

ELECTROMAGNETIC FLOWMETERS



INSTRUCTION MANUAL

ELECTROMAGNETIC FLOWMETERS

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GENERAL INFORMATION

The **MICROMAG** are flanged or insertion type electromagnetic flow meters used for pipe 1/2" to above in wastewater, chemical, industrial water or municipal application. MICROMAG has no moving parts and has round headed self cleaning type electrodes designed to discourage fouling, magmeter performs well and requires minimum maintenance in applications where debris or sand would impede propeller meters. There is no rotor to stop turning or bearings to wear out. Minimal straight pipe requirements allow MICROMAG meters to be used in piping configurations where there is little space between the meter and an elbow. Flow rate and total indications are standard on all models. Flow measurement units are customer-selected and factory set and can only be changed in the field by an authorized Saitechflow Instruments & Control.

Measuring Principle:

The measurement is based on Faraday's law of Electromagnetic Induction according to which, when a conductor is moved in a magnetic field, a voltage is induced in the conductor. The voltage induced, in the case of an electromagnetic flow meter is:

$$U=K. B. V. D.$$

K=Instrument constant

B=Strength of magnetic field

V=Average Velocity

D=Pipe diameter.

SPECIFICATIONS:

Pipe size	DN10 to DN2000 (for higher sizes consult factory)	
Flanges	Carbon Steel / SS 316 / SS 316L / SS 304 / ANSI / PN/DIN / BS / SMS / Tri-clamp.	
Pressure	Up to DN 80: PN 40, DN 100 to DN 200: PN 16, DN 250 to DN 350: PN 10	
Temperature	PFA Liner	0-200°C max,
	PTFE Liner	0-150°C max,
	Rubber Liner	0-90°C max,
	(Ambient Temperature Range 0-50°C).	
Accuracy	±0.5% of reading [at ref. conditions] between 100% to 10% of calibrated range	
	±0.7% of reading for flow rate between 10% to 5%[refer accuracy graph]	
Body Materials	Stainless steel / M.S.	

Liner	Soft and Hard Rubber / PTFE / PFA/ Neoprene/Without Lining	
Electrode	Hastelloy 'C' /S.S.316	
Electronics Housing	IP65 Die cast Aluminum/ Flame proof/IP 67/ IP 68	
Power	230VAC/110VAC, 50Hz/24VDC.	
Signal output	4-20 mA dc isolated in max. 600 ohms.	
Frequency output	0-10KHz prop. To 100% Flow rate (open collector with 10 mA /24Vdc max)	
Flow range	0.3mtr/sec to 12 mtr/sec	
Display Digits	For Flow Rate	For Total
	04 Digits	09 Digits
Units	M ³ /Hr	M ³
	Liters/Minute	Liters
	Liters/Second	Liters
	Gallons/Minute	Gallons x 1000

INSTALLATION AND GROUNDING

POSITIONING THE METER:

These meters can be installed horizontally, vertically and radial position.

STRAIGHT PIPE RECOMMENDATION:

As with most flow meters, the MICROMAG requires some straight pipe before and/or after the meter for best accuracy. However, the ability of electromagnetic meters to average the flow across the entire pipe allows for shorter straight pipe recommendations than most mechanical meters.

FULL PIPE RECOMMENDATION:

Micromag require a method for determining that the pipe is empty, to prevent false reading. This meter is designed to go to zero reading if one or more electrodes are exposed. For highest accuracy, install the meter so that the pipe will be full when there is flow or in idle condition. If air bubbles may be present in the pipe or sludge accumulation is an issue, rotate the meter by one flange hole to position the control housing at 45° angle.

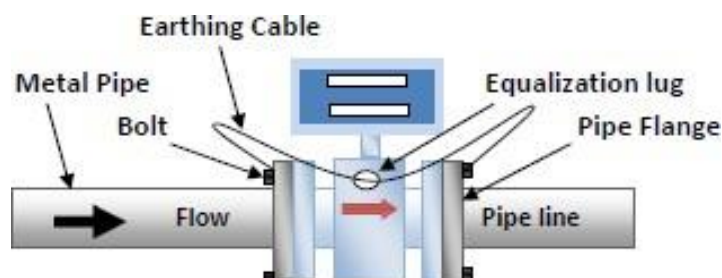
FITTING:

The MICROMAG flanges have standard class ANSI 150 and mate with any other flanges.

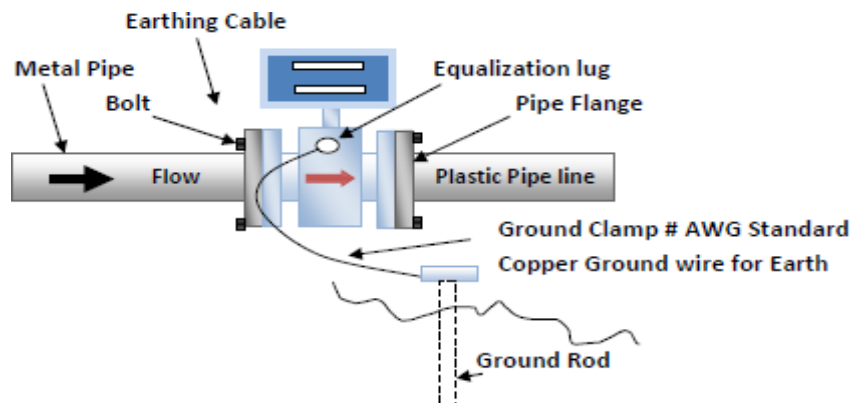
CALIBRATION: The MICROMAG flow meters are factory calibrated on water velocity of 5-6 m/s and will not require any form of field calibration.

EQUALIZATION AND GROUNDING

Metal pipe Installation: To equalize the electrical potential of the fluid, the MICROMAG meter, and the surrounding pipe secure the flange plates (factory installed on the equalization lug) to both pipe flange at one of the bolt holes, as shown below. Be sure the lock washer fits between the pipe flange and the flange plate.



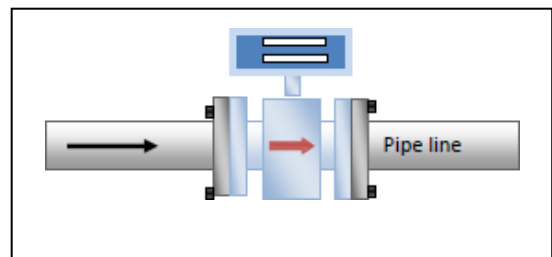
Plastic pipe Installation: When the MICROMAG is installed in the plastic piping system, it is not necessary to use the equalization straps, but very important to ground the meter to avoid electrical shock hazard and electrostatic interference with meter function.



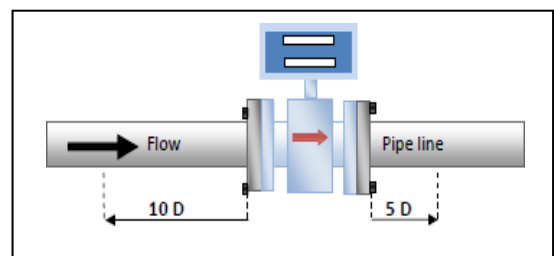
Commissioning of Primary Flow Meter [MICROMAG]

The Primary Flow meter can be installed at any point in the pipe run either horizontal or vertical provided the following conditions are met:

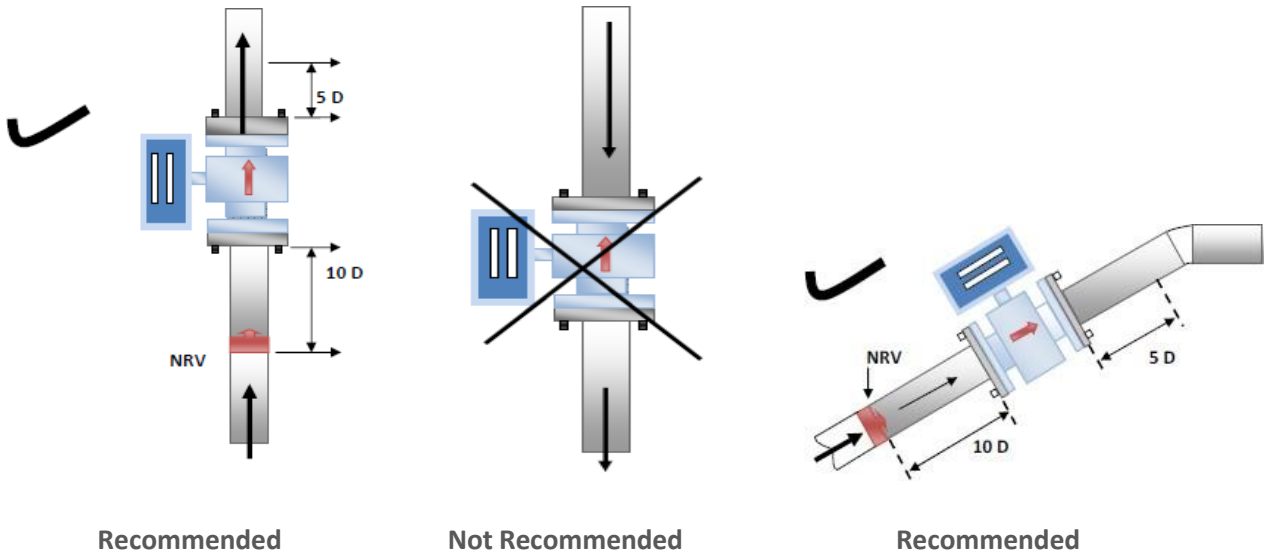
1. The direction of flow through the pipe is same as indicated on the primary flow tube by a red arrow.



2. Straight lengths of maximum 5D on up-stream and minimum 2.5D on down-stream as shown. If disturbances like cork screwing or vortex flow conditions are present straight lengths should be increased or flow straightners should be used. Flaps, slidegates, valves etc should be arranged at a distance of at least 5D downstream of primary flow tube.



3. Ensure that primary flow tube remains completely filled by the fluid under measurement even under no flow condition. This ensures trouble free and reliable operation of the Flow Meter. Select a location on the pipe, which will always run full of liquid. For vertical installations the direction of flow against gravity ensures full pipe. Some of the recommended installations are as under –

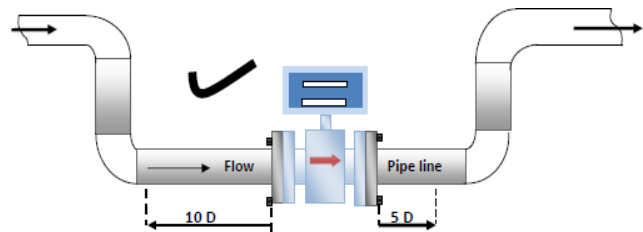


Recommended

Not Recommended

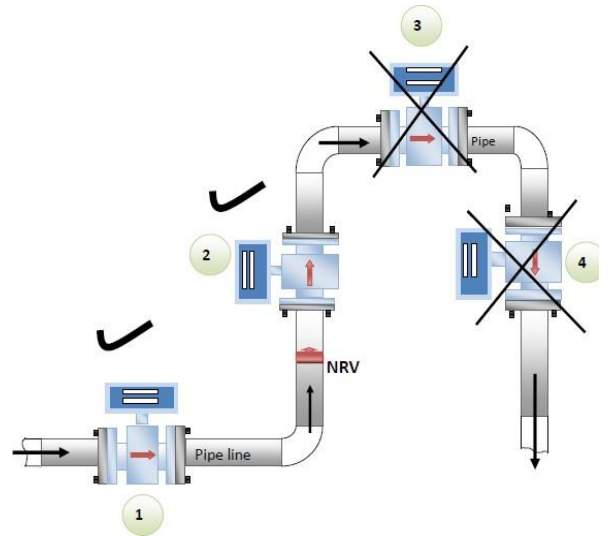
Recommended

4. Open Feed or Open Discharge
 Provide sluice underpass if Full pipe cannot be assured.
 This ensures full pipe under No flow condition.

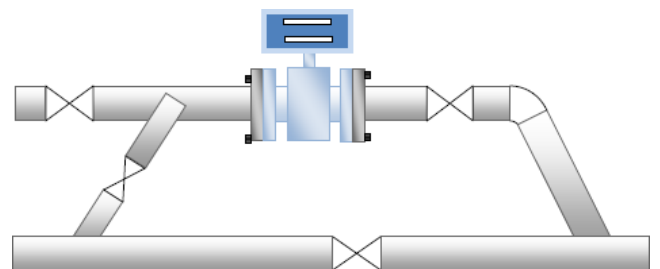


5. Preferred Locations:

- Locations 1 and 2 are recommended locations.
- Location 3 is the highest point in pipe run. This location is not recommended since air bubbles collect in the metering tube which will lead to faulty measurements.
- Location 4 is also not recommended since at zero flow the line will get drained and hence will give false measurements

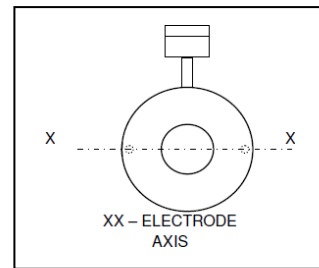


6. In case of heavily contaminated Fluids, the primary flow tube should be installed with a Bypass pipeline and isolation valves so that it can be removed for cleaning without interrupting operation.

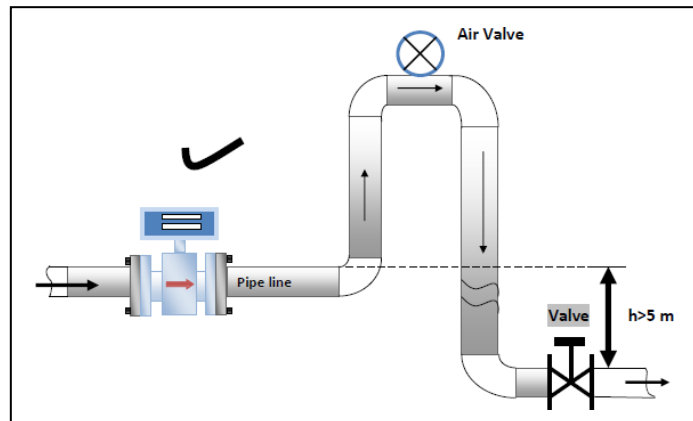


Primary Flow tube
 Isolation valve and pipeline For Draining and Cleaning

7. For Horizontal installations the measuring Electrode axis should always lie in horizontal Plane to prevent contamination on electrodes and avoid loss of contact of electrodes with Fluid because of gas bubbles, if present.



8. It is important to fit Air valve as shown if The down pipe is at a height Greater than 5 meters to remove



A1.Strong Electromagnetic fields should not be located in the immediate vicinity of the flow tube since these could affect the field generated by the coils in flow tube and hence disturb the reading stability and accuracy. Ensure that no magnetic material other than the pipe and connecting flanges should come in contact with the flow tube.

B1. Ensure that the minimum conductivity of the fluid under measurement is greater than **5 $\mu\text{s/cm}$** is maintained. Ensure that the fluid under measurement does not contain magnetic particles in it otherwise it will lead to measurement errors.

c1.Reducers -

Reducers should be flanged and generally Shall reduce by one size nominal bore otherwise The pressure loss will be high. The table given below is a general guideline Dimensions for reducers

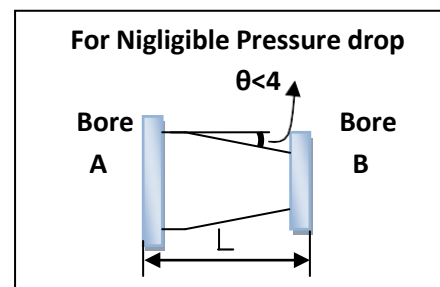
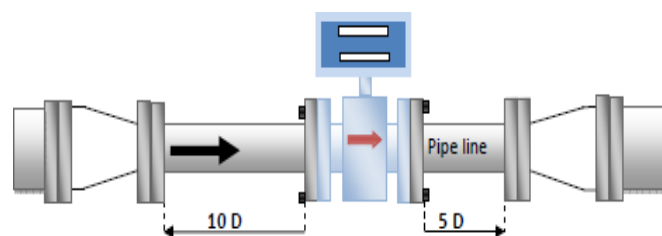


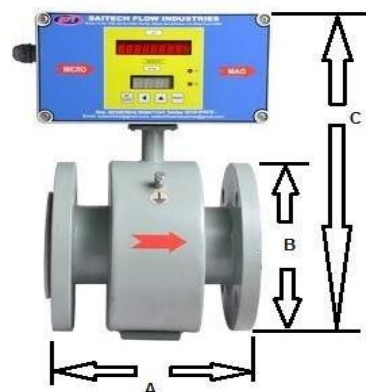
Table:

Nominal Bore A (in mm)	Nominal Bore B (in mm)	Length L (in mm)
40	25	150
50	40	200
65	50	200
80	65	200
100	80	250
150	100	300
200	150	300

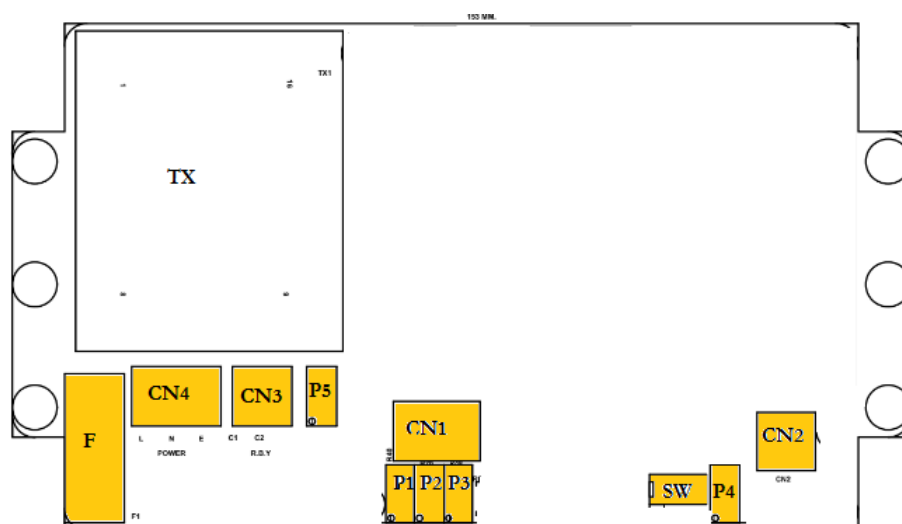


DIMENSIONAL DETAILS OF MAGNETIC FLOW METER ASSEMBLY

METER SIZE					
DN	A (mm)	B (mm)	C (mm)	Weight Kg	Weight \pm
15	200	88.9	290	6.0	1.0
20	200	98.4	290	6.5	1.0
25	200	107.9	295	7.5	1.0
32	200	117.5	295	8.5	1.0
40	200	127.0	285	9.0	1.5
50	200	152.4	310	11.0	1.5
65	200	177.8	335	14.5	1.5
80	200	190.5	350	16.5	1.5
100	250	228.6	385	22.0	1.5
125	250	254.0	410	26.0	1.5
150	250	279.4	435	29.0	2.0
200	300	342.9	500	43.0	2.0
250	350	406.4	560	57.0	2.0
300	350	482.6	640	77.0	2.0



Commissioning of primary Amplifier Board:



Commissioning and operating points:-

1. P1- Span Pot
2. P2- Range Setting Pot.
3. P3 – Zero Pot
4. P4– Live Zero Pot
5. P5 – Current adj. Pot
6. CN1 - Sensor E1, E2, G
7. CN2 – 4-20mA Out Put
8. CN3 - Coil (C1,C2,G)
9. CN4 – 230 AC (L,N,E)
10. SW - Velocity Switch (1, 2, 3, 4)
11. F - Fuse

Range changes by a factor of 2

Range changes by a factor of specification or a multiple there of are performed simply by means of changing the link configuration

The following configurations are available for the range adjustment:

Configuration	1	2	3	4	5
Link	BE	AB/BE	AB/BD	AB/BC	AB

Each increase by a positive step in the configurations number represents changes in the full scale range by a factor specification.

Each reduction in the configuration number by a negative step represents changes in the full scale range by a factor commissioning.

Example: Full scale range 4.5m/s. Existing link configuration 4. The desired new full scale range is 9 m/s. An increase by a factor specification is therefore necessary. For this the link configuration AB/BC must be changes to AB. i.e. link BC must be removed.

After removal, reset the zero and change the name plate to indicate the new full scale range.

Link may either directly be connected from pin B to target pin e.g. E or short circuiting all pins between B and target pin.

REPLACEMENT OF CIRCUIT BOARDS

REPLACEMENT OF CIRCUIT BOARD: The PCB is replaceable without sensitivity readjustment.

1. Check whether the new circuit board is suitable for the mains voltage.
2. Disconnect the mains voltage.
3. Remove cover plate.
4. Detach the connections to terminal blocks 1-L, 2-N, 3-E and the solder pin.
5. Transfer the range link A...E position the old circuit board to the new one.
6. Fit cover plate.
7. Switch on mains voltage.
8. Adjust zero point at zero flow, check polarity.

REPLACEMENT OF CIRCUIT BOARD POWER SUPPLY (PS):

The PS is replaceable without sensitivity readjustment. The replacement procedure is as follows:

1. Switch off mains voltage.
2. Unscrew cover plate of power supply and disconnect flat cables.
3. Fit new power supply.
4. Plug in flat cable, avoiding twisting into terminal block on power supply.

5. Switch on mains voltage.
6. At zero flow, check zero point of signal output (0-4mA) and if required, readjust zero point, check properly.

RANGE CHANGES

The MICROMAG is supplied for a fixed full scale range. The name plate contains the following information:

Full scale range in m³/hr, Ltr/min or Ltr/sec, Serial No., Input.
Note the following when using options.

Conversion of range changes

In order to affect a range changes. The full scale range (m³/hr) for a given meter size (DN in mm or inches) must be converted into the exact flow velocity (v) in m/s or ft/sec. in accordance with the details given in the following table.

Flow Table:

DN	V=0.3m/s (min)	V=1m/s	V=12m/s(max)
15	0.1909	0.636	7.634
20	0.3393	1.131	21.20
25	0.5301	1.767	21.20
32	0.8686	2.895	34.74
40	1.358	4.524	54.28
50	2.121	7.068	84.83
65	3.584	11.95	143.2
80	5.429	18.90	217.1
100	8.483	28.2	339.2
125	13.26	44.18	530.1
150	19.09	63.62	763.1
200	33.93	113.1	1357
250	53.02	176.7	2120
300	76.35	254.5	3053
350	103.9	364.4	4156
400	135.8	452.4	5428
500	212.1	706.9	8482
600	305.4	1018	12215

The Optimum flow velocity should be 2-3 m/s or 6-9 ft/s.

For products with solid contents it should be between 3 and 5 m/s or 9-15 ft/s.

The exact flow velocity can be determined from the columns in the tables.

For V= 12m/s as shown in the following example.

Example for m³/h:

Meter size: DN80

Desired measuring range: 55M³/hr

From the table 1 obtain for V = 12m/s the flow rate of 217.1 M³/h at DN80.

$$V = \frac{55m^3/hr}{217.5m^3/hr} \times 12 m/s ; \quad V = 3.04 m/s .$$

TROUBLESHOOTING

Trouble Shooting of Flow Meter MFM:			
Problem	Possible Fault		Remedy
Instrument is completely Dead	1	Fuse Blown on Power Supply Board	Replace the fuse a) 500 mA for 230 V ac
	2	Mains Supply is not available or is not proper	Apply proper mains supply (Refer label pasted on meter.)
The Flow meter shows Negative readings.	1	Installation of flow meter is Reversed.	Install the flow meter with the direction of flow as indicated by the Red arrow on flow Meter body.
Flow Meter Reading is Fluctuating.	1	Loose connection	Tighten the connections.
	2	Line is empty or partially Filled with the liquid.	Ensure line is full with liquid Without bubbles
	3	Air Bubbles are present in Line or leakage on Inlet side	
The Flow meter permanently shows Zero Reading.	1	Terminals 8, 9 & 10 are short circuited externally	Check the connections and Remove the short circuit.
Flow meter shows wrong Readings.	1	Trim pots are disturbed.	Contact to factory.
	2	Flow tube is partially filled	Ensure Full pipe Flow.
Display shows correct Readings but current Output (4–20mA) is zero.	1	Terminals 4 & 5 Connector may be Short circuited externally.	Check / repair the short circuit.
	2	Connections made to Terminals 4 & 5 Connector may be open.	Check / connect properly.
Current output (4–20mA) is less than the desired output.	1	Trim pots disturbed	Contact to factory.
	2	The current output (4–20mA) is getting loaded.	Verify the load connected Across the output terminals 4 & 5. It should be Less than 600Ω.

If the above given steps fail to correct the problem call factory or send Flow Meter back to factory. Please have the following information available when you call:

- a) Meter Serial Number
- b) Detailed description of the problem.
- c) When does the problem occur or repeat?
- d) What is the meter size, Full scale flow rate, meter constant, service liquid of the flow Meter ?
- e) What is the output load on the meter, grounding technique used?

Flow rate indicator cum Totalizer manual

Specification

1. Microcontroller based 16x2 LCD display.
2. Size: 85 X 85 mm diameter.
3. Supply: 5V DC
4. Input: 4 to 20 mA

Display

Line 1: 10 digit display indicating current reading of TOTAL FLOW.
Line 2: 6 digit display will show FLOW RATE.

Front keys



*Above mentioned keys are used to set the parameters and enter password

Sr. No.	FUNCTION	DISPLAY	RANGE
1	Low range	Low range	<high range
2	High range	High range	0000 to 9999
3	Unit	Unit	LPS,LPM,LPH,M3/ Hr
4	DECIMAL POINT SELECTION	Set Decimal Point	0.000 to 0000.

Operation

1. Set Unit:

- Press SW1 key for 2 sec and enter password to change LPS, LPH, M³/Hrs.
- Use SW2/SW3 key to select the parameter
- Flow Rate Line will indicate LPS or LPH or M³/hour.

2. Set Flow Decimal:

- Press SW1 key for 2 sec and enter password. Again press SW4 key to Set Flow Decimal.
- Use SW2 / SW# key to set Flow Decimal.

3. Set low range:

- Press SW1 key for 2 sec and enter password.
- Press SW4 key two times.
- Display will indicate Set Low Range.
- Press SW1 key to shift decimal point and SW2/SW3 key to set the value.
- Maximum value of low range selection will be < higher range.

4. Set High Range:

- Press SW1 key for 2 sec and enter password the password.
- Press SW4 key three times.
- Display will indicate Set High Range.
- Press SW1 key to shift decimal point and SW2/SW3 key to set the value.
- Display will indicate High range upto 9999.
- Maximum value of Flow range selection will be 9999 M³/Hrs.

Working:

- When power is supplied to the instrument the display will show the present flow rate.
- Display 1st line shows the Total Flow and the Display 2nd line shows Flow Rate.
- The process flow rate can be shown or calculated as per requirement in cubic meter per hour etc.
- The flow sensor will provide 4 to 20 mA input to the flow rate indicator. The display will indicate the flow rate as per selectable range value.
- If the lower range set to 0000 and higher range set to 9999, then at 4mA input display shows 0000 and at 20mA input display shows 9999 selected higher range.
- In total flow point is fixed 7 digits.

- If u want to reset the total flow want to reset the total flow count on the display, you can press SW1 for 6 sec then Password will be seen on the LCD screen, press SW2 key three times as a password. You will see two options as Yes: ENT; No: SET, Press SW4 key to reset the total flow or press SW1 key to exit without reset.
- If input is not connected, display will show OPEN msg.

Enter Password

There are four modes in which you have Password which are mentioned below:

1) Configuring Parameter Mode:

To configure parameters you have to press SW1 for 2 sec, then Password will be seen on the LCD screen, press SW3 key three times as a password. Now you can set the Parameter as per your choice.

2) Reset Mode:

When you want to reset the total flow count on the display, press SW1 for 6Sec then Password will be seen on the LCD screen, press SW2 key three times as a password. You will see two options as Yes: ENT; No: SET, Press SW4 key to reset the total flow or press SW1 key to exit without reset.

3) Calibration Mode:

To calibrate the Totalizer between 4 mAmp to 20 mAmp, you use can press SW4 for 6Sec then Password will be seen on the LCD screen, press SW1 key three times as a password. Follow the instructions and then calibrated the Totalizer.

4) Password Exit Mode:

In any of the above condition you don't want to enter any password or you want to exit from password screen then wait for 9 sec you will automatically exit from password option.

Special Features:

- Advanced Microcontroller based design.
- Easy user-interface through Tactile keypad.
- Flexibility in range change without recalibration
- User defined range and resolution of the display.
- Online data logging: through RS 485.
- Huge capacity of counter upto 9999999.999 units
- Flow batching facility available.
- Password protection user programming calibration & totalizer reset.
- User selectable units for flow rate: M3/Hr, Ltr/Min, Ltr/Sec etc.

Prepared by		Checked by		Approved by	
Name		Name		Name	
Sign		Sign		Sign	
Date		Date		Date	

Variable	Endianness	Modbus Address
Totalised Flow	Highest byte	40001
		40002
	Lowest Byte	
FlowRate	Highest byte	40003
		40004
	Lowest Byte	
Batch1 Current Value	Highest byte	40005
		40006
	Lowest Byte	
Batch1 Counter	0x00	40007
	Lowest Byte	
Batch2 Current Value	Highest byte	40008
		40009
	Lowest Byte	
Batch2 Counter	0x00	40010
	Lowest Byte	
Low Range	Highest byte	40011
		40012
	Lowest Byte	
High Range	Highest byte	40013
		40014
	Lowest Byte	
Slope	0x00	40015
		40016
	Lowest Byte	
Const	0x00	40017
		40018
	Lowest Byte	
Range Slope	0x00	40019
		40020
	Lowest Byte	
Unit	0x00	40021
	Lowest Byte	
BaudRate	0x00	40022
	Lowest Byte	
Slave ID	0x00	40023
	Lowest Byte	
Decimal Pt	0x00	40024
	Lowest Byte	
Batch1 Reference Value	Highest byte	40025
		40026
	Lowest Byte	
Batch2 Reference Value	Highest byte	40027
		40028
	Lowest Byte	

Baud Rate	2400/9600/19200
No. of Bits	8
Parity	N
Stop Bits	1
Supported Function	Read Holding Register

Product	
Sr. No.	
Line Size:	
Lining Material:	
Flow Range	

WARRANTY CERTIFICATE

We certify that the instrument mentioned above has been tested by us and has a limited warranty of 1 year from the date of dispatch. We undertake to make good by replacement or repair defects arising due to faulty design, material and or workmanship within the above mentioned period. Provided that the part in respect to which the complaint is made, is sent at the purchaser's expenses.

The warrantee is valid subject to:

The meter or part there of not being subject to alteration, accident abuse or misuse. The installation having been done as per guide lines in the manual. The unit is weather-proof, but if the glands are tempered with for the sake of extension, & if the meter & sensors are separated, leakages may happen-if water enters the meter, warranty stands null & void.

Client: _____

Date of Dispatch _____

FOR SAITECHFLOW INSTRUMENTS & CONTROL

Important Notes:-