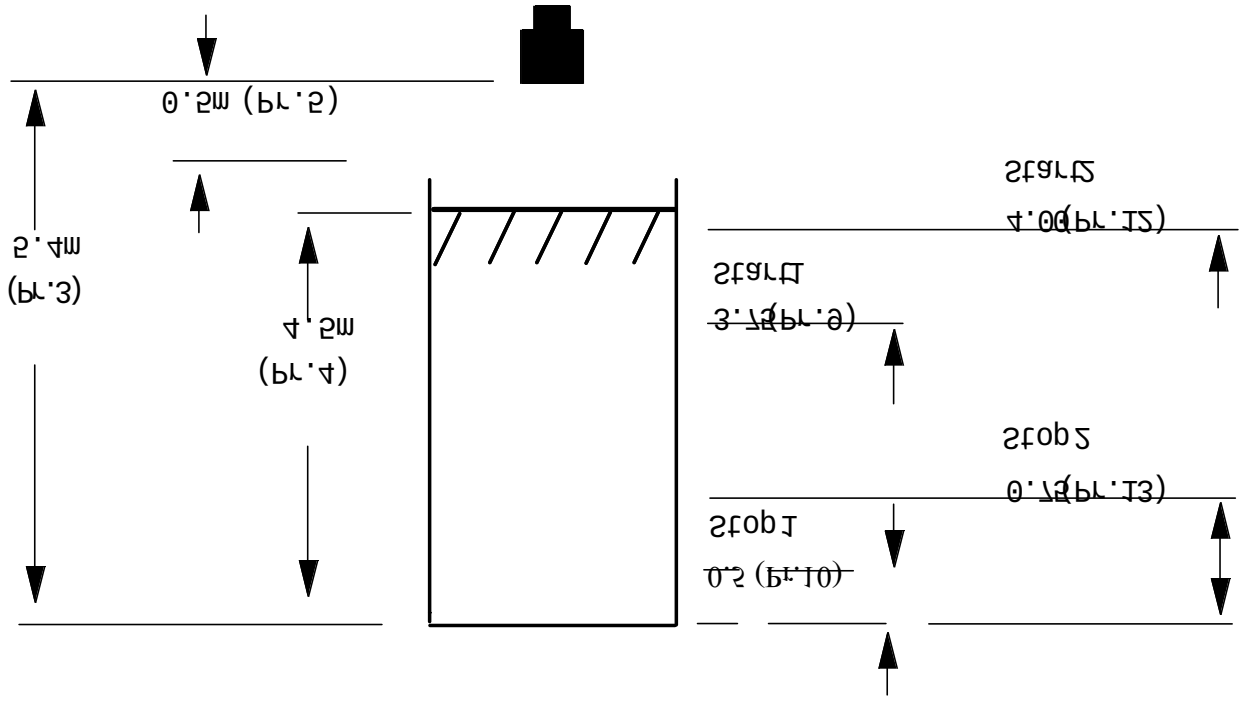


The application :

To measure the level in a conical bottomed cylindrical tank. Dimensions as shown
Total volume of tank = 120 m^3 when level is 8.5 m
Output display in m^3
Analogue output to be 0-20 mA proportional to volume in tank
High alarm at 90 m^3, low alarm at 10 m^3 volume

Pr. 1	=	1	Defines level measurement.
Pr. 2	=	10	Programme in meters, display/control in volume.
Pr. 3	=	9	Transducer to zero level = 9.0 m
Pr. 4	=	8.5	The span over which measurement is required.
Pr. 5	=	0.5	Blanking zone into which the level should not rise.
Pr. 6	=	10	The rate of change of level will not exceed 10.0 m/min
Pr. 8	=	1	Relay 1 to alarm on volume (normally energised)
Pr. 9	=	90	Relay 1 de-energises at 90 m^3. High alarm on.
Pr.10	=	85	Relay 1 energises at 85 m^3 to clear high alarm.
Pr.11	=	1	Relay 2 to alarm on volume (normally energised)
Pr.12	=	10	Relay 2 de-energises at 10 m^3. Low alarm on.
Pr.13	=	15	Relay 2 energises at 15 m^3 to clear low alarm.
Pr.30	=	3	Analogue output to be 0-20 mA fixed to span.
Pr.40	=	3	Define vessel as conical bottomed.
Pr.41	=	2.0	Define the depth of cone as 2.0 m
Pr.43	=	1.2	Define total capacity 120 m^3.
Pr.78			Simulate the program.

4.3. Pump control (Pr.1 = 1)



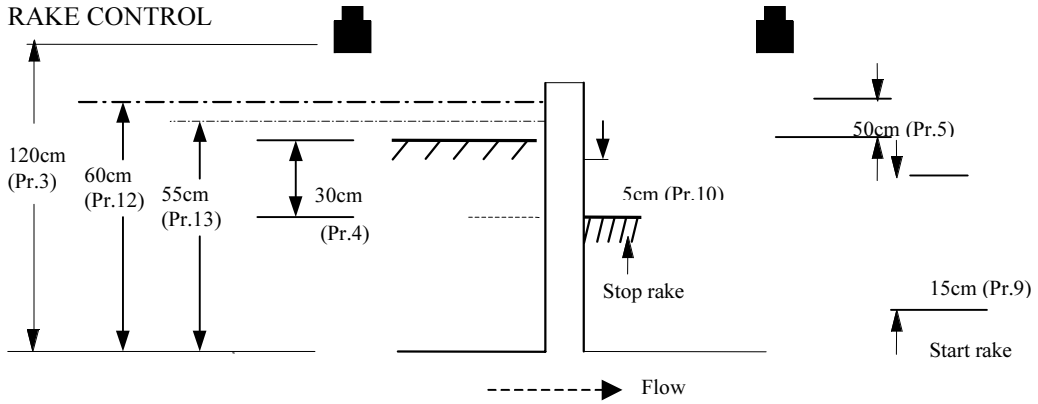
The application :

2 pump control, pump down in a wet-well, duty-assist operation
Alternate pump duty to reduce wear
4-20 mA to remote indicator
Loss-of-Echo indication to telemetry
Display actual level in meters

Pr. 1	=	1	Defines level measurement.
Pr. 2	=	2	Programme in meters, display in meters.
Pr. 3	=	5.4	Transducer to zero level = 5.4 m.
Pr. 4	=	4.5	The span over which measurement is required.
Pr. 5	=	0.5	Blanking into which the material will not rise.
Pr. 6	=	1.5	Max. rate of level change 1.5 m/min.
Pr. 8	=	2	Relay 1 control on level (normally de-energised).
Pr. 9	=	3.75	Relay 1 energises at 3.75 m to turn pump 1 on.
Pr.10	=	0.5	Relay 1 de-energises at 0.5 m to turn pump 1 off.
Pr.11	=	2	Relay 2 to control on level (normally de-energised).
Pr.12	=	4.0	Relay 2 energises at 4.00 m to turn pump 2 on.
Pr.13	=	0.75	Relay 2 de-energises at 0.75 m to turn pump 2 off.
Pr.17	=	7	Relay 4 assigned to indicate loss-of-echo to the telemetry system.
Pr.23	=	2	Switch pump 1 off on failsafe.
Pr.24	=	2	Switch pump 2 off on failsafe.
Pr.28	=	1	Analogue output to 4 mA on failsafe.
Pr.29	=	30	Failsafe delay 30 secs.
Pr.30	=	2	Analogue output to be 4-20 mA fixed to Pr.4.
Pr.51	=	2	Alternate pump duty.
Pr.78	=		Simulate the program.

4.4. Differential level mode (Pr.1 = 3)

In the differential mode, the transceiver drives two transducers, to measure the difference in levels by subtracting the downstream level from the upstream level.
Please refer to connection diagram Fig. 6 for transducer wiring.



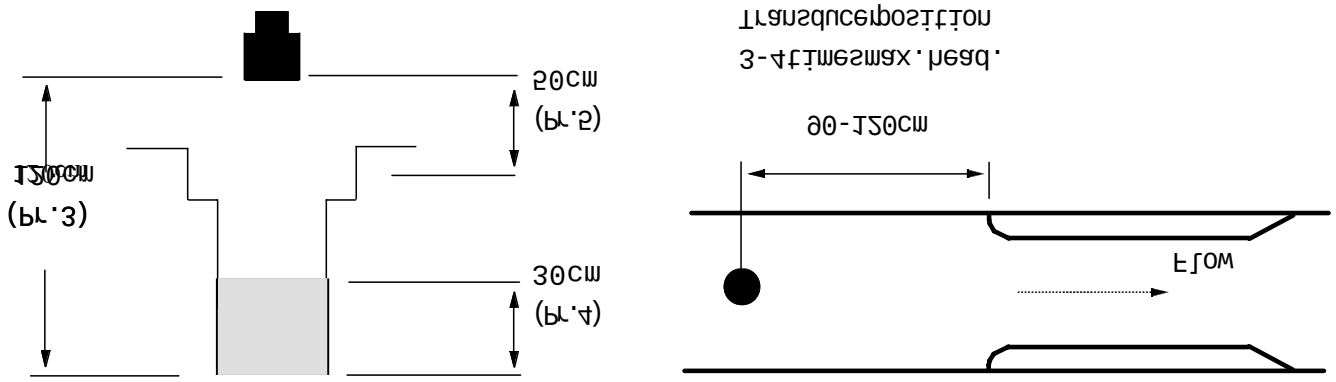
The upstream transducer should be chosen to give a positive differential value.

The application :

Start rake when differential reaches 0.15 m
Stop rake when differential falls to 0.05 m
Maximum differential 0.3 m
Alarm if level on upstream side exceeds 0.6 m
Loss-of-Echo indication to telemetry system
4-20 mA signal proportional to differential

Pr. 1	=	3	To define differential level measurement.
Pr. 2	=	4	As distances are small programme in cms.
Pr. 3	=	120	The distance from bottom of channel to transducers in cms.
Pr. 4	=	30	The maximum differential span in cms.
Pr. 5	=	50	Blanking zone in cms.
Pr. 6	=	100	The max. rate of change of level in cms.
Pr. 8	=	3	Relay 1 designated for differential control.
Pr. 9	=	15	Relay 1 energises at diff. 15 cm to start rake.
Pr.10	=	5	Relay 1 de-energises at diff. 5 cm to stop rake.
Pr.11	=	5	Relay 2 to alarm on an upstream level.
Pr.12	=	60	Relay 2 de-energises at 60 cm high alarm.
Pr.13	=	55	Relay 2 energises at 55cm to clear high alarm.
Pr.17	=	7	Relay 4 assigned to indicate loss-of-echo to the telemetry system.
Pr.23	=	2	Switch rake off on failsafe.
Pr.24	=	3	Hold alarm level indication on failsafe.
Pr.28	=	3	Analogue output holds on failsafe.
Pr.29	=	120	Failsafe time is left at default of 120 s.
Pr.30	=	1	4-20 mA output fixed to span (Pr. 4)
Pr.97 (optional)	=	2	This counts the number of times the rake is turned on, and how many hours it has been energised.

4.5. Open channel Flowmeter (Pr.1 = 4)



The application : Rectangular flume, with a max. flow of 150 l/s at head 0.3 m
Loss-of-echo indication to telemetry system
4-20 mA signal proportional to flow
Totalise flow and provide pulsed output to external totalizer
Display flow reading

Pr. 1	=	4	To define open channel flow metering.
Pr. 2	=	4	As distances are small, work in cms.
Pr. 3	=	120	Distance of trans. from bottom of channel.
Pr. 4	=	30	Level at which max. flow rate value is defined.
Pr. 5	=	50	Blanking zone into which level will not rise. It is suggested that this is above the top of the channel to allow the system to continue reading up to that level.
Pr. 6	=	50	Rate of Change of level 50 cm/min.
Pr.17	=	7	Relay 4 assigned to indicate loss-of-echo to the telemetry unit.
Pr.20	=	5	Relay 5 to operate as external totaliser switch.
Pr.28	=	3	Analogue output "holds" on failsafe, as factory set.
Pr.29	=	120	Failsafe time is left at default of 120 s.
Pr.30	=	1	4-20 mA output fixed to span (Pr.4).
Pr.31	=	2	Analogue output represents flow rate.
Pr.37	=	2	Probe enable if Temperature Compensation is used
Pr.45	=	2	To define that a rectangular flume is being used.
Pr.46	=	39	Defines the max. flow is 39 l.
Pr.47	=	1	Flow in Pr.46 is in litres per second.
Pr.48		3	To avoid totalizer overflow, totalise in cubic meters rather than litres.
Pr.49	=	1	Sets external totaliser to same as internal totaliser.
Pr.78	=		Simulate the program.
Pr.98			Clear and initiate the totalizers.

Note : In normal 'RUN' mode display will always show Flow. Instantaneous readings of "High total", "Low total", "Head" and "Flow" can be obtained by pressing keys 1 to 4. The display will revert back to Flow after 15 seconds.

4.6. Open channel flowmeter (Pr.1 = 4) with penstock control

The application : As chapter 4.5. but additionally to control a penstock via Relays 1 and 2 to modulate flow between 25 and 30 l/s

ENTER:			Pr.1 - Pr.6 as example 5, then go to Pr.9
Pr.9	=	30	Defines top flow limit 30 litres per second.
Pr.10	=	25	Defines low flow limit 25 litres per second.
Pr.12	=	8	Duration of penstock drive pulse is 8 seconds.
Pr.13	=	4	Time between drive pulses is 4 seconds.
ENTER:			Pr.14 - Pr.48 as example 5, then go to Pr.50.
Pr.50	=	2	To initiate penstock control.
ENTER:			Pr.78 and Pr.98 as example 5.

5. Fault Finding

5.1. Fault finding - Hardware

A) The display is blank or frozen, the l.e.d's are unlit and the neon does not fire:

1. Ensure that power is being supplied to the board, and that it is correctly wired. Refer to figure 6, on Page 9.

2. Check fuses.

3. Check that the supply voltage is within specified levels (See Section 2 Page 10). A large voltage drop can cause the unit to lock to show last distance or level reading.

B) The fuse blows continuously:

* In this case the system is drawing excessive current.
1. Power down and fit a new fuse - refer to Page 10
Disconnect all cabling from the unit except for the power lead. If the fuse does not blow on power up, there is a fault in the external wiring.

2. Check that the power supply is within specified limits - refer to Page 10.

3. Check the enclosure for metal debris which may be under the lower PCB.

C) The system powers up, but displays '8888':

* In this case a connection in the PCB is giving a continuous or intermittent fault.
1. Check; with power off, that an Eprom is fitted at U7 and that the chip has not vibrated free from its socket.

D) The display shows 'LOSt':

* In this case the instrument is not reciving a good signal grom the transducer.
1.Check the transducer wiring and connections to the instrument. Note that different connections are used if a temperature compensated transducer is connected. See Figure 6, Page 9.

2. Check whether the neon light adjacent to terminal 22 is flashing. If it is proceed to number 3, if it is not then :

a: Disconnect the transducer: If the neon now lights then there is a short circuit in the cabling.

b: If the neon does not light the transmission fuse may have blown. Check F1 and F2 T80mA fuses on the bottom PCB.

c: If the unit still shows 'LOSt' check that you can hear the transducer "clicking" when close to the ear.

d: If the transducer cable has been extended, disconnect and remove the transducer and connect it direct to the Liquiflex. If the unit now operates, recheck the extension cable connections and routing, avoiding power cables. Re-instal the transducer checking that its aim is perpendicular to the target surface.

e: If the transducer does not click proceed to 5.

3. Is there a target within the empty distance specified in Pr.3?
This is particularly important if temperature variations are experienced and no compensation is applied.

4. Is the vessel empty with a conical, parabolic, sloping or spherical bottom?
This commonly causes loss of echo if the transducer cannot be mounted over the centre of the vessel. When the vessel becomes empty the pulse from the transducer hits the sloping sides of the bottom section and the signal is not reflected back to the transducer. Under this condition the display will indicate 'LOSt' but the failsafe designation will operate until product returns and the system will automatically recover and track level. If the transducer cannot be mounted centrally, the problem may be overcome by the installation of a target plate.

5. Connect a known good transducer to the instrument and check the operation.
If the known transducer gives a good signal check the instruments gain by pressing the 'TEST' key. The number displayed ranges from 1 - 100 and the lower the number the better the signal strength.

If the gain figure is 50 - 100 check the surface level for foam or other materials which may float in and out of the beam and cause poor echoes.

6. Check that the ST6 eprom is seated correctly at U6 on the bottom PCB

E) The keypad fails to respond:

1. Check for correct alignment of connection from keypad to main board.

2. Check that key press sequence is valid; refer to Programming Section.

3. Power down unit and wait 5 seconds. Power up and immediately press 'MODE'. This should result in 'PROG' being displayed. It is now advisable to reset to factory parameters; refer to Programming Section 3.

F) Analogue Output is Unstable:

1. Connect a test meter in series with your external wiring.
Can the fault be seen on the test meter? If YES, then use Pr.34 to enter a stable value into the current loop. Suitable values range from 4 to 20.
If the output is still unstable disconnect external wiring

and connect a meter across terminals 25 and 26 and repeat Pr.34 test.
If the output is now stable check wiring and meters

G) Analogue has no Output:

1. Check programme value at Pr.30 - Value 1-6.

2. Insert a test meter in series with the output. Under Pr.34 enter a fixed output.
If still no output, connect a test meter directly across terminals 25 and 26, repeat test under Pr.34.
If no value is read at terminals 25 to 26 contact Krohne.

H) Analogue Output is less than 20 at maximum display reading:

1. The load attached to the output may be too high. To check this disconnect all the external wiring and see if it know reads 20. The output is capable of driving 20mA into 750 Ohms.

I) Analogue Output does not correspond to application:

1. Checked that the correct options (Pr.30 to Pr.33) have been selected.

2. Check that the correct span (Pr.4) has been input, this is the value over which the analogue will be spanned unless a separate entry has been made at Pr.32 or Pr.33.

J) Reading on display and outputs stay high:

* This is usually caused by return echoes from close-in obstructions.

1. Check for obstructions. If the transducer is mounted on a standpipe, check for rough edges at the connection with the vessel, refer to the figure Page 12.

2. If there are no close-in obstructions ensure that the isolation kit is fitted on the transducer and the transducer is mounted correctly. The isolation kit should enable the transducer to move slightly, it should not be solid. (Not applicable to flanged transducers.)

3. Check the entry at P5, Blanking distance, and return to 0.5m if reduced from factory setting

4. May be caused by rate of change, Pr.6 being too small.

K) Reading is lower than expected:
* This only occurs when the system is locked on to a multiple of the true echo.
1. Check that Pr.3 and Pr.4 are correctfor the application

2. It can be caused when the level rises into the blanking zone. The system can then lock on to a multiple echo, and may continue tracking the multiple when the level decreases. Using check search Pr. 69 should rectify this situation, but preventing the level entering the blanking zone is the preferred solution.

3. It can also be caused by the level moving at a much faster rate than is allowed for by the defined rate of change (Pr.6) . To solve the problem the rate of change value should be increased to more closely match the real rate.

L) Reading is unstable :

1. If a high rate of change (Pr.6) is defined the display will be more unstable. Therefore, an unnecessarily high value of Pr.6 should be avoid.

M) Reading changes in steps:

* This is usually caused by the rate of change value (Pr.6) being too small to keep up with the process.

1. To rectify, increase the value of Pr.6 to match the rate of change of level.

N) The display is inaccurate:

1. The empty distance (Pr.3) of the vessel may be incorrectly set.

2. The dimensions of the vessel or flume may be incorrect, as may the values of maximum flow, volume or mass conversion.

3. The system may require temperature compensation.

4. The application may include vapours that significantly change the speed of sound. Provided these are constant over the range the speed of sound can be adjusted through Pr.70.

O) Temperature is inaccurate :

1. The position of the transducer/temperature sensor is important to prevent heating by sunlight and convection currents. Also the sensor should be in a free-air vented position if possible to prevent hot-spots.

2. Check that temperature compensation is enabled at Pr.37.

3. Check the resistance of the temperature probe when disconnected against the value in Pr.39 when connected. If using a temperature compensated transducer, check this resistance value across the shield and black core when disconnected.

NOTE: The sensor sensor compensates only for temperature variance, it is not expected to accurately measure the actual temperature.

P) The boards hums loudly:

* Usually vibration from the transformer.

1. Check the mounting screws for tightness.

Q) Relays not switching:

1. Check the programmed relay designations and settings at Pr.8 - Pr.22 Functions can be tested under simulation using Pr.78.

2. Test the actual relays using Pr.75 or Pr.76.

3. Check contact continuity at the terminals 4 - 18.

WARNING: It is reccomended that all external controls, alarms etc. are disconnected before performing the above tests.

5.2. Programming sheet

Pr	Description	Factory Default	User	Eng	Pr	Description	Factory Default	User	Eng
Basic Set-up					Open Channel Flow				
1	Application	2.00			45	Flow Exponent	1.00		
2	Units	2.00			46	Max. Flow Rate	0.00		
3	Empty Distance	10.00			47	Time Base for Flow	1.00		
4	Operational Span	10.00			48	Totalise Display Conv.	0.00		
5	Blanking Distance	0.50			49	Contr. for Ext. Sampler	0.00		
6	Rate of Change	1.00			50	Penstock Control	1.00		
Relays					Pump Controls				
8	Relay 1	0.00			51	Pump Sequence	1.00		
9	Relay 1 Set	0.00			52	Duty Standby	1.00		
10	Relay 1 Reset	0.00			53	Pump Exerciser	1.00		
11	Relay 2	0.00			54	Pump Tolerance	1.00		
12	Relay 2 Set	0.00			55	Pump Maintenance	0.00		
13	Relay 2 Reset	0.00			56	Run-on-Interval	0.00		
14	Relay 3	0.00			57	Run-on-Time	0.00		
15	Relay 3 Set	0.00							
16	Relay 3 Reset	0.00			Echo Detection				
17	Relay 4	0.00			68	Echo Selection	2.00		
18	Relay 4 Set	0.00			69	Check Search	1.00		
19	Relay 4 Reset	0.00			70	Echo Velocity	344.10		
20	Relay 5	0.00							
21	Relay 5 Set	0.00							
22	Relay 5 Reset	0.00							
Failsafe					Miscellaneous				
23	Failsafe R1	3.00			71	Correction Value	0.00		
24	Failsafe R2	3.00			72	Parameter Display	0.00		
25	Failsafe R3	3.00			73	Software Rev. No	LA *		
26	Failsafe R4	3.00			74	Reset Counter	0.00		
27	Failsafe R5	3.00							
28	Failsafe Analogue	3.00							
29	Failsafe Time Delay	120.00							
Analogue					Test Parameters				
30	Analogue Output	1.00			75	Digital Output Set	0.00		
31	Analogue Options	1.00			76	Hardware Test			
32	Analogue Datum	0.00			77	Transmitter Test			
33	Analogue Span	100.00			78	Simulation			
34	Analogue Test	0.00							
Temperature					Number Store				
37	Probe Enable	1.00			95	Serial Number Store	Ser.No.		
38	Temp. Compensation	20.00			96	Security Code Store	15.02		
39	Probe Test	0.00							
Volume Conversion					Reset				
40	Vessel Shape	0.00			97	Relay Hrs/Starts Reset			
41	Dimension H	0.00			98	OCM Totaliser Reset			
42	Dimension L	0.00			99	Full System Reset			
43	Display Conversion	1.00							
44	Volume Linearisation								

6. Technical Data Level-Sonic

6.1. Converter

	BM90 / BM90 L	BM90 E / BM90 LE
Enclosure	IP65 Aluminium	NORYL DIN43700. IP55 to front of panel. IP20 behind panel.
Dimensions	206 (8.11") x 326 (12.83") x 123 (4.84")	144H X 96W X 140D (mm).
Weight	4 Kg (8.8 lb)	1.75Kg
Power Supply	110/230 V selectable, 50/60 Hz, 10 VA 12 V or 24 VDC not selectable 6 W	110/230Vac + 10% selected automatically. 50/60Hz, 12VA, 24Vdc + 25%
	Nominal voltages +/- 10 %	- 10%, 9W. Separate terminals.
Fuse Rating	125 mA (slow blow) AC 250 mA @ 24 V DC 500 mA @ 12 V DC	F2 T160mA for ac supply F1 T315mA for 24Vdc supply F3 & F4 T80mA
Range	Up to 10 m (32.8 feet) and up to 15 metres liquids and solids with L.	
Accuracy	+/- 0.25 % of measured distance at constant temperature	+ 0.25% of measured distance from the transducer at constant temperature of 20 C.
Ambient Temp.	- 20 C to + 50 C (- 4 F to + 122 F)	-40 deg C to + 70 deg C.
Calibration	Integral keypad with security code	5 X 4 integral keypad with security code.
Resolution	2 mm (0.08 ") or 0.1 % of range (set at Pr.3) whichever is greater	2mm or 0.1% of range, whichever is the greater.
Analogue Output	Opto isolated 4-20 mA or 0-20 mA into 750 ohms Short circuit protected	4-20mA into 750 Ohms. 16 bit. Short circuit protected and opto-isolated on ac powered units. Not opto-isolated on 24Vdc units. Maximum allowable degradation of signal 2% under extremes of transient and constant conducted immunity tests to EN50082.
Relay Outputs	5 multifunction SPDT relays rated 5 A/230 V a.c resistive	5 multi-function SPDT relays rated 8A/230Vac/30Vdc resistive, with gold contacts.
Indication	Integral 4 digit LCD, 12 mm (0.47") high characters 5 red LED's to indicate relay status	Integral, 4 digit LCD, 12mm high characters. 5 red LED's to indicate relay status.
Failsafe	High, low, hold (Pr.23 to 29)	High, Low, Hold
Damping	Fully adjustable (Pr.7)	Fully adjustable
Blanking	Fully adjustable (Pr.5) min 0.3 m (11.82 ")	Fully adjustable
Optional Temp. sensor	Reduces ambient temperature errors from 0.17 % / 1 C of measured distance to 0.01 % / 1 C (34 F)	

6.2. Transducer

Type BM90 / L BM90E/ LE	RZV15 RXV15	RZT15 RXT15	RZV15T RXV15T
Temperature Compensation	Uncompensated	Compensated	Uncompensated
Frequency (in KHz)	41.50	41.50	41.50
Beam Angle at 3dB	10 degrees	10 degrees	10 degrees
Body Material	CPVC	CPVC	CPVC
Face Material	Urethane	Urethane	Teflon
Process Temperature *	-40 to + 90 deg C	-40 to + 90 deg C	-20 to +90 deg C
Protection	IP68	IP68	IP68
Weight (Kg)	2.00	2.00	3.00

NOTE: *All the above transducers can be approved for use in Hazardous Areas, Zones 1 & 2 but Ambient Temperature limited to: -20 to + 60 deg C. CENELEC: EExm II T6 CERTIFICATE NO: 93C.108.020X

CE approved - EMC tested in accordance with EN50081 & EN50082 Parts 1 & 2

Low voltage directive, EN61010

APPENDIX 1 Vessel or Flume linearisation

This feature allows volume conversion to be applied on irregular shaped vessels and flow measurements to be made on open channels providing that level/volume/flow relationships are known.

The system allows the entry of a volume or flow profile of up to 16 points into memory, that is then used to produce the required flow or volume values when in 'RUN' mode. The required profile is stored in parameter 35.

Before proceeding it is useful to write down the point numbers and 'A'/'b' values to facilitate programming.

Note % Head or Level designated 'A'
l% Flow or Volume designated 'b'

Flow

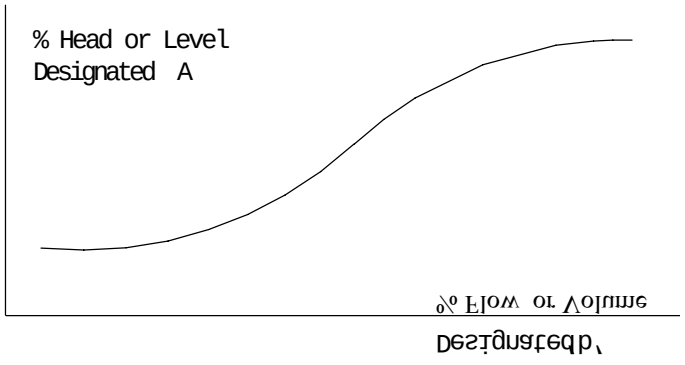
When using the facility for flow it is enabled by Pr.40 = 4. The profile is stored as percentage of head, against percentage of flow.

Volume

When using the facility for volume, it is enabled by Pr.32 = 8. The profile is stored as percentage of level, against percentage of the total volume.

Procedure

The procedure uses a 16 point curve to map the profile, but all 16 points do not have to be used.



The profile data is input into Pr.35 which when accessed [Pr.35, 'DSP', 'ENT'] will display 'A1', which means the data pointer is at value 1 on 'A' data. The values can be displayed and changed as required.

Pr.44 - Keyboard Controls

#	Toggles the display between data blocks 'A' and 'b'
s t	Increases and decreases the point number, when either the point number or its value is displayed
CE	Clears the display when inputting a new value.
DSP	Toggles the display between the block and point number and the value.
ENT	Enters a new value.
TEST	Exits Pr.44 and returns the operator to the normal program.
0-9	The number keys and decimal point are used to input new values. Point numbers can only be changed by using the 's' and 't' keys.

Pr.44 - Inputting Values

When a new value is to be entered, first display the old value and then input the new and press 'ENT', the system will display the value it has stored in memory. The values input have to be in a specific form.

1. Head or Level designated 'A'

These values must be a whole number. Decimal places will be ignored.

ie. 11 will be accepted as 11
22.3 will be accepted as 223.

The allowable range of values is 0-250 %, any unused data values must be set to 255.

PARAMETER RESET LOADS 255 TO ALL DATA VALUES

2. Flow or Volume designated 'b'

These values are expected to contain one decimal place, therefore, it is not necessary to input the decimal place, but the procedure will display it.

ie. 10 will be accepted as 1.0
100 or 10.0 will be accepted as 10.0

The allowable range of values is 0-500 %

PARAMETER RESET LOADS 0 TO ALL DATA VALUES.

Note :

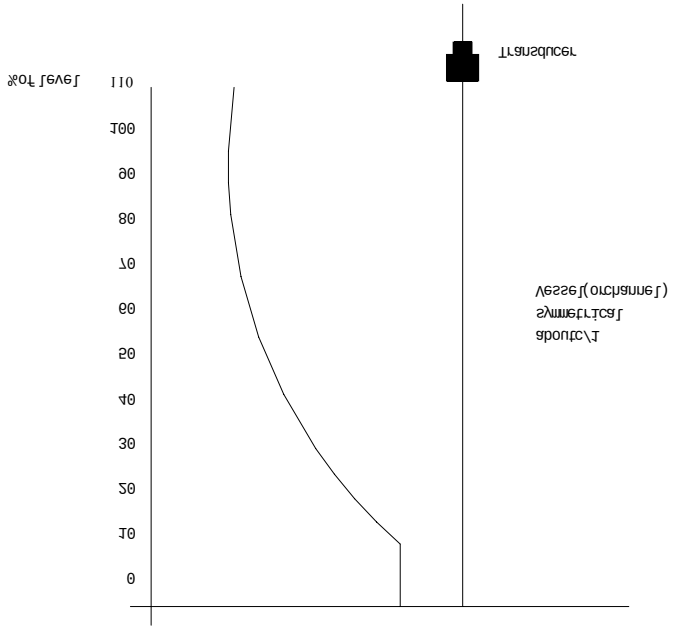
1. As time is required to enter all the data, the standard keypad timeouts are suspended.
2. We recommend that the required values are written in table form, as shown, before programming commences. Then enter all Block A values, before entering all block b values.

Example: Flow - Special Flume Mapping

Use Example 4.5 on Page 31, but substitute a special 'U' throat flume with maximum flow 39 litres/second at 30 cm/hd.
First, create the following table from the relationship of head and flow which must be given forthe special flume.

Point	Head (cm)	% Head	'A' Value	Flow litres/sec	% Flow	'b' Value
1.00	0.0	0.0	0.00	0.0	0.0	0
2.00	2.5	8.3	8.00	0.4	1.1	11
3.00	5.0	16.70	17.00	1.7	4.4	44
4.00	7.5	25.0	25.00	3.7	9.5	95
5.00	10.0	33.30	33.00	6.3	16.2	162
6.00	15.0	50.0	50.00	12.70	32.5	325
7.00	20 0	66.60	67.00	20.30	52.0	520
8.00	25.0	83.20	83.00	29.30	75.0	750
9.00	30.0	100.0	100.00	39.0	100.0	1000
10.00	Not used	Not used	255.00	Not used	Not used	0
11.00	Not used	Not used	255.00	Not used	Not used	0
12.00	Not used	Not used	255.00	Not used	Not used	0
13.00	Not used	Not used	255.00	Not used	Not used	0
14.00	Not used	Not used	255.00	Not used	Not used	0
15.00	Not used	Not used	255.00	Not used	Not used	0
16.00	Not used	Not used	255.00	Not used	Not used	0

NOTE: 1. Points 10 to 16 not used - leave at factory default value.
2. 'A' values must be whole numbers, no deci mals allowed.
3. 'b' values must be entered as the tabulated value, the decimal will be automatically allocated.



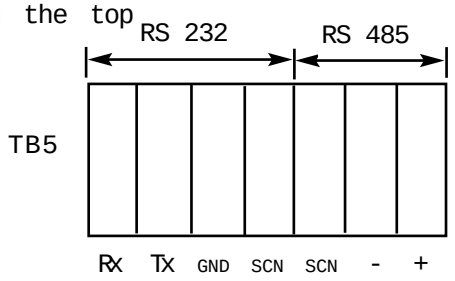
Now continue programming the instrument as follows:
Programme the instrument exactly as section 4.5 on Page 31, except:

Change	Pr.45	from 2 to 4, which denotes "Special Flow Device".
Go to	Pr.44	and proceed as follows:
Press	Pr.44	to display Pr.44:
Press	'DSP'	to show
Press	'ENT'	to show 'A1'
Press	'DSP'	to show value of 'A1' (default = 255)
	Key in the value '0' from Table 1 and press 'ENT'	
Press	'DSP'	to show 'A1' again
Press	'↓'	to show 'A2'
Press	'DSP'	to show value of 'A2' (default = 255)
	Key in the value '8' from Table 1 and press 'ENT'	
	Continue for all points which you need to use (up to 'A16)'	
	Any points not used must be left at the default of 255	
Press	'DSP'	to display the last 'A' number used, then
Press	'↑'	several times to return to 'A1'
Press	#	to show 'b1'
Press	'DSP'	to show value of 'b1' (default = .0)
	Key in the value '0' from Table 1 and press 'ENT'	
Press	'DSP'	to show 'b1' again
Press	'↓'	to show 'b2'
Press	'DSP'	to show value of 'b2' (default = .0)
	Key in the value '11' from Table 1 (accepted as 1.1)	
	Continue for all points which you need to use (up to 16)	
	Any points not used must be left at the default of .0	
Press	'TEST' then 'DSP' to show Pr.44	
	Leave the linearisation part of the programme by dis playing any other parameter, or go into 'RUN' mode.	

Points Number	'A' % Head or Level	'b' % of Flow of volume
1	0	0.0
2	10	0.0
3	20	7.2
4	30	16.1
5	40	27.3
6	50	37.5
7	60	48.5
8	70	59.5
9	80	70.5
10	90	80.0
11	100	89.5
12	110	100.0
13	255	-
14	255	-
15	255	-
16	255	-

APPENDIX 2 Serial Communications BM90 L ONLY

The Level-Sonic BM90E is fitted with two serial communications channels as standard. Channel 1 has been built for RS232 and Channel 2 for RS485. The connector is TB5 on the top PCB.



RS232

1. RS232 : BM90E ---------> PLC COMPUTER

15M

CABLE - 3 CORE SCREENED

As only one BM90 L unit can be connected to each RS232 serial port on the computer, and the transmission distanc is limited, this is only likely to be used for communications within a control room.

RS485

2. RS485 : BM90E 01 ---------- BM90E 31

PLC COMPUTER

1000M to further unit

CABLE - SINGLE PAIR SCREENED

This option allows up to 31 Level-Sonic BM90 L units to be daisy-chained on the same cable, connected to a single port on the computer. Therefore where multiple Level-Sonic BM90E units are being used this option should be used.

Converters / Repeaters

To interface to the Level-Sonic BM90E a computer or PLC with the required serial port will be required. Usually the RS232 port will be fitted as standard, with the RS485 being available as an option.

If the required serial option cannot be fitted, then signal converters and repeaters are on the market. These will convert RS232 to RS485 and will extend greatly the transmission distances.

DATA COMMUNICATIONS

There are at present two types of data communications available in the Level-Sonic BM90E Unit.

1. Commissioning System

The commissioning system allows the echoes being received and processed by Level-Sonic BM90LE to be downloaded to an IBM or compatible computer (usually portable), so that they can be viewed easily. This system has made the use of an oscilloscope for on-site cimmissioning unnecessary.

To use this option requires a software package and interface cables. These are detailed along with its operation in a separate bulletin.

2. Pleed Data Transfer

This option allows an external computer to obtain data that can be used to produce any required display i.e. tables, mimics. The data is transmitted in a format that can be understood and processed by any programmable device using High or Low level languages.

The data obtained depends on the application programmed.

LEVEL

a) Level
b) Displayed value - %, volume, tonnage, etc.
c) Rate of change of level
d) Temperature
e) Status of 4 relays
f) Loss of transducer and loss of echo

DISTANCE

a) Distance
b) Displayed value - % - ullage etc.
c) Rate of change of level
d) Temperature
e) Status of 4 relays
f) Loss of transducer and loss of echo

DIFFERENTIAL

a) Upstream level
b) Downstream level
c) Difference of levels
d) Temperature
e) Status of 4 relays
f) Loss of transducer and loss of echo

O C M

a) Flow rate
b) Head
c) Totaliser value
d) Temperature
e) Status of 4 relays
f) Loss of Transducer and loss of echo

To use this option will require software to be written for the PLC or computer that requests the data. Details of the transmission protocols and hardware connections are given in a sepatate bulletin.

APPENDIX 3 TECHNICAL DATA LEVEL-SONIC

Converter

	BM90 / BM90 L	BM90 E / BM90 LE
Enclosure	IP65 Aluminium	NORYL DIN43700. IP55 to front of panel. IP20 behind panel.
Dimensions	206 (8.11") x 326 (12.83") x 123 (4.84")	144H X 96W X 140D (mm).
Weight	4 Kg (8.8 lb)	1.75Kg
Power Supply	110/230 V selectable, 50/60 Hz, 10 VA 12 V or 24 VDC not selectable 6 W	110/230Vac + 10% selected automatically. 50/60Hz, 12VA, 24Vdc + 25%
	Nominal voltages +/- 10 %	- 10%, 9W. Separate terminals.
Fuse Rating	125 mA (slow blow) AC 250 mA @ 24 V DC 500 mA @ 12 V DC	F2 T160mA for ac supply F1 T315mA for 24Vdc supply F3 & F4 T80mA
Range	Up to 10 m (32.8 feet)	Up to 15 metres liquids and solids.
Accuracy	+/- 0.25 % of measured distance at constant temperature	+ 0.25% of measured distance from the transducer at constant temperature of 20 C.
Ambient Temp.	- 20 C to + 50 C (- 4 F to + 122 F)	-40 deg C to + 70 deg C.
Calibration	Integral keypad with security code	5 X 4 integral keypad with security code.
Resolution	2 mm (0.08 ") or 0.1 % of range (set at Pr.3) whichever is greater	2mm or 0.1% of range, whichever is the greater.
Analogue Output	Opto isolated 4-20 mA or 0-20 mA into 750 ohms Short circuit protected	4-20mA into 750 Ohms. 16 bit. Short circuit protected and opto-isolated on ac powered units. Not opto-isolated on 24Vdc units. Maximum allowable degradation of signal 2% under extremes of transient and constant conducted immunity tests to EN50082.
Relay Outputs	5 multifunction SPDT relays rated 5 A/230 V a.c resistive	5 multi-function SPDT relays rated 8A/230Vac/30Vdc resistive, with gold con tacts.
Indication	Integral 4 digit LCD, 12 mm (0.47") high characters 5 red LED's to indicate relay status	Integral, 4 digit LCD, 12mm high characters. 5 red LED's to indicate relay status.
Failsafe	High, low, hold (Pr.23 to 29)	High, Low, Hold
Damping	Fully adjustable (Pr.7)	Fully adjustable
Blanking	Fully adjustable (Pr.5) min 0.3 m (11.82 ")	Fully adjustable
Optional Temp. sensor	Reduces ambient temperature errors from 0.17 % / 1 C of measured distance to 0.01 % / 1 C (34 F)	

Transducer

Type BM90 / L BM90E/ LE	RZV15 RXV15	RZT15 RXT15	RZV15T RXV15T
Temperature Compensation	Uncompensated	Compensated	Uncompensated
Frequency (in KHz)	41.50	41.50	41.50
Beam Angle at 3dB	10 degrees	10 degrees	10 degrees
Body Material	CPVC	CPVC	CPVC
Face Material	Urethane	Urethane	Teflon
Process Temperature *	-40 to + 90 deg C	-40 to + 90 deg C	-20 to +90 deg C
Protection	IP68	IP68	IP68
Weight (Kg)	2.00	2.00	3.00

NOTE: *All the above transducers can be approved for use in Hazardous Areas, Zones 1 & 2 but Ambient Temperature limited to: -20 to + 60 deg C. CENELEC: EExm II T6 CERTIFICATE NO: 93C.108.020X
CE approved - EMC tested in accordance with EN50081 & EN50082 Parts 1 & 2
Low voltage directive, EN61010

APPENDIX 4

PARAMETER SETTINGS BM90 / L ; (--) = BM90 E / LE SETTINGS

Pr	Description	Factory Default	User	Eng	Pr	Description	Factory Default	User	Eng
Basic Set-up					Open Channel Flow				
1.00	Application	2.00			45.00	Flow Exponent	1.00		
2.00	Units	2.00			46.00	Max. Flow Rate	0.00		
3.00	Empty Distance	10(15)			47.00	Time Base for Flow	1.00		
4.00	Operational Span	10(15)			48.00	Totalise Display Conv.	0.00		
5.00	Blanking Distance	0.50			49.00	Contr. for Ext. Sampler	0.00		
6.00	Rate of Change	1.00			50.00	Penstock Control	1.00		
7.00	Decimal Display	2.00							
Relays					Pump Controls				
8.00	Relay 1	0.00			51.00	Pump Sequence	1.00		
9.00	Relay 1 Set	0.00			52.00	Duty Standby	1.00		
10.00	Relay 1 Reset	0.00			53.00	Pump Exerciser	1.00		
11.00	Relay 2	0.00			54.00	Pump Tolerance	1.00		
12.00	Relay 2 Set	0.00			55.00	Pump Maintenance	0.00		
13.00	Relay 2 Reset	0.00			56.00	Run-on-Interval	0.00		
14.00	Relay 3	0.00			57.00	Run-on-Time	0.00		
15.00	Relay 3 Set	0.00							
16.00	Relay 3 Reset	0.00							
17.00	Relay 4	0.00							
18.00	Relay 4 Set	0.00							
19.00	Relay 4 Reset	0.00			Echo Detection				
20.00	Relay 5	0.00			68.00	Echo Selection	2(1)		
21.00	Relay 5 Set	0.00			69.00	Check Search	1.00		
22.00	Relay 5 Reset	0.00			70.00	Echo Velocity	344.1		
Failsafe					Miscellaneous				
23.00	Failsafe R1	3.00			71.00	Correction Value	0.00		
24.00	Failsafe R2	3.00			72.00	Parameter Display	0.00		
25.00	Failsafe R3	3.00			73.00	Software Rev. No.	S/Ware		
26.00	Failsafe R4	3.00			74.00	Reset Counter	0.00		
27.00	Failsafe R5	3.00							
28.00	Failsafe Analogue	3.00							
29.00	Failsafe Time Delay	120.00							
Analogue					Test Parameters				
30.00	Analogue Output	1.00			75.00	Digital Output Set	0.00		
31.00	Analogue Options	1.00			76.00	Hardware Test	═══		
32.00	Analogue Datum	0.00			77.00	Transmitter Test	═══		
33.00	Analogue Span	100.00			78.00	Simulation	═══		
34.00	Analogue Test	0.00							
Temperature					Number Store				
37.00	Probe Enable	1.00			95.00	Serial Number Store	Ser.No		
38.00	Temp. Compensation	20.00			96.00	Security Code Store	15.02		
39.00	Probe Test	0.00							
Volume Conversion					Reset				
40.00	Vessel Shape	0.00			97.00	Relay Hrs/Starts Reset	═══		
41.00	Dimension H	0.00			98.00	OCM Totaliser Reset	═══		
42.00	Dimension L	0.00			99.00	Full System Reset	═══		
43.00	Display Conversion	1.00							
44.00	Volume Linearisation	═══							

To scroll through parameters 1-74 press "MODE" followed by "1" followed by "TEST".
To stop the scroll press "CE".