

**INSTRUCTION MANUAL
FOR
INSERTION TYPE
ELECTROMAGNETIC FLOW METER
MODEL NO. : ELMAG-100**

Authorised Dealer



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SAFETY WARNING & GENERAL INSTRUCTIONS

1. Read User manual carefully and understand instructions & directions provided in this manual.
2. Installation, connections, commissioning and service shall carry out by only qualified and authorized person.
3. To protect instrument from any external hazards, customer should take necessary care while preparing site ready before installation.
4. Ensure proper supply voltage (24V DC) with proper polarity to the instrument, before Powering ON instrument.
5. During calibration, follow the steps mentioned in the manual. Calibration should be done by authorised technical person only.
6. Verify that earthing is proper.
7. The following principles should be considered during installation:
 - If there is a noisy power supply voltage (especially peaks generated, usually by motors), use an external power supply filter between the flow meter and power supply.
 - Protect the flow meter and the internal lining of the sensor pipe from mechanical damage, especially during installation or cleaning.
 - Do not expose the flow meter to intense vibration.

INTRODUCTION

ELMAG-100 is micro-controller based full bore type electromagnetic flow transmitter specially used for various industrial applications. This flow transmitters accurately measures the flow rate of conductive liquids & slurries in closed pipes. Due to simple, rigid & obstruction less design the flow transmitter is a maintenance free instrument in place of conventional mechanical flow measuring device. The use of 'Pulsed DC' excitation technology offers highest ability & better measuring accuracy in the form of electrical signal 4 - 20 mA DC linearly proportional to volumetric flow.

ELMAG-100 standard configuration is a sensor with transmitter integrated in one unit. It's performance is independent of temperature, pressure, density and viscosity of the medium. The simple design allows easy and quick installation of the meter with unskilled personnel.

ELMAG-100 is a flanged meter available in sizes from DN 10 to DN 300. The rugged flow sensor is constructed from completely welded construction. The sensor housing is filled with polyurethane foam for excellent protection.

In the instrument, the sensor and the electronics form one mechanical entity. A retransmission output of 4-20 mA is provided.

Sensor: The sensor consists of metering pipe; electrodes and coils. It is accommodated in welded and a fully encapsulated steel enclosure, filled with expanded polyurethane, to prevent it from getting exposed to moisture and environmental conditions.

Electronics: The conditioning electronics circuitry is housed in a cast aluminium connection box. The termination of this electronics is given in the same housing through cable glands for the required connecting cables.

Applications:

- 1) Applications include measurement of flow on conducting liquids, pastes and slurries (even highly corrosive and abrasive) in chemical and petrochemicals, fertilizers, foodstuffs, paper, mining industries etc.
- 2) Monitoring water flow in cooling circuits in steel plants, power plants etc.
- 3) Measuring flow of clean water, effluent, sludges etc. In pollution and environmental control.
- 4) The isolated 4-20 mA output proportional to flow can be fed to PLCs, DCS or remote mounted indicator.
- 5) The electromagnetic flow meter is used for measurement of flow of conducting liquids and slurries in a wide range on industries such as chemical, petrochemical, fertilizer, pharmaceutical, foodstuff, mining, dairy, sugar, breweries, paper, steel etc.

Operating principle:

The flow meter is designed for electrically conductive fluids. Measurement is based on Faraday's law of induction, according to which a voltage is induced in an electrically conductive body, which passes through a magnetic field.

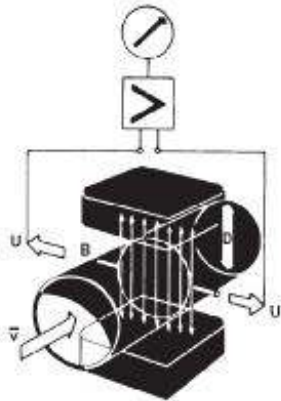


FIG.1.

The following expression is applicable to the voltage:

$$U = K \times B \times v \times D$$

where:

U = induced voltage

K = an instrument constant

B = magnetic field strength

v = mean velocity

D = pipe diameter

Thus the induced voltage is proportional to the mean flow velocity, when the field strength is constant. Inside the electromagnetic flowmeter, the fluid passes through a magnetic field applied perpendicular to the direction of flow. An electric voltage is induced by the movement of the fluid (which must have a minimum electrical conductivity). This is proportional to the mean flow velocity and thus to the volume of flow. The induced voltage signal is picked up by two electrodes, which are in conductive contact with the fluid and transmitted to a signal converter for a standardized output signal.

This method of measurement offers the following advantages:

- 1) No pressure loss through pipe constriction or protruding parts.
- 2) Since the magnetic field passes through the entire flow area, the signal represents a mean value over the pipe cross-section; therefore, only relatively short straight inlet pipes x DN from the electrode axis are required upstream of the primary head.
- 3) Only the tube liner and the electrodes are in contact with the fluid.
- 4) Already the original signal produced is an electrical voltage, which is an exact linear function of the mean flow velocity.
- 5) Measurement is independent of the flow profile and other properties of the fluid.

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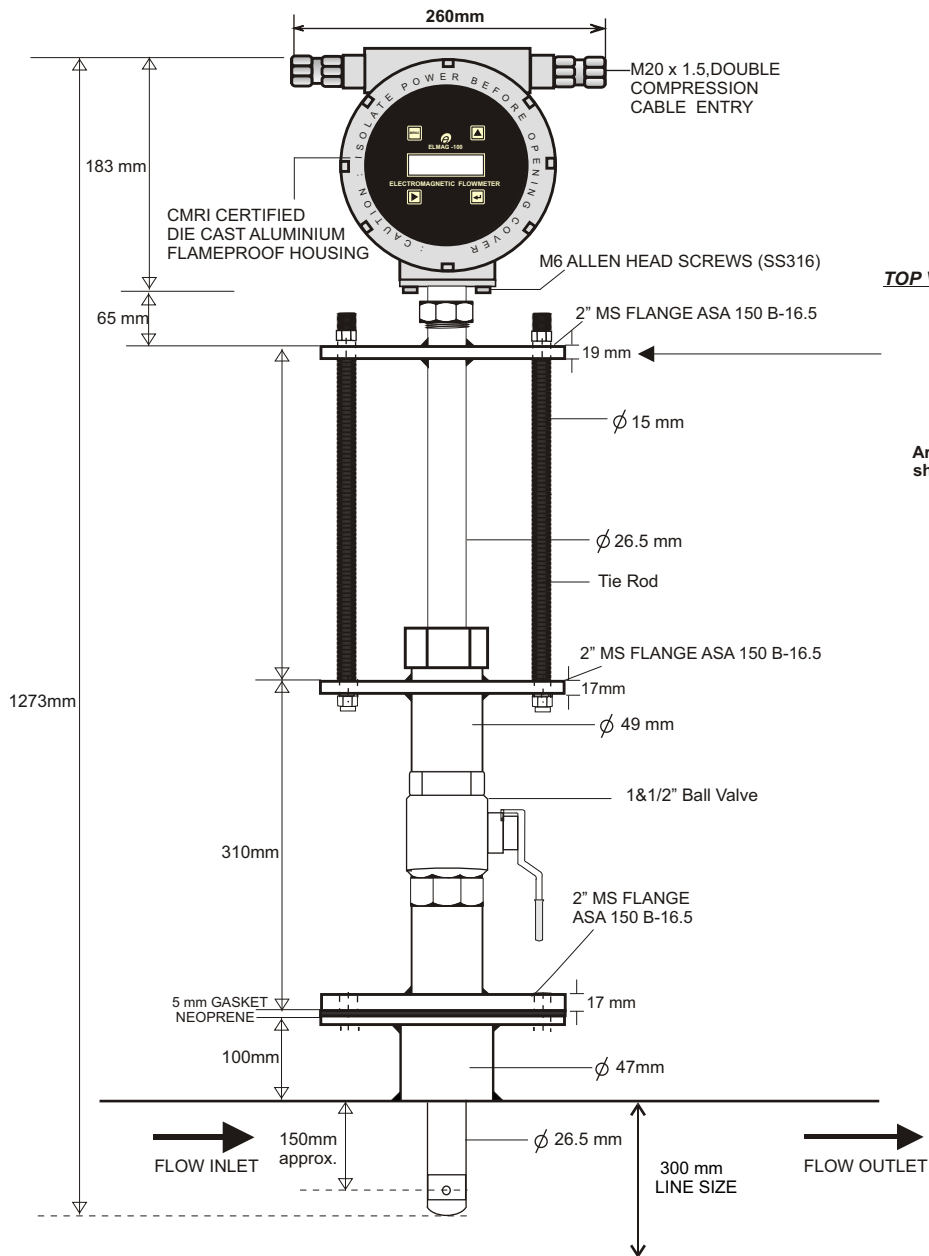
1. TECHNICAL SPECIFICATIONS

LINE SIZE	: 300NB
SR.NO.	: ----
PROCESS CONNECTIONS	: 2" ASA 150 # RF Flanged
CALIBRATION RANGE	: 0 to 1526.81 m ³ /hr
PROCESS FLUID	: River Water
ACCURACY	: +/- 2 % of flow rate
LINEARITY	: +/- 1 %
RETRANSMISSION OUTPUT	: 4-20 mA DC, Isolated
DISPLAY	: 16 x 2 Alphanumeric LCD display
POWER SUPPLY	: 230V AC, 50Hz, +/-10%
ISOLATION	: 1.4 KV between input, output & power supply
MINIMUM CONDUCTIVITY	: 5 μ siemens/ cm
MOUNTING	: Vertical (Insertion)
DIRECTION OF FLOW	: Electrode Position Perpendicular of Flow
UPSTREAM STRAIGHT LENGTH	: 10 x DN (Meter size)
CABLE ENTRY	: 2 Nos,M20 X 1.5,Double Compression Cable Gland
MATERIAL -	
RETRACTABLE ASSEMBLY	: MS
ELECTRODE	: SS 316L
WETTED PART	: MS
METERING PIPE	: SS 316, Seamless
ISOLATION VALVE	: CS
ENCLOSURE MATERIAL (HOUSING)	: Aluminium Die Cast

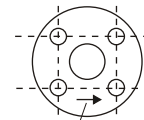
ENVIRONMENTAL SPECIFICATIONS : →

AMBIENT TEMPERATURE OF ELECTRONICS	: 0 - 55°C max.
WORKING TEMPERATURE OF PROCESS FLUID	: 0 - 85°C max.
OPERATING PRESSURE OF MECHANICAL ASSEMBLY	: 0 - 10 Kg/cm ²
RELATIVE OPERATING HUMIDITY OF ELECTRONICS	: 5 - 95 % RH Non condensing

2. ASSEMBLY OVERVIEW

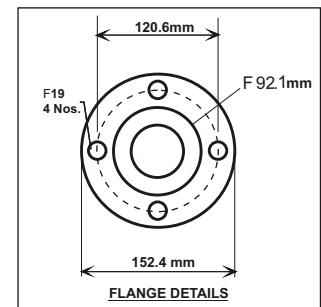


TOP VIEW OF THIS FLANGE



Arrow mark on this flange shows direction of flow

DIMENSIONAL DETAILS OF FLANGE



NOMINAL PIPE SIZE	2"	50mm
Flange Diameter D (mm)	152.4	
Diameter of Raised Face (R) (mm)	92.1	
Diameter of Bolt Hole Circle DBC (mm)	120.6	
Diameter of Bolt Hole (mm)	19.0	
No. Of Holes	4	
Material of Flange	MS	
Thickness of flange	19.0	
Type / Class of Flange	ASA 150 B 16.5 RF FLANGE	

NOTE : All dimensions are in mm

3. KEYBOARD DETAILS



PROGRAM KEY: - This key is used to toggle between Run mode and Program mode.



INCREMENT KEY: - This key is used to 1) Increment the numerical value of any digit, from 0 to 9, by one at each time.
2) Go to the next parameter in Program mode.



SHIFT KEY: - 1) This key is used to shift the cursor to the next digit.



ENTER KEY: - 1) This key is used to validate the function or value of parameter.
2) Press this key for 5 to 6 sec. to reset the totaliser.

4. TERMINATION DETAILS

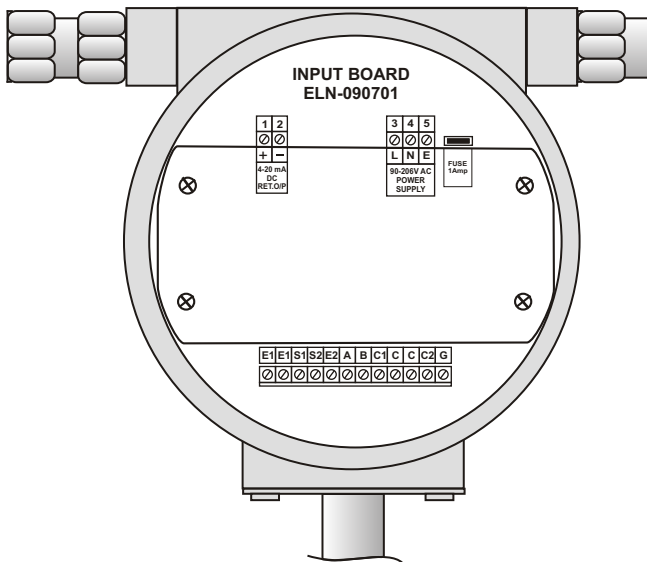


Fig 4 . Rear View

1	+	4-20 mA DC RET. OUTPUT	E1	ELECTRODE
2	-		E1	
3	L	90-260V AC Power Supply	S1	EMPTY PIPE
4	N		S2	
5	E		E2	
FUSE 1 Amp			A	EMPTY PIPE
			B	
			C1	COIL
			C	
			C2	
			G	GROUND

NOTE : To change the flow measurement direction inter change coil connections of terminals C1 & C2.

5. INSTALLATION DETAILS

5.1 Internal View

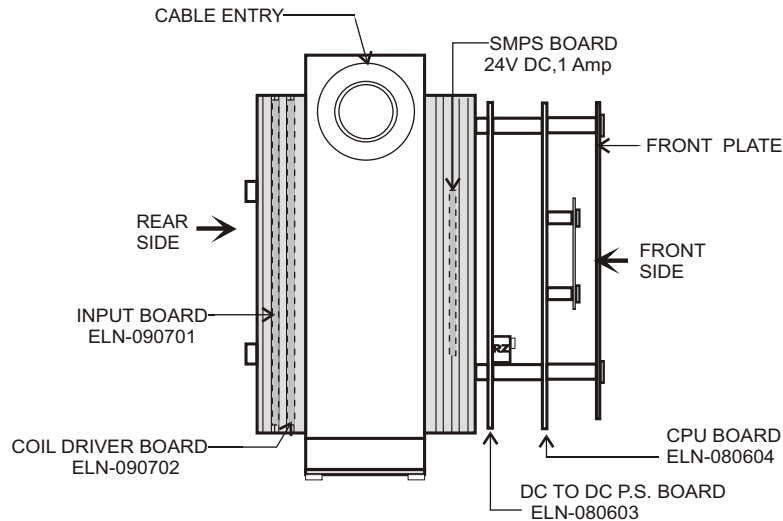
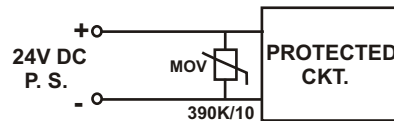


FIG.5. INTERNAL ASSEMBLY LAYOUT

Surge Protection :-



Surge protection against transient is provided by putting Mov (390K/10) across the 24V DC supply line.

5.2 How to Install Flow Meter :-

- 1) Flowmeter can be installed in any position either vertical or horizontal.
- 2) **Select a pipe location which will always run full of liquid.** Vertical installation with flow from down to top assures full pipe condition.
- 3) For horizontal installation, the electrode axis should always be in horizontal plane.
- 4) Flowmeter is to be installed in such a way that flow is always in the direction pointed by red arrow on the instrument.
- 5) Suitable gasketing can prevent leakages from near the flanges.

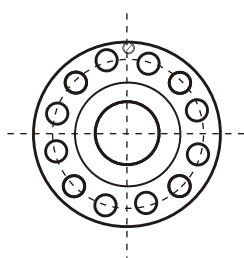


FIG.8a.

← Fit gaskets ensuring proper alignment.

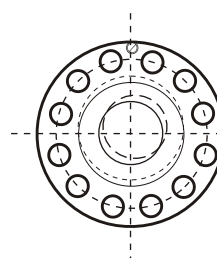
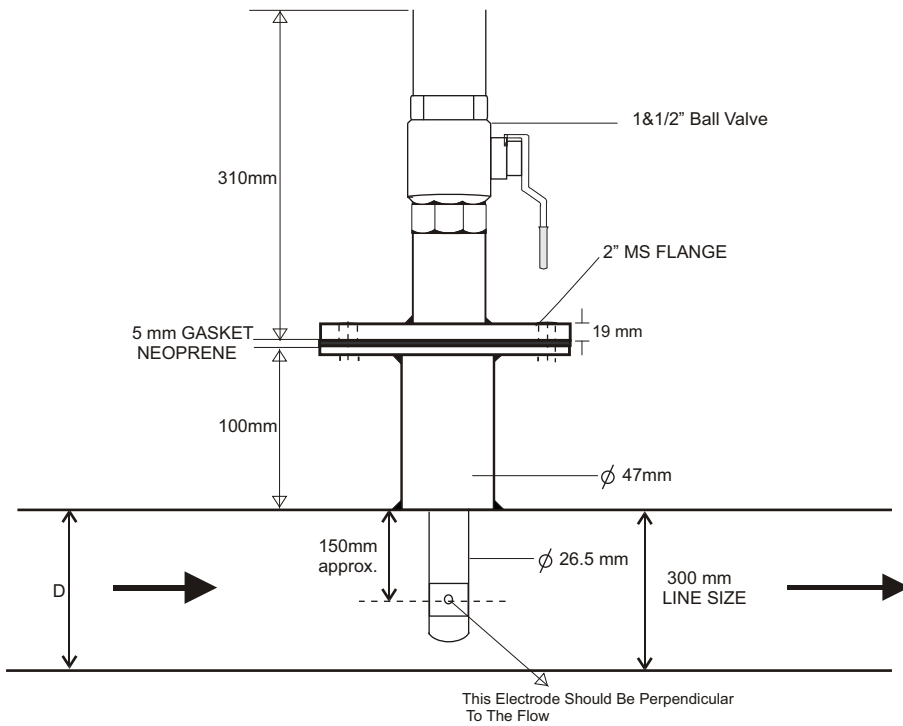


FIG.8b.

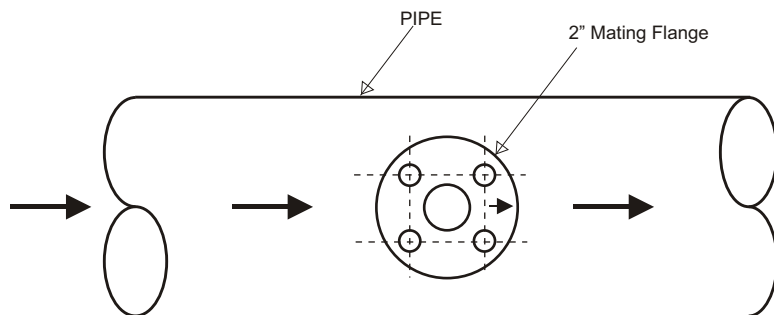
← Poorly aligned gasket can cause leaks and flow errors.

FIG.6. GASKET ALIGNMENT

5.2.1 Installation In Side View & Top View :-



5.2.2 Top View :-

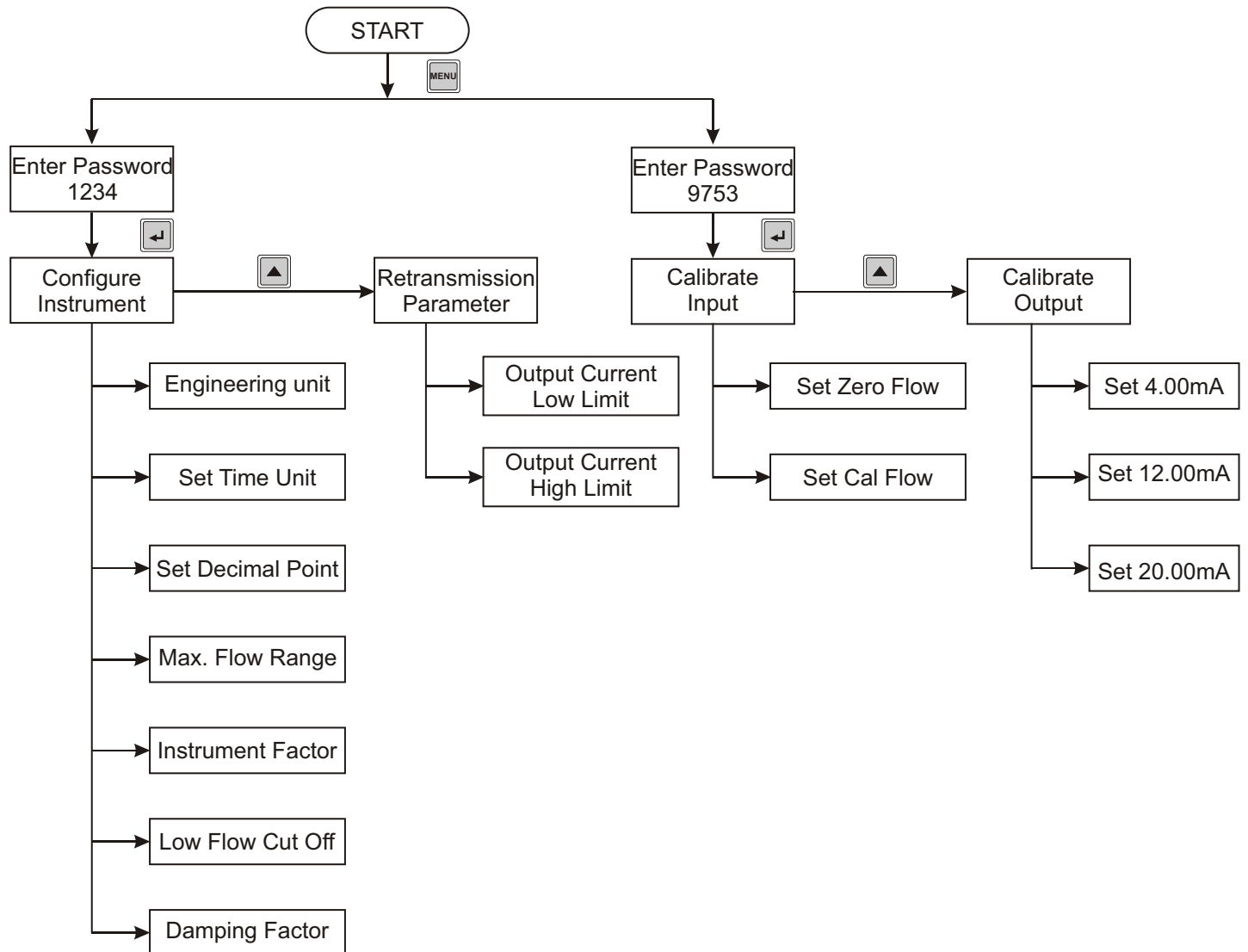


Note:- Mating Flange should be welded to the pipe as shown above

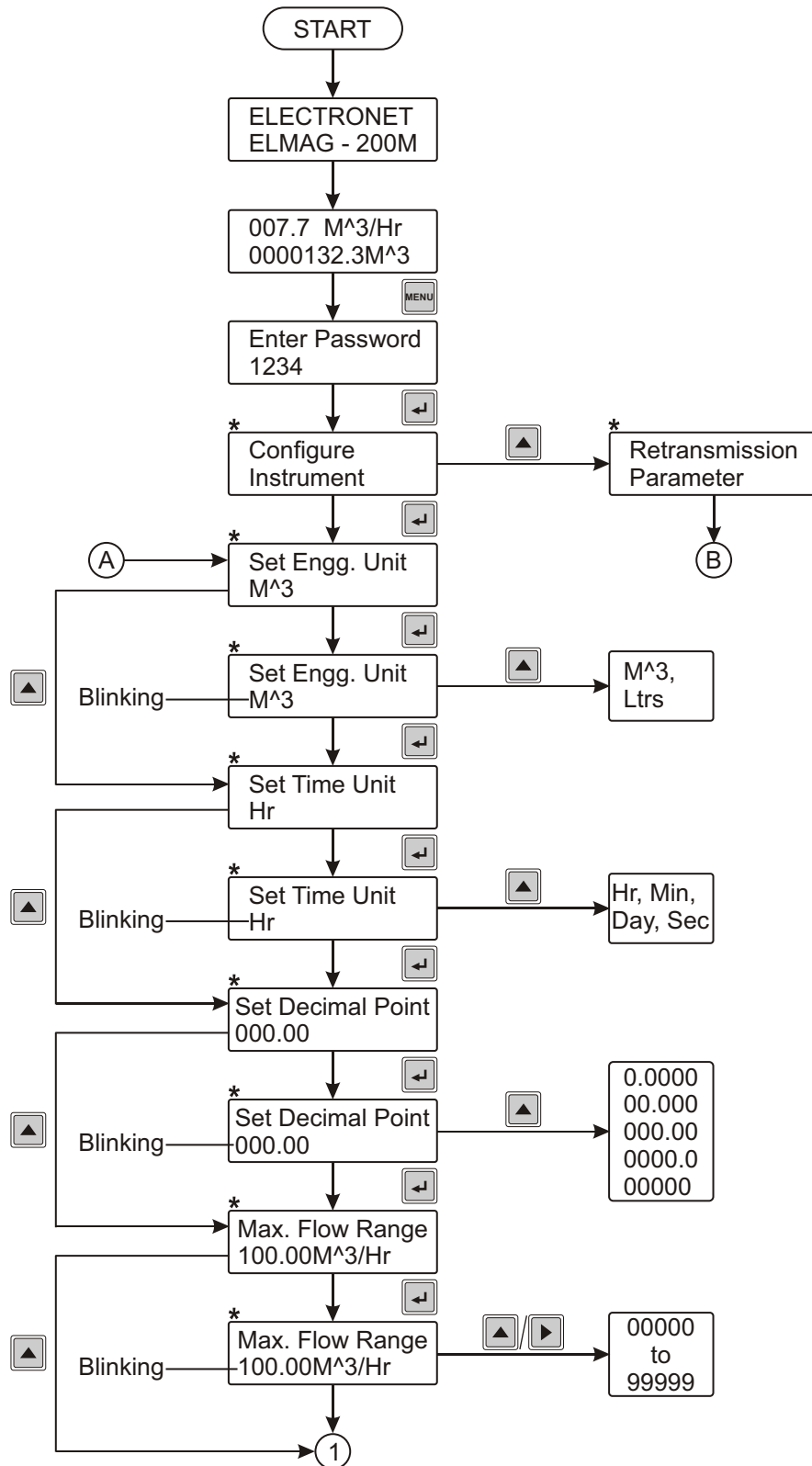
NOTE: Flow meter can be installed in any position either vertical or horizontal. Select a pipe location which will always run full of liquid. Vertical installation with flow from down to top assures full pipe condition.

6. FLOW CHARTS

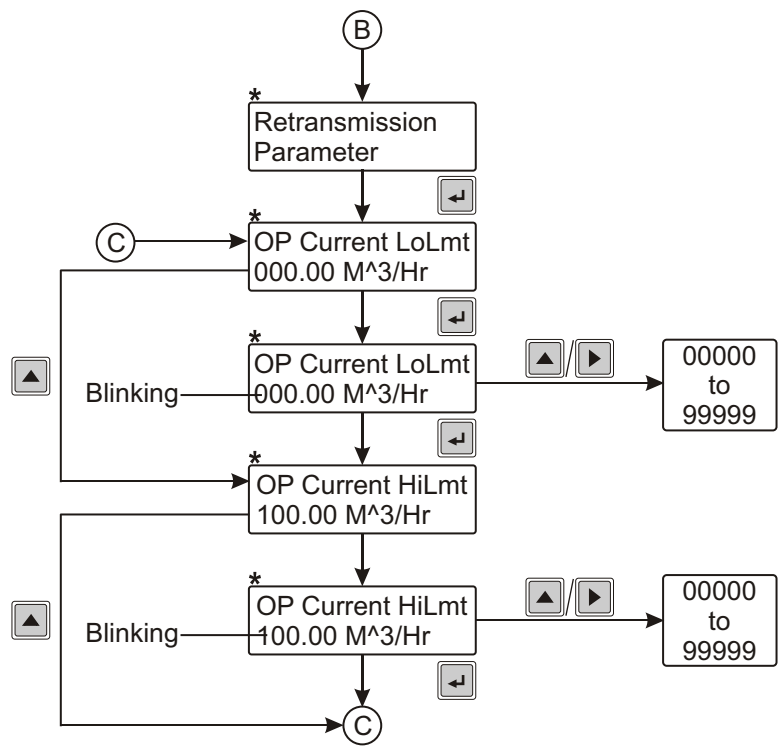
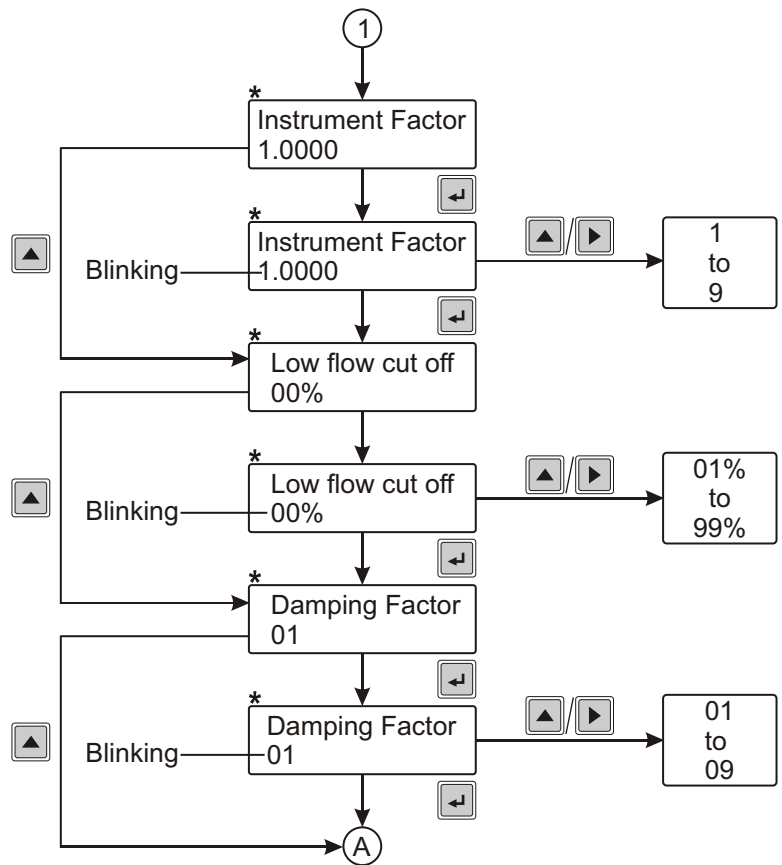
6.1 General Overview of Operations :




6.2 Configure Mode :

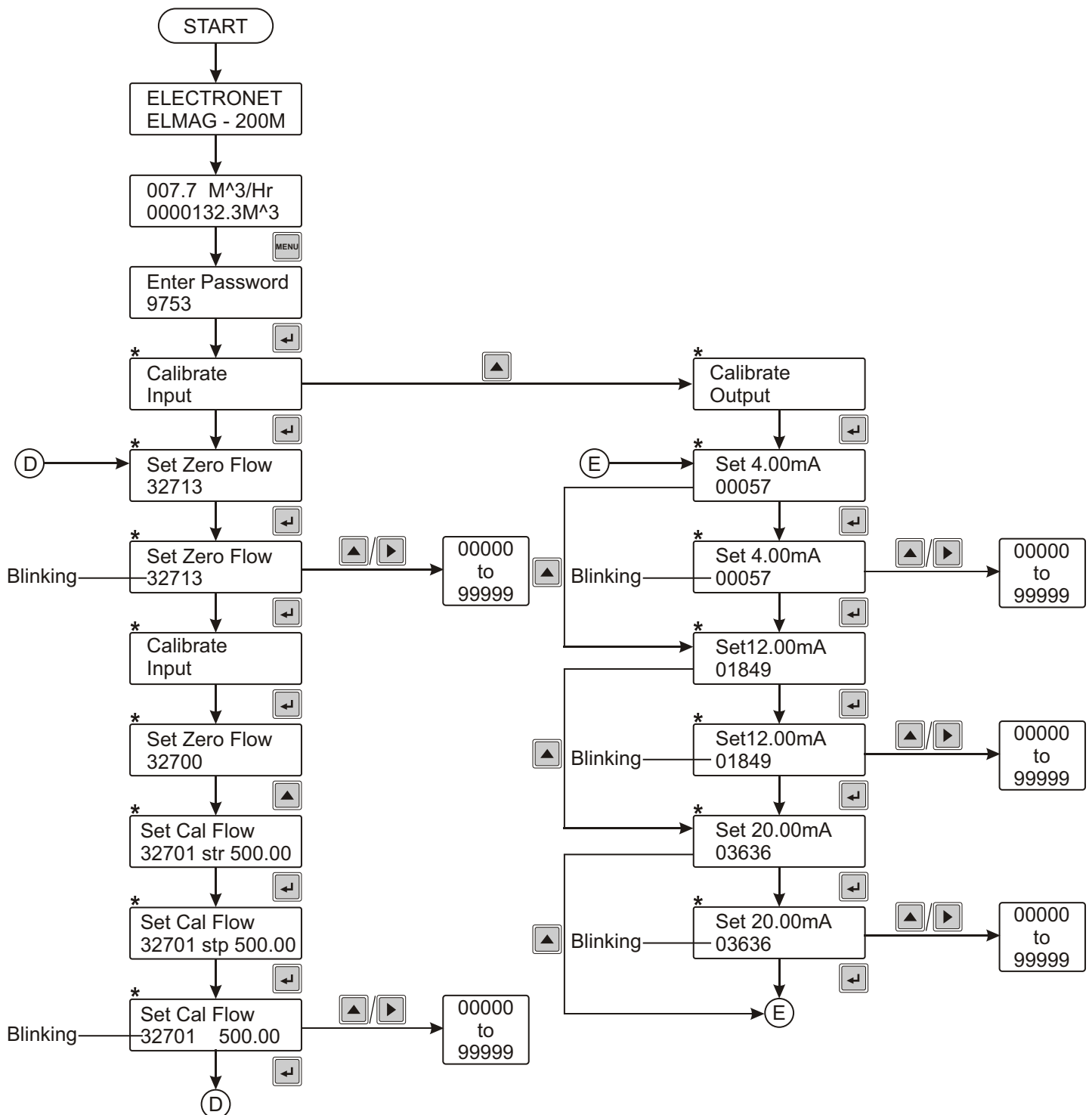


* Press To Exit to higher level menu



* Press  To Exit to higher level menu

6.3 Calibration Mode :



IMPORTANT NOTE:- IT IS RECOMMENDED TO PLEASE DON'T GO INTO CALIBRATION MODE, SINCE CALIBRATION IS ALREADY FACTORY SETTED, PERFORM CALIBRATION IF NECESSARY BY AUTHORIZED PERSON ONLY

* Press To Exit to higher level menu

6.4 Configure Instrument Functions :

The instrument will have to be configured as per user settings for range, decimal point, engineering unit etc.

The configuration functions available are:

6.4.1) Program Instrument: The instrument can be configured for Set time Unit, Set decimal point, Max. Flow Range, Instrument Factor, Low Flow Cut Off, Damping Factor

Enter Password 1234	The display indicates password. The password to be entered is 1234. The password is factory setted. Please do not disturb it.
Configure Instrument	This mode is use to configure different parameters mention below
Set Engg. Unit Ltrs	The display indicates engineering unit Ltrs.
Set Time Unit Hr	The display indicates time unit like Hour, minute, second, Day Select any one of them.
Set Decimal Point 000.00	The display indicates the decimal point position. "0.0000", "00.000", "000.00", 00000.
Max. Flow Range 6.000 Ltrs / Hr	The display indicates the range to be selected by the user.
Instrument Factor 1.0000	The display indicates the instrument Factor, which is a constant. The instrument Factor is factory calibrated. Please do not disturb it.
Low Flow Cut O ff 00%	The display indicates the Low flow cutoff. It is the integer value below which the display and the retransmission output shows the lower limit value.
Damping Factor 05	The display indicates the Damping factor. No. Of ADC count of which average is taken for stabilize the display.

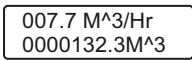

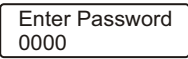
6.4.2) Retransmission Parameters: The instrument can be configured for retransmission output. The lower limit and the higher limit can be set as per desired by the user. The user can also select a different range within the range selected for retransmission purposes only.



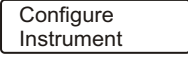

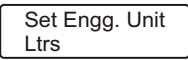
E.g. The range selected for the ELMAG-100 is 0 to 100 LPH. The user can select 1 to 50 LPH for retransmission output signal. When the flow is 1 LPH the retransmission output will show 4.00 mA and for 50 LPH it will show 20.00 mA.



OP Current LoLmt 000.00 M ³ / Hr	The display indicates Low limit value of retransmission output. The user can select any value within the range specified by.
OP Current HiLmt 350.00 M ³ / Hr	The display indicates High limit value of retransmission output. The user can select any value within the range specified by.



6.5 Configure Instrument Method :



The instrument will have to be configured as per user settings for time unit, decimal point, Range instrument factor, output current etc.


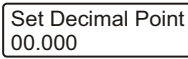
- 1] Power On the instrument it will be in RUN mode. Display will show 
- 2] Press  key. Display will show 



Enter the password 1234 using  &  key. Display will show 
- 3] Press  key. Display will show 


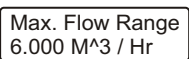
Press  key. Display will show to blink. The  key is used to change Engg. unit.





Press  key to enter the unit value.
- 4] Now, Display will show 



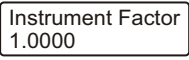
Press  key. Display will start to blink. The  key is used to change time unit.



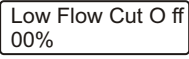
Press  key to enter the unit value.
- 5] Now, Display will show 




Press  key. Display will start to blink. The  key is used to change decimal point.

Press  key to enter the decimal point.
- 6] Display will show 


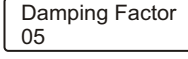
Press  key. The numeric digit will start to blink. Enter the desired value one by one using  &  key. The  key is used to increment the numeral value from 0 to 9.




Press  key used to shift the cursor to the next digit. Press  key to enter the value.
- 7] Display will show 


Press  key. Display will start to blink, but which is constant. The instrument factor is factory calibrated. Please do not disturb it. Press  key.
- 8] Display will show 



Press  key. The display will start to blink. Enter the desired value using  &  key.

It is the integer value below which the display & the Ret. Output shows the lower limit value.

Press  key to enter the value.
- 9] Now, Display will show 

Press  key. The display will start to blink. Enter the desired value using  &  key.

It is No. of ADC count of which average is taken for stabilize the display. Press  key.

Now, Display will show  . Press  key.

- 10] Display will show Retransmission
Parameter
- Press ← key. Display will show OP Current LoLmt
000.00 M³ / Hr
- Press ← key. The numeric digit will start to blink. Enter the desired value one by one using ▲ & ▶ key. Press ← key to enter the value.
- 11] Display will show OP Current HiLmt
350.00 M³ / Hr
- Press ← key. The numeric digit will start to blink. Enter the desired value one by one using ▲ & ▶ key. Press ← key to enter the value.
- 12] Press twice MENU key. Go to RUN mode.

6.6 Online Diagnostic Features :

6.6.1) Empty Pipe Indication:- For proper functioning of electromagnetic flow meter, flow tube should always be completely filled, So it is important to detect whether flow tube is filled or empty. 'Pipe Empty' message is displayed on display whenever flow tube is empty. Output current is 4.00 mA during empty pipe condition

6.6.2) Flow Over Range :- 'Flow Over Range' message is displayed whenever current flow rate exceeds 110% of calibrated Range. For e.g. If Range is 0 -350.0 m³/hr, then flow meter will show reading upto 385.0 m³/hr i. e. 110 %. If flow exceeds 385.0 m³/hr display will show 'Flow Over Range' message. Ret. output will also be 21.60 mA (max.) at 385.0 m³/hr.

6.6.3) Average Flow Rate :- This feature is used to calculate average value of flow rate over a given period of time. It is extremely useful whenever current flow rate is fluctuating and we are required to know what is the average flow rate over a given period of time.

Procedure for Average Flow Rate :-

Display in RUN mode. Press ▲ key 15 to 20 Sec

Now, Display will show

Instantaneous flow rate	Previous Average flow rate
000.4	065.0
000293	00002
Average ADC count	No. of ADC sample count

get the average flow rate. Press ▲ key No. of ADC sample count start to

increasing. Now get the average flow rate. Press ▶ key.

Display will show

Instantaneous flow rate	Average flow rate
000.4	078.0
000293	00002
Average ADC count	No. of ADC sample count

Now, come to RUN mode. Press MENU key.

7. CALIBRATION MODE PROCEDURE

7.1 INPUT CALIBRATION :-

1. Do the connections as per the termination details.

2. Power ON the instrument, LCD display will show 007.7 M³/Hr
0000132.3M³

3. Go to the program mode by pressing MENU key. Now display will show Enter Password
0000

with left most 0 digit blinking. Enter password as 9753 using ▲ key, to increment value & ▶ key, to shift cursor to immediate next digit on right side.

4. When last digit enter Press ◀ key. Now Display will show Calibrate
Input

5. Press ◀ key. Display will show Set Zero Flow
33421 ——— Approximate ADC Count

Press ◀ key. Display will show Set Zero Flow
33421 ——— Approximate ADC Count Blinking

6. Now Ensure that the flow in the pipeline is zero & pipe is completely filled with fluid. (Half filled pipeline will lead to incorrect calibration)

7. Press ◀ key, to Store Zero Flow Counts.

8. Now, Display will show Calibrate
Input . Press ◀ key

Display will show Set Zero Flow
33421 . Press ▲ key. Set cal Flow
33421 stp 200.0 ——— LAST SET FLOW

9. Now display will show Set cal Flow
33421 str 200.0 ——— Last Set Flow

Press ◀ key. Display will show Set cal Flow
33421 stp 200.0 ——— Last Set Flow

Now, pass the known flow near about 25% of full scale value. Now count will start increasing let the count get stabilize. Once count is stable press ◀ key.

Display will show Set cal Flow
60000 200.0 ——— Last Set Flow
APPROX. ADC count ——— Blinking

10. Now enter that known flow rate by using ▲ & ▶ key in right most 4 digit.

11. Then press ◀ key, to store cal flow (span) counts.

Press MENU key to come back to run mode.

7.2 RET. OUTPUT CALIBRATION :-

1. Do the connections as per the termination details.

2. Power ON the instrument, LCD display will show 007.7 M³/Hr
0000132.3M³

3. Go to the program mode by pressing MENU key. Now display will show Enter Password
0000

with left most 0 digit blinking. Enter password as 9753 using ▲ key, to increment value & ▶ key, to shift cursor to immediate next digit on right side.

4. When last digit enter Press ◀ key. Now Display will show Calibrate
Input

5. Press ▲ key. Display will show Calibrate
Output

6. Press ◀ key. Display will show Set 4.00mA
00057 ——— Approximate ADC Count

Press ◀ key, display will show Set 4.00mA
00057 ——— Approximate ADC Count Blinking

7. Now, adjust 4.00mA at output with the help of ▲ & ▶ key.

Press ◀ key to save the count.

8. Similarly, Adjust respective output current as display shows 12mA, & 20.00mA.

9) Calibration End. Now Press MENU key to come out of calibration mode.

10) Now check the current output as per the retransmission set limit i.e. Lo & Hi limit.

8. DOS & DON'TS

General mishandling on site :-

1. Application of power supply 230 V AC at incorrect terminals like input .
2. Loose connection on terminations.
3. Incorrect calibration.

Precautions to be taken on site :-

1. Read the instruction manual carefully before installing the instrument.
2. Do the connections as per the termination details given in the manual.
3. Terminal connections should be tight.
4. Check for proper supply voltage. It should be between 90 to 260V AC.
5. During calibration, follow the steps mentioned in the manual.
6. Verify that earthing is proper.

9. TROUBLE SHOOTING PROCEDURE

SYMPTOMS	CAUSE OF FAILURE	ACTION TO BE TAKEN
No display indication	<ol style="list-style-type: none"> 1. Absence of power supply at terminal block 2. Loose connection on termination. 	<ol style="list-style-type: none"> 1. Check power supply connections & rectify the fault. 2. Tight the termination connections.
Incorrect display indication.	<ol style="list-style-type: none"> 1. Incorrect calibration. 	<ol style="list-style-type: none"> 1. Recalibrate the instrument. Refer calibration procedure.
Flow is not registered at all.	<ol style="list-style-type: none"> 1. Reverse flow direction. 	<ol style="list-style-type: none"> 1. Check for correct flow measurement direction as indicated by arrow on the flowmeter.
Incorrect retransmission output.	<ol style="list-style-type: none"> 1. Retransmission output calibration disturbed. 	<ol style="list-style-type: none"> 1. Recalibrate the instrument for retransmission output. Refer calibration procedure.

Periodical maintenance :-

The flow meter does not require any special maintenance. Dependent on the media being measured it is recommended that approx. once a year, remove the sensor from the pipe and clean the liner. Method of cleaning consists of removing mechanical dirt and any non-conductive coating (like oil film) from the liner. A very dirty liner could cause inaccuracy of the measurement. Check mechanical state of the liner.

Authorised Dealer



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