SPINK CONTROLS®

CE-2424

JAS-ANZ

An ISO 9001:2008
Certified Company

INSTRUCTION MANUAL

FOR

MAGNETIC FLOW METER [MFM]

AND

MICROMAG SERIES

FULL BORE ELECTROMAGNETIC FLOWMETERS

SPINK CONTROLS®

CE-2424

An ISO 9001:2008 Certified Company

GENERAL INFORMATION

The **MICROMAG** are flanged or insertion type electromagnetic flow meters used for pipe 1/2" to above in municipal or industrial water, wastewater and chemical application where propeller meters have typically been used in the past. Because the MICROMAG has no moving parts and has electrodes designed to discourage fouling, this magmeter performs well and requires much less frequent maintenance in applications where debris or sand would impede propeller meters. There is no rotor to stop turning or bearings to wear out.
Minimum straight pipe requirements allow MICROMAG meters to be used in piping configurations where there is little space between the meter and an elbow. Rate and total indications are standard on both models. Flow measurement units are customer-selected and factory set and can only be changed in the field by an authorized Spink Controls Flow Industries.

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]	
Materials Body Liner Electrode Electronics Housing	Stainless steel / M.S. Soft and Hard Rubber / PTFE / PFA/ Neoprene. S.S.316, Hastelloy 'C' & 'B' Titanium IP65 Die cast Aluminum	
Display Digits	Rate	Total
	04	09
Units	Gallons/Minute Liters/Second Liters/Minute M^3 /Hr	Gallons x 1000 Liters Liters M^3
Power	230VAC/110VAC, 50Hz/24VDC.	
Pulse output Signal output Frequency output	With adjustable count rate from 1count/Hr to 10^5 Counts/Hr.(Open collector with 100 mA/24V dc Capacity) 4-20 mA dc isolated in max. 600 ohms. 0-10KHz prop. To 100% Flow rate (oper collector with10 mA /24Vdc max)	
Flow range	0.1 m/s to 10m/s	

INSTALLATION AND GROUNDING

INSTALLATION

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:

All magmeter 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. 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:

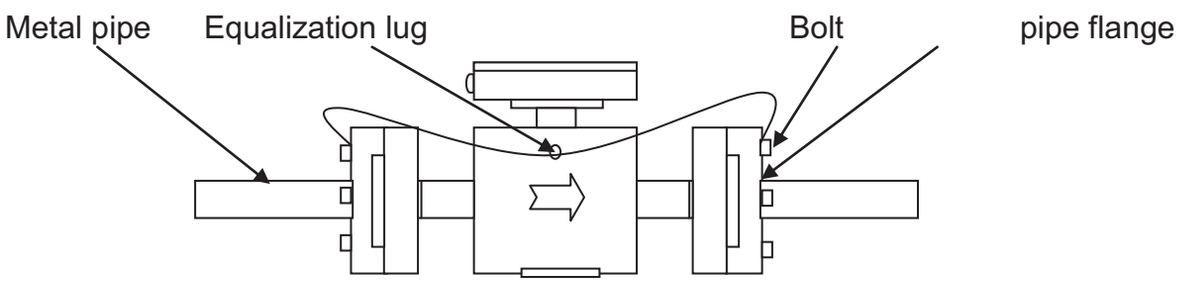
The MICROMAG flanges have standard ANSI 150lb, and mate with any other flanges.

CALIBRATION:

The MICROMAG flow meters are factory calibrated and will not require any form of field calibration.

EQUALIZATION AND GROUNDING

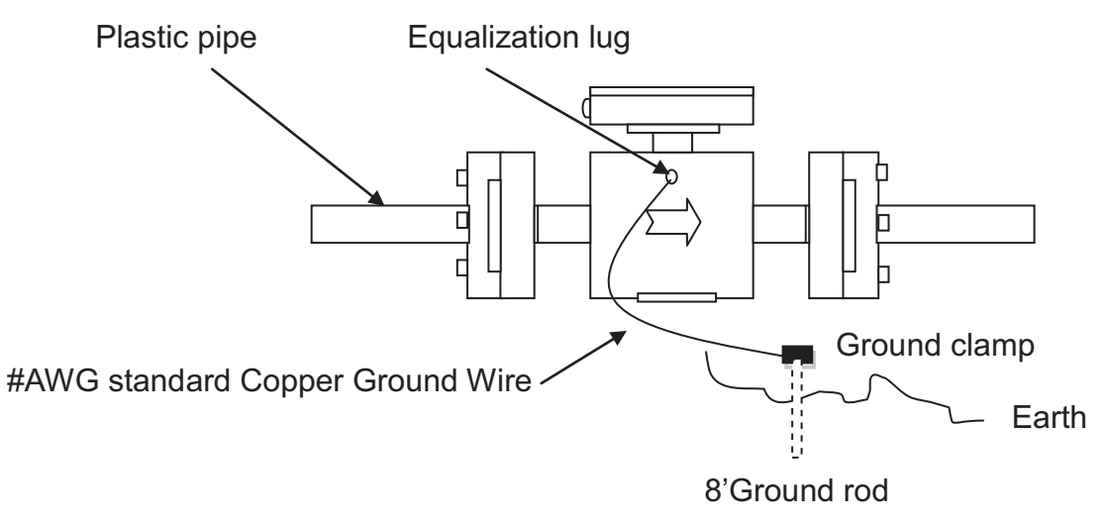
Metal pipe Installation: To equalize the electrical potential of the fluid, the MICROMAG meter, and the surrounding pipe secure the flange plates (factory installed on the equalization lug) to both pipe flange at one of the bolt holes, as shown below. Be sure the lock washer fits between the pipe flange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



EQUALIZATION DIAGRAM

Run wire from equalization lug to both pipe flanges;
Secure flange plates under bolt heads as shown.

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.

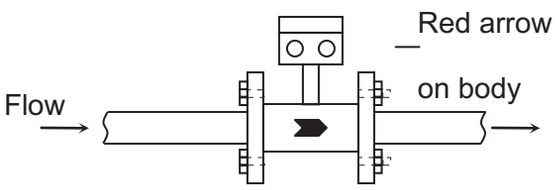


GROUNDING DIAGRAM

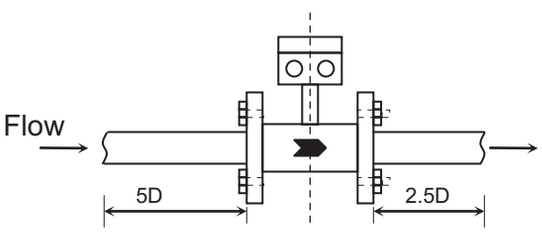
Commissioning of Primary Flow Meter [MICROMAG]

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

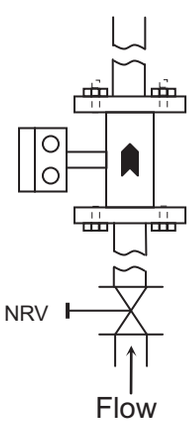
1. The **direction of flow** through the pipe is same as indicated on the primary flow tube by a red arrow.



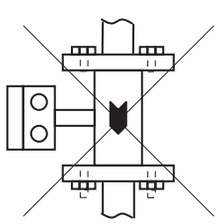
2. **Straight lengths** of maximum 5D on upstream and minimum 2.5D on down-stream as shown. If disturbances like cork screwing or vortex flow conditions are present straight lengths should be increased or flow straightners should be used. Flaps, slidegates, valves etc should be arranged at a distance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



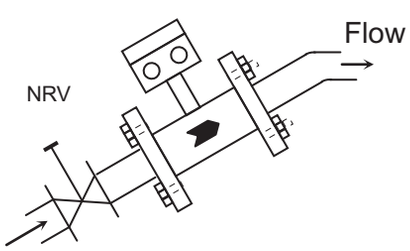
3. Ensure that primary **flow tube remains completely filled** by the fluid under measurement even under no flow condition. This ensures trouble free and reliable operation of the Flow Meter. Select a location on the pipe, which will always run full of liquid. For vertical installations the direction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



1) Recommended



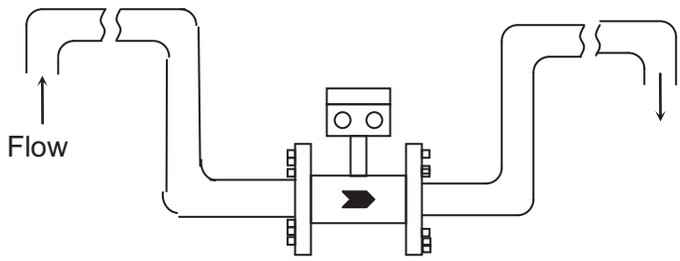
2) Not Recommend



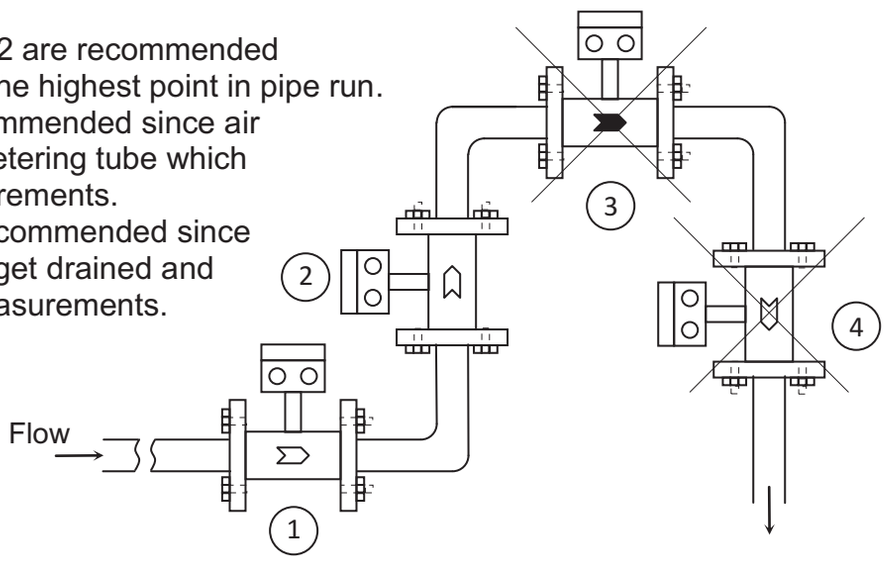
3) Recommended

4. Open Feed or Open Discharge

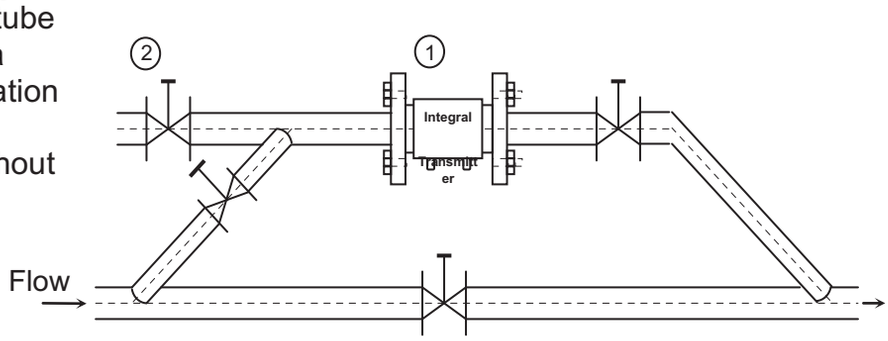
Provide sluice underpass if Full pipe cannot be assured. This ensures full pipe under No flow condition.



5. 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.

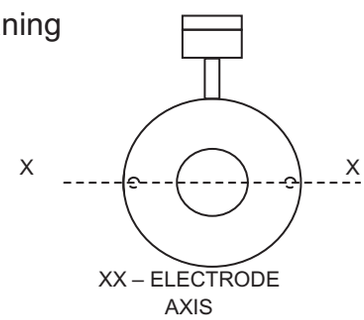


6. In case of **heavily contaminated Fluids**, the primary flow tube should be installed with a Bypass pipeline and isolation valves so that it can be removed for cleaning without interrupting operation.

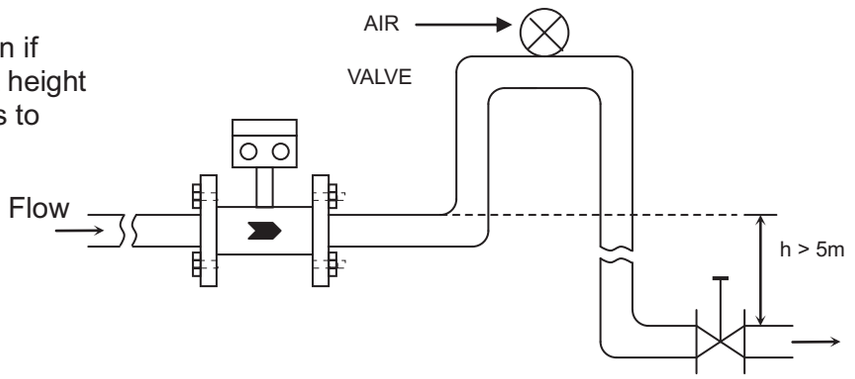


1. Primary Flow tube
2. Isolation valve and pipeline For Draining and Cleaning

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. Fit **Air valve** as shown if
The down pipe is at a height
Greater than 5 meters to
Remove vacuum.



a. **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.

b. Ensure that the **minimum conductivity** of the fluid under measurement is **greater than 5 µseimens / cm** is maintained. Ensure that the fluid under measurement **does not contain magnetic particles** in it otherwise it will lead to measurement errors.

c. **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

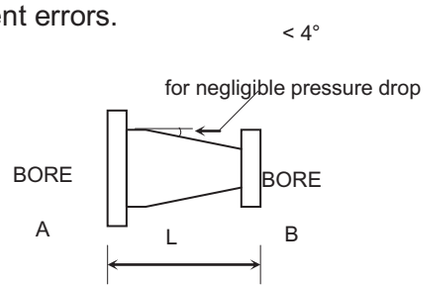
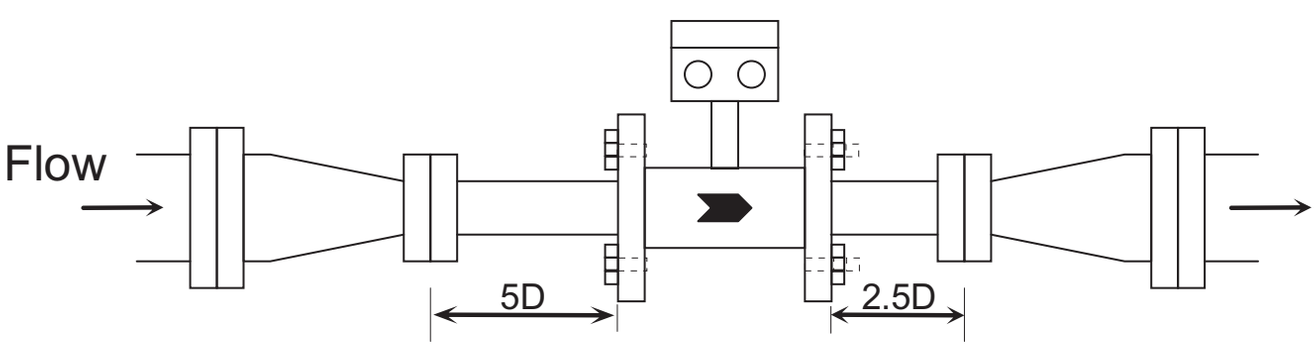
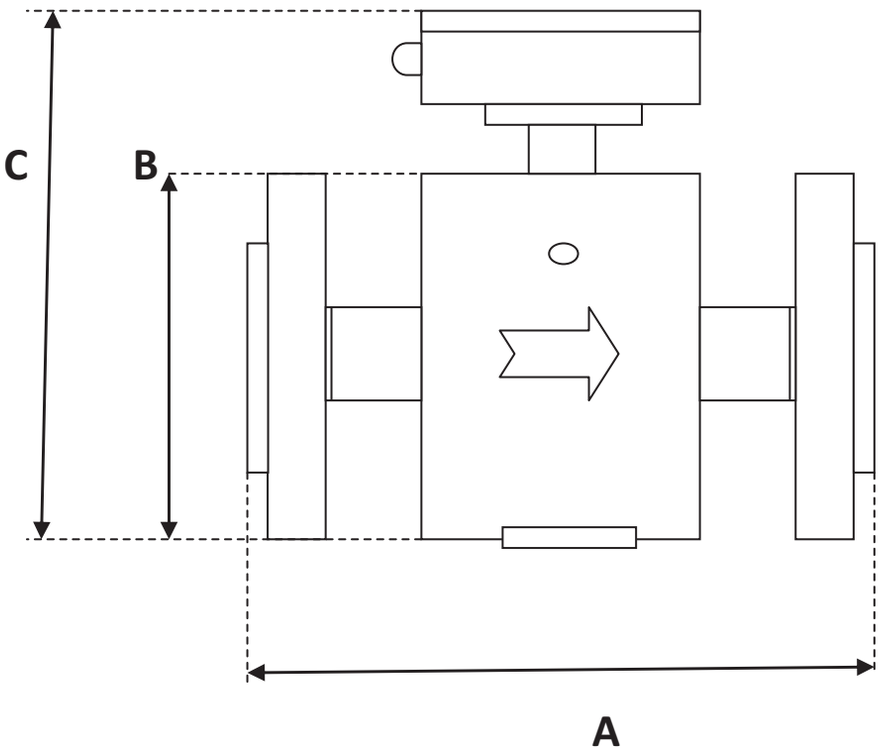


Table:

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



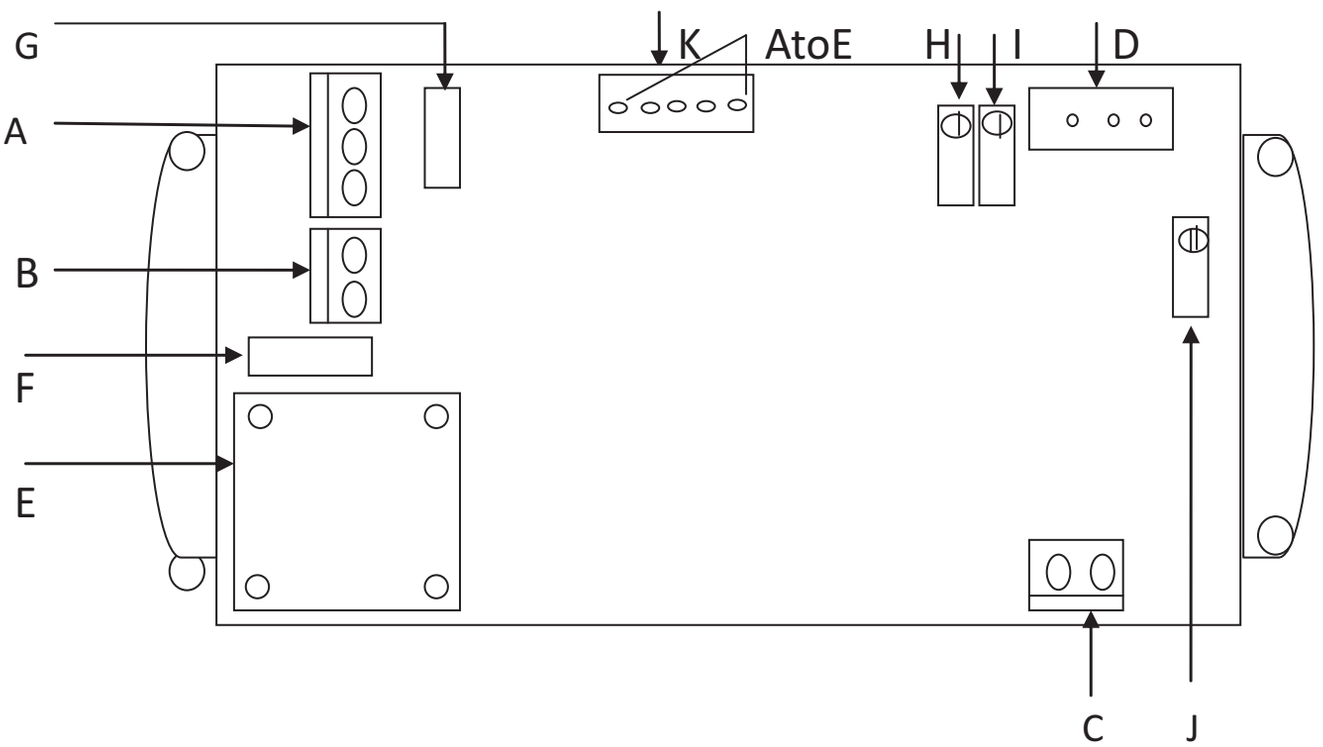
DIMENSIONAL DETAILS OF MAGNETIC FLOW METER ASSEMBLY



METER SIZE					
DN	A (mm)	B (mm)	C (mm)	Weight Kg	Weight ±
15	200	89	290	6.0	1.0
20	200	99	290	6.5	1.0
25	200	108	295	7.5	1.0
32	200	118	295	8.5	1.0
40	200	127	285	9.0	1.5
50	200	155	310	11.0	1.5
65	200	178	335	14.5	1.5
80	200	190	350	16.5	1.5
100	250	229	385	22.0	1.5
125	250	254	410	26.0	1.5
150	250	280	435	29.0	2.0
200	300	343	500	43.0	2.0
250	350	407	560	57.0	2.0
300	400	483	640	77.0	2.0

Commissioning of primary Amplifier Board:

Commissioning and operating points



A – Mains connection (terminal 1- L, 2- - N, 3 - E)

B – Signal output mA connection (4, 5)

C - Coil connection (6, 7)

D – Electrode connection (8, 9, 10)

E – Transformer

F – Fuse

G – Live Zero Pot

H – Zero Pot

I – Span Pot

J – Range Setting Pot. K-Link (1, 2, 3, 4, 5)

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 etc
Primary Constant
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: 55M^3/hr

From the table 1 obtain for V = 12m/s the flow rate of 217.1 M^3/h at DN80.

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

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

REPLANCEMENT 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. Turn the four screws of the assembly plate anticlockwise until the complete unit can be removed.
6. Slacken the connecting screws between PCB and assembly plate.
7. Transfer the range link A….E position the old circuit board to the new one.
8. Screw the new circuit board onto the assembly plate and mount the unit in the terminal box. Reconnect the cable; solder wire from the test socket Sim to the pin marked. Reconnect 1-L, 2-N, 3-E.
9. Fit cover plate.
10. Switch on mains voltage.
11. 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. Slacken both clamping bolt.
4. Fit new power supply.
5. Plug in flat cable, avoiding twisting into terminal block on power supply.
6. Screw on cover plate.
7. Switch on mains voltage.
8. At zero flow, check zero point of signal output (0-4mA) and if required, readjust zero point, check properly.

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 b] 500 mA for 110 V ac c] 2 A for 24 V dc
	2 Mains Supply connection Not proper.	Make proper connections
	3 Mains Supply is not available or is not proper	Apply proper mains supply (Refer label pasted on meter.)
Fuse blows very often in Operation	1 Fluctuation in mains supply	Constant Voltage Transformer (CVT) with 30 VA rating is Recommended.
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. (Refer Installation Page 06 of this Manual.)
Flow Meter Reading is Fluctuating.	1 Loose connection at terminals 8, 9 and 10 of TS1 connector.	Tighten the connections.
	2 Gasket ID is less than Specified.	Ensure gasket ID as per Table (Refer Installation page 06, Subsection VII of this Manual.)
	3 Fluctuating Mains Supply	Ensure stable Mains Supply.
	4 Line is empty or partially Filled with the liquid.	Ensure line is full with liquid. (Refer Installation page 06 Subsection III of this Manual.)
	5 Air Bubbles are present in Line or leakage on Inlet side	Refer Installation page06 Of this Manual.
The Flow meter permanently shows Zero Reading.	1 Terminals 8, 9 & 10 of TS1 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.

Trouble Shooting of Flow Transmitter		(Continued)
Problem	**Possible Fault**	**Remedy**
Flow Meter shows ½ readings then actual	2 Flow tube is partially filled	Ensure Full pipe Flow.
	1 Connection/Cable to TS1-8 & 9 terminals externally Short circuited.	Check / Remove short circuit. (Contact Factory)
	2 Connection/Cable to TS1-8 & 10 terminals externally Short circuited.	Check / Remove short circuit. (Contact Factory)
Counter or Open Collector Output shows Wrong Tantalization or is Not Working.	1 Trim pots are disturbed on Counter board.	Contact to factory.
	2 2 pin Relimate connector cable of Counter may be open	Check / repair the Connector/ connections.
Display shows correct Readings but current Output (4 – 20 mA) Is zero.	1 Terminals 4 & 5 of TS1 Connector may be Short circuited externally.	Connector / connections. Check / repair the short circuit.
	2 Connections made to Terminals 4 & 5 of TS1 Connector may be open.	Check / connect properly.
	3 Fuse inside the DMM under use is Blown	Check / Replace
Current output (4 – 20 mA) is less Than the desired output.	1 Trim pots disturbed	Contact to factory.
	2 The current output (4 – 20 mA) is getting Loaded.	Verify the load connected Across the output terminals 4 & 5 of TS1. It should be Less than 600 .

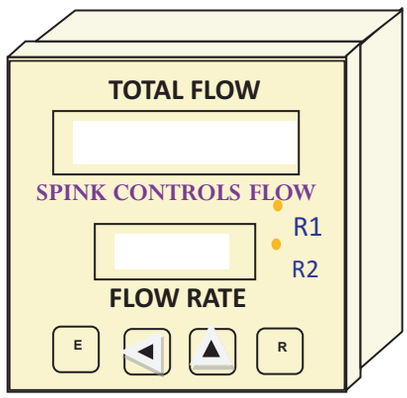
If the above given steps fail to correct the problem call factory or send Flow Meter back to factory. Please have the following information available when you call:

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?

GUIDE TO OPERATE *FLOW RATE INDICATOR TOTALIZER*

Specifications:

- Micro controller based, Double Display.
- Size : 96x96x65 mm.
  panel cut-out: 92x92mm.
- Supply: 230VAC ±10%, 50Hz.
- Input : 4 to 20 mA.
- Output: 2 Relay with 1 C/O,
  5A, 230 VAC contact..



Displays:

Display 1: 6 digit displays in RED indicate current reading of TOTAL FLOW in m^3/hrs.
Display 2: 4 digit display in GREEN will show **FLOW RATE** in m^3/hrs.
Two small Red LEDs in right hand side glows when RELAYS are switched ON.

Front keys:

SET/ ENT

◄ **DIGIT SHIFT/SELECT KEY**

▲ **UP KEY**

RST

These front keys can be used to see and change the current values of **set count** & TIME.

FUNCTION	DISPLAY	RANGE
SET POINT 1	**Set 1**	0-999999
SET POINT 2	**Set 2**	0-999999
LOW RANGE	**Lrng**	0-9999
HIGH RANGE	**Hrng**	0-9999
ADD	**Add**	LPM/LPH/m3/hrs
Decimal point selection	**Dp**	0000/000.0/00.00/0.000

OPERATION:

1. **ADJUSTMENT OF SET POINT 1:**
   Press **SET/ENT** key for 2 second to go into SET MODE.
   Lower display will indicate the current value of SET POINT 1.
   Upper Display will indicate Set 1.
   Follow below method to set value:
   * Select the next digit by ◄ Key.
   * Increase the parameter by ▲ key.
   * Press **SET/ ENT** key to store new value.

2. **ADJUSTMENT OF SET POINT 2:**
   Press **SET/ENT** key for 4 second to go into SET MODE.
   Lower display will indicate the current value of SET POINT 2.
   Upper Display will indicate Set 2.
   Follow below method to set value:
   * Select the next digit by ◄ Key.
   * Increase the parameter by ▲ key.
   * Press **SET/ ENT** key to store new value.

3. SETTING FOR LOW RANGE SELECTION:

Press **SET/ENT** key for 6 seconds to go to SET mode.
Lower display will indicate the current value of lower range.
Upper Display will indicate **Lrng**.
Follow below method to set value:

* Select the next digit by ◄ Key.
* Increase the parameter by ▲ key.
* Press **SET/ ENT** key to store new value.

4. SETTING FOR HIGH RANGE SELECTION:

Press **SET/ENT** key for 8 seconds to go to SET mode.
Lower display will indicate the current value of higher range.
Upper Display will indicate **Hrng**.
Follow below method to set value:

* Select the next digit by ◄ Key.
* Increase the parameter by ▲ key.
* Press **SET/ ENT** key to store new value.

5. . SETTING FOR ADDITON:

Press **ENT** key for 10 second to SET Mode.
Lower Display will indicate the current value of ADDRESS.
Upper Display will show Add.
Follow below method to set value:

* Select the next digit by ◄ Key.
* Increase the parameter by ▲ key.
* Press **SET/ ENT** key to store new value.

6. ADUSTMENT OF DECIMAL POINT:

Press SET/**ENT** key for 12 second to adjust decimal point.
Shift Decimal point UP ◄ key and ▲ key.
Press SET/ENT key to store a new value.

WORKING

- Do all connection as shown in connection diagram and turn ON Instrument.
- Upper Display will indicate total flow and lower display will indicate flow rate.
- When start switch is short at once and removed then pulse will be given to the instrument. So both relays turn on.
- When process value touches set1 then relays R1 turns off.
- When process value touches set2 then relays R2 turns off.
- After relay R2 turns off then 1 cycle will complete so there will be increment of 1 batch in count. And upper display shows last reading while lower display will be reset and it shows 000.
- Again when start switch is short at once and removed then pulse will be given to the instrument so upper display will be reset and it shows 000000 and both realys turn on. This cycle continues.

* By pressing Digit Shift key you can see the total flow and while pressing UP key you can see the number of batch.

* If Reset Key is pressed for 2 seconds then upper display will be reset and if reset key is pressed for 6 seconds then total flow and number of batch will be reset.

* If cycle is not completed and between stop switch is short and removed then all process will stop and when again start switch is short at once and removed then process will start from that last stored value.

- If POWER goes off during counting, last TOTALISING reading is stored in non-volatile memory and the counter starts counting from stored value when power turns ON.

CONNECTION DIGRAM: