Hydronett
Saving water, Enriching lives

Product Data Sheet

HYDROMASTER SERIES

Electromagnetic Flow Meter

- Accuracy +/- 0.5%
- Working range 0.1 m/s to 5 m/s
- Low flow as low 0.01m/s
- Open / Short Coil Alarms
- Low Flow / High Flow Alarms
- Built-in Empty pipe detection
- Communication Options GSM/GPRS
- NbIoT, Wireless Mesh
- IP68 Resistance

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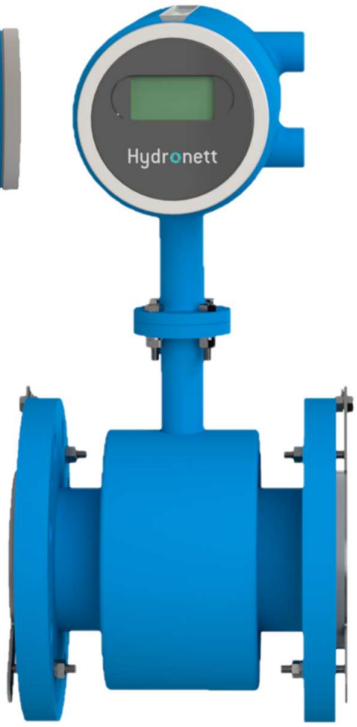
Product Selection Guide

Remote type - Electromagnetic Flow meter

Model Name	Hydro master Series
Diameter	DN 50 to DN 600
Type of lining	Rubber /PTFE
Accuracy	+/- 0.5 %
Electrodes	316
Flow rate	0.1 m/s to 5 m/s
Resistance	IP68

Field Mount type - Electromagnetic Flow meter



Model Name	Hydro master Series
Diameter	DN 50 to DN 600
Type of lining	Rubber /PTFE
Accuracy	+/- 0.5 %
Electrodes	316
Flow rate	0.1 m/s to 5 m/s

Hydro master Series Features

Performance Features

Working range	0.1 m/s to 5 m/s
Alarms	Open / Short Coil Alarms
Alarms	Low Flow / High Flow Alarms
Error Information	Built-in Empty pipe detection, Coil short, RTC failure, Memory Fail, Excess flow rate

Operational features

- Suitable For both Vertical & Horizontal orientation
- 128 x 64 graphical backlit display
- Pulsed DC operation
- Programmable digital filters
- Inbuilt RTC and non-volatile memory to save periodic flow record
- Batch Control Operation
- Batch start stop from RS485 commands
- 4-20mA input for partial flow measurement

Operating Temperatures

- Maximum Operating Temperature used Rubber Lining (NBR) - 55 ° C
- Maximum Operating Temperature used PTFE Lining - 160 ° C.

Electrical Parameters

Power supply	90-270V AC with continuous protection up to 440VAC, 50Hz
Signal Input	Induced EMF picked up by sensors in the flow tube
Coil Drive Output	Constant Current / Frequency
Display	128x64 graphical LCD display
Operations	Using 4 keys
Analog Output	Isolated 4-20mA
Digital Output	Pulse. Isolated open collector output
Communication	Isolated RS485 / MODBUS protocol
Isolation Voltage	1.5KV
Relay Outputs	2 Maximum*
Relay Rating	5A at 220V AC linear load
Programmable Setpoints	4
Resistance	IP68

Environmental Features

Max. Operating Temperature:	55 °C
Storage Temperature	0 – 80 °C
Humidity	0 – 80% non-condensing

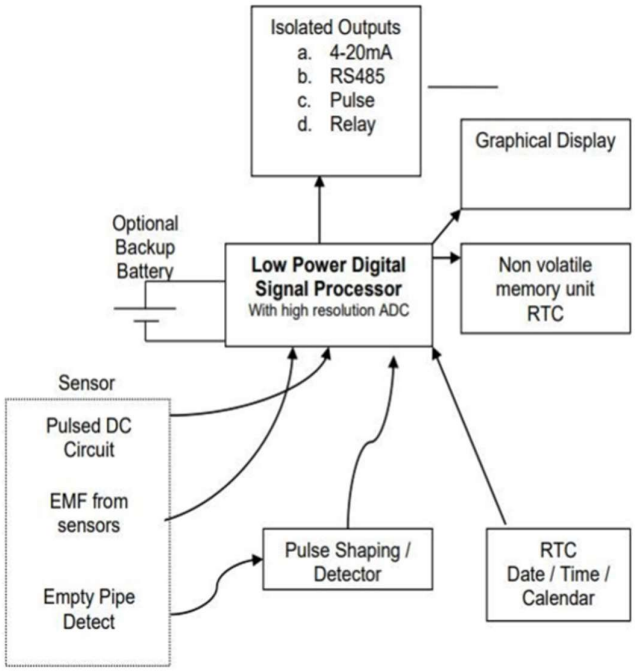
Flow parameters

Flow Rate	m3/hr
Forward / Reverse	Indicated on Screen
Total Flow	Forward Total Flow Reverse Total Flow
Induced EMF	Displayed in diagnostic Screen only (not standard)
Date/ Time	From Inbuilt RTC
Flow K Factor	0.0001 to 9.9999
Stored Parameters	Date/time, Rate of flow, forward total flow, reverse total flow, tamper information & periodic stored Records

Communication & memory Features

Serial Communication	RS485 / MODBUS Protocol
GSM/GPRS Communication	Facility to add GSM Modem
GSM/GPRS Communication Method	GPRS/TCPIP to static IP server, SMS to programmed numbers, FTP to server
Memory	32K bytes Maximum
No of records stored	2500 maximum
Record Storage Interval	Programmable Minimum: 1 Minute Maximum: 1 Day
Memory Type	Non-Volatile memory
Memory Retention	100 Years

Hydromaster internal block diagram



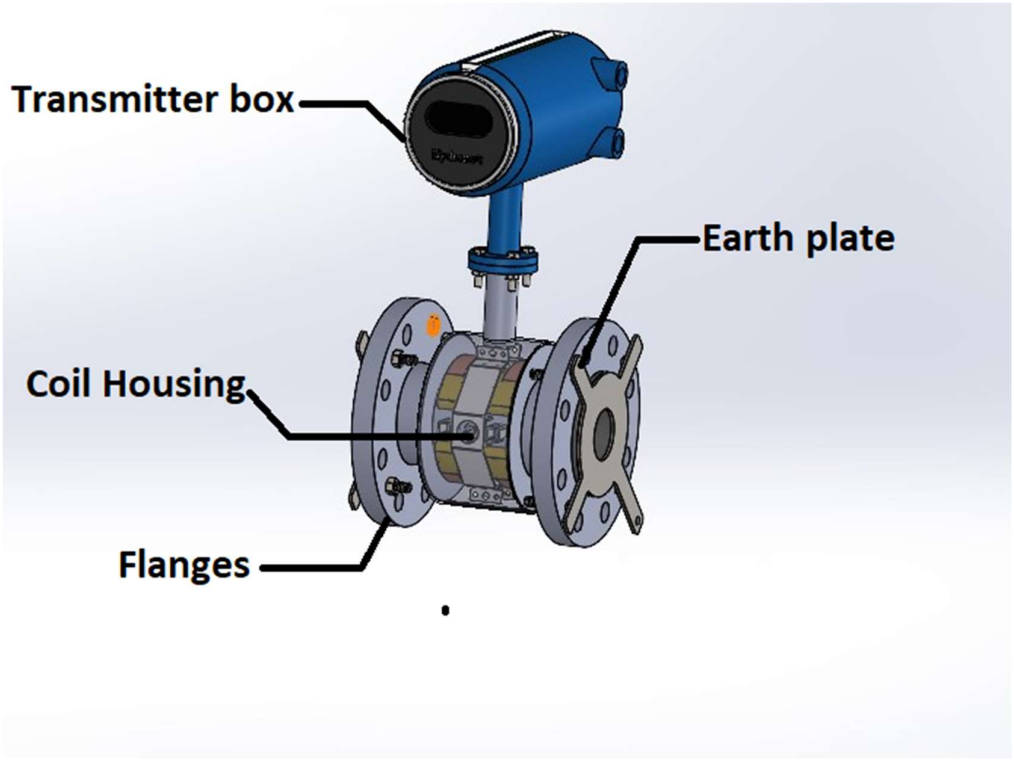
Working Principle

Faraday's law of principle

Faraday's law of electromagnetic induction (referred to as Faraday's law) is a basic law of electromagnetism predicting how a magnetic field will interact with an electric circuit to produce an electromotive force (EMF). This phenomenon is known as electromagnetic induction.

Principle Of operation

The operation of a magnetic Flow meter or Mag meter is based upon Faraday's law, which states that the voltage induced across any conductor as it moves at right angles through a magnetic field is proportional to the velocity of that conductor. Here water is the moving conductor. A uniform magnetic field is generated by two coils and forcing a constant current through the coil. The magnetic field is in a transverse direction to the flow of water. Since movement of water (corresponding to a moving conductor) generates an EMF transverse to the magnetic field and direction of flow. This EMF is picked up by three sensors which are then amplified by high sensitivity amplifiers. The amplified signal is then converted using high resolution ADC which is then sampled and digitally filtered using a digital signal processor to convert to flow readings.



Basic Working of the Hydromaster

The Digital Signal Processor core

The heart of the system is the DSP core which controls the entire working of the flow meter. A highly integrated and efficient SMPS is used to power the various building blocks of the unit. The SMPS and other power blocks are controlled by the PMU (Power management unit).

The core is responsible for pulsed DC timing, converting the amplified signal using high resolution ADC, digitally filtering the samples, and calculating flow velocity, rate flow and integrating total flow.

RTC (Real Time Clock / Calendar)

Time keeping is done by a RTC (Real time clock). This keeps a tab on time, date, and the calendar. Apart from keeping time the RTC helps the microcontroller in informing the main controller when it is time to save data into the internal memory.

Non-Volatile Memory

The internal memory blocks consist of a set of non-volatile modules capable of storing large amounts of data. This module is powered ON when required by the controller. Data stored can be retrieved using one of the three communications methods. Date / Time, Rate of Flow, Forward Total Flow, Reverse Total Flow, Status and Tamper Flags information are stored at programmed intervals into this unit.

Measurement

Hydromaster uses the pulsed DC measurement technique. Here the current through the coils is changed in direction every few time-intervals. This creates a pulsed magnetic field which changes in direction every few milli seconds. The induced EMF is measured by a reference electrode and two main electrodes. The signals are amplified using a instrumentation pump before feeding to the Analog to Digital Converter (ADC).

Multi point Calibration Feature

For higher accuracy and to preserve linearity across the flow range a multiple point calibration technique is used. It is possible to achieve +- 0.2% accuracy with this calibration technique. Instead of one flow calibration factor multiple calibration factors are used for different segments of flow rate.

User Interface

The Graphical LCD and the keys make the display and user interface mechanism. The keys can be used to display flow, change screens, change settings and the various other functions of the flow meter.

Interface to the outside World (Methods)

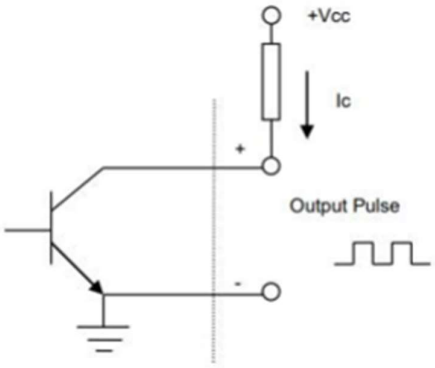
There are many methods of communicating the flow data to the external world. They are mentioned below.

Pulse Output

Consists of fixed pulses per liter or per m3 of flow passed in the line.

Equivalent Circuit for Pulse Output

The following is the equivalent circuit for the output stage of the pulse.



Recommended Pulse Output Interface Connections

Item	Value
Pulse output Type	Open Collector (NPN)
Maximum Pullup Voltage (+Vcc)	30 Volts
Minimum Pullup Voltage (+Vcc)	5 Volts
External Pullup Resistor Minimum	To be chosen so that current Ic does not exceed 20mA. See Note 1
External Pullup Resistor Maximum	To be chosen so that current Ic does not fall below 1mA. See Note 1
Over Voltage Protection	Not provided. See Note 2
Over Current Protection	Not provided. See Note 3

Note 1: Current Ic = (+Vcc – 0.3) / Pullup Resistor Value

Note 2: Voltage above the maximum pullup voltage will irreversibly damage the meter output.

Note 3: Pullup resistor selection that results in current above the maximum current will irreversibly damage the meter output.

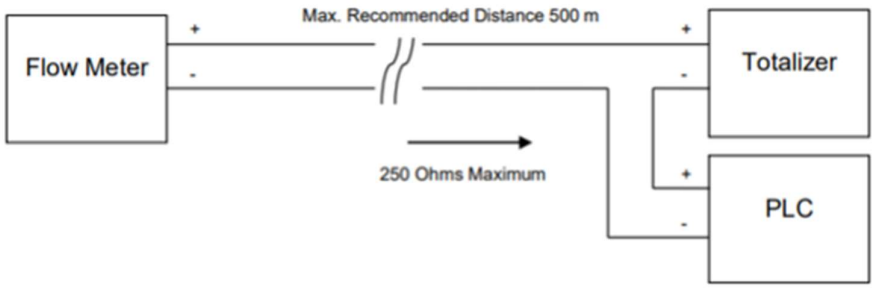
Line size in mm	Pulse Weight Settings in mL/Pulse Velocity: 5m/s Maximum		Pulse Weight Settings in mL/Pulse Velocity: 10m/s Maximum	
	Minimum*	Maximum	Minimum*	Maximum
15	1	65535	2	65535
20	2	65535	5	65535
25	3	65535	5	65535
32	5	65535	9	65535
40	7	65535	13	65535
50	10	65535	20	65535
80	26	65535	51	65535
100	40	65535	79	65535
125	62	65535	123	65535
150	89	65535	177	65535
200	157	65535	314	65535
250	246	65535	491	65535
300	354	65535	707	65535
400	628	65535	1256	65535
500	982	65535	1963	65535
750	2208	65535	4416	65535
1000	3925	65535	7850	65535
1200	5652	65535	11304	65535
1500	8832	65535	17663	65535

2000	15700	65535	31400	65535
3000	35325	65535	65535	65535

***Note:** Pulse Weight selection below the minimum values for a selected line size will give incorrect pulse output.

4-20mA output

The isolated 4-20mA output is proportional to the flow rate calculated inside the Hydromaster. This information is converted to an analog value by a Digital to Analog Converter (DAC) and then to 4-20mA by electronic circuit. Isolation ensures that ground paths between various systems do not destroy electronics.



Recommended Output Current settings for Various Line Sizes

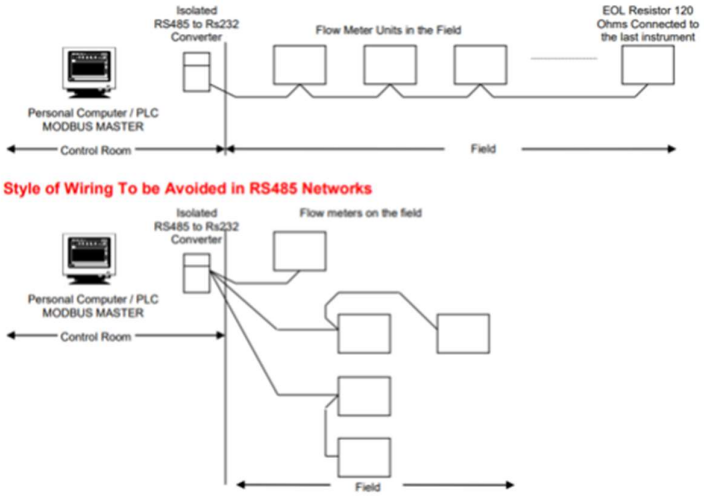
Line size in mm	Output Current Settings in m3/Hr Velocity: 2.5m/s Maximum		Output Current Settings in m3/Hr Velocity: 5m/s Maximum	
	4mA	20mA	4mA	20mA
25	0	4.4	0	8.8
32	0	7.2	0	14.4
40	0	11.3	0	22.6
50	0	17.6	0	35.2
65	0	29.8	0	59.7
80	0	45.2	0	90.4
100	0	70.6	0	141.3
125	0	110.4	0	220.8
150	0	159.0	0	318.0
200	0	282.6	0	565.2
250	0	441.5	0	883.0
300	0	635.8	0	1271.7
350	0	865.4	0	1731.0
400	0	1130.4	0	2260.8
450	0	1430.6	0	2861.3

500	0	1766.2	0	3532.5
750	0	3974.0	0	7948.0
1000	0	7065.0	0	14130.0
1200	0	10173.6	0	20347.0

RS485 Output (MODBUS)

Hydromaster comes with standard RS485 / MODBUS protocol to export data to the outside world. All information like rate flow, forward flow, reverse flow, programmable parameters and other host of information can be read from the flow meter. In addition to reading the parameters the programmable parameters can be remotely programmed using the RS485 interface. Here are the standard parameters that can be read and written.

Example of Correct Multidrop RS485 communication with PC/PLC as the master



MODBUS Registers Details

Address	Parameter	R/W
0000	Rate of Flow (Low Word)	R
0001	Rate of Flow (High Word)	R
0002	Total Flow Forward (Low word)	R
0003	Total Flow Forward (High Word)	R
0004	Total Flow reverse (Low Word)	R
0005	Total Flow reverse (High Word)	R
0006	Total Flow Forward Before Decimal Point (Low word)	R
0007	Total Flow Forward Before Decimal Point (High word)	R
0008	Total Flow Reverse Before Decimal Point (Low word)	R
0009	Total Flow Reverse Before Decimal Point (High word)	R
000A	Date 32(Low word)	R
000B	Date 32(High word)	R
000C	Reserved	R
000D	Reserved	R
000E	Batch Total Flow (Low word)	R

000F	Batch Total Flow (High word)	R
0190	Rate Flow Setpoint #1 Max	R/W
0193	Rate Flow Setpoint #1 Min	R/W
0195	Rate Flow Setpoint #2 Max	R/W
0197	Rate Flow Setpoint #2 Min	R/W
0199	Relay Mode #1	R/W
0201	Relay Mode #2	R/W
0203	4mA Value	R/W
0205	4mA Value	R/W
0207- 0225	Reserved	R/W
0226	System	R/W
0228	Log Interval	R/W
0230	Reserved	R/W
0232	Reserved	R/W
0234	Filter	R/W

Details of Batch Operation controlled through MODBUS communication.

To set a batch flow use the 10 functions. Write the total flow allowed in the batch to address 08.

Format

Value in Hex	Description
01	Slave ID
10	Function ID
00	Batch Total Flow Address High Byte
08	Batch Total Flow Address Low Byte
00	No of registers high
02	No of registers low
04	Byte count
aa	Batch Flow MSB of high Word
bb	Batch Flow LSB of High Word
cc	Batch Flow MSB of Low Word
dd	Batch Flow LSB of Low Word
CRCH	CRC High Byte
CRCL	CRC Low Byte

To Start the batch, send a 06 function to address 03fe shown below.

Where?
aa is the control word.,
aa = 1 (Start the batch),
aa = 2 (Stop the batch

Value in Hex	Description
01	Slave ID
06	Function ID
03	Batch Control Address High Byte
FE	Batch Control Address Low Byte

00	Control Word High
aa	Control Word Low
CRCH	CRC High Byte
CRCL	CRC Low Byte

Relay Outputs

Hydromaster can be shipped with a relay output which is programmable for batch operation or simple alarm operation based on rate flow. This is a useful mechanism for alerting the user for under flow / high flow and other alarms.

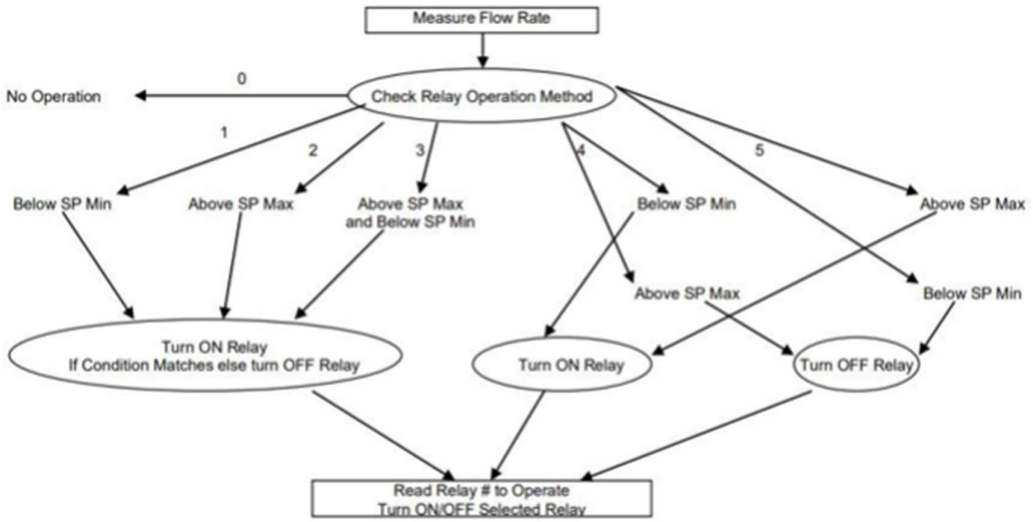
Set Point Relay Activation Mode

Value	Relay Operation
0	Not activated
1	Activate relay below Flow rate Setpoint Minimum
2	Activate relay above Flow rate Setpoint Maximum
3	Activate relay below Flow rate Setpoint and above Flow rate Setpoint Maximum
4	Activate Relay below Flow rate Setpoint Minimum. Deactivate Relay after Flow rate Setpoint Maximum
5	Activate Relay above Flow rate Setpoint Maximum. Deactivate Relay below Flow rate Setpoint Minimum
6	Batch Mode Operation

Batch Mode Operation

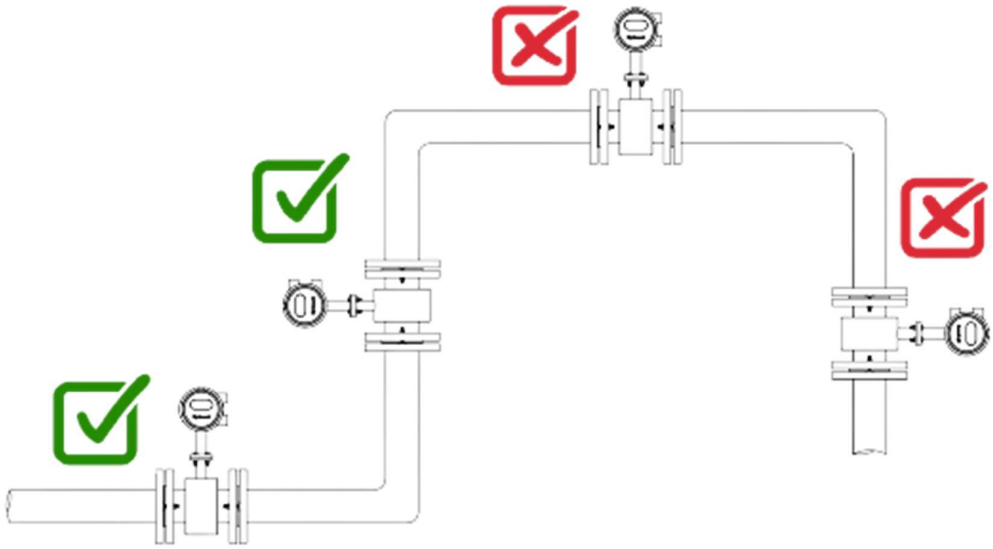
Batch mode operation can be controlled both from the keys provided or from RS485 communication interface. Batch mode operation allows you to Preset a batch volume and start the batch. Relay is ON as soon as the batch is started. Relay is OFF when the batch volume is complete. This relay can be used to switch ON/OFF pumps or valves to control the amount of water.

Block Diagram of Relay Operation for Setpoint

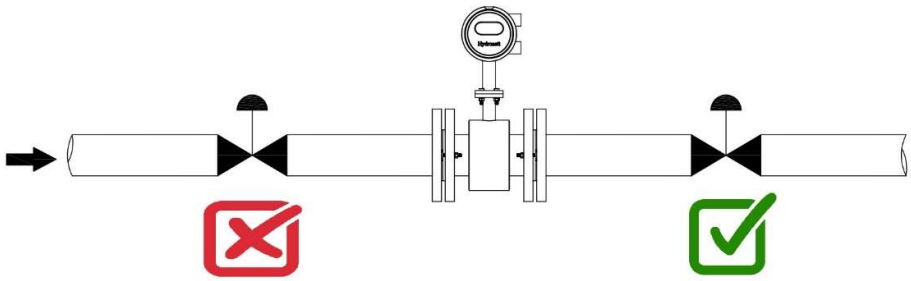


Installation Procedure

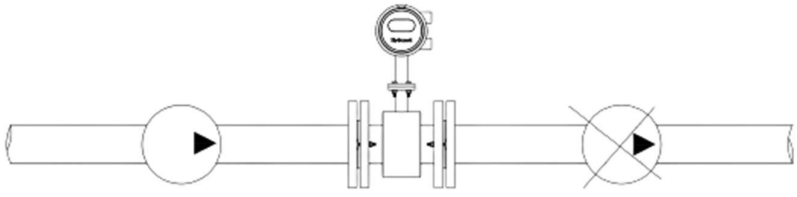
Preferably install the sensor in an ascending pipe and ensure a sufficient distance to the next pipe.
elbow: h ≥ 2 × DN.



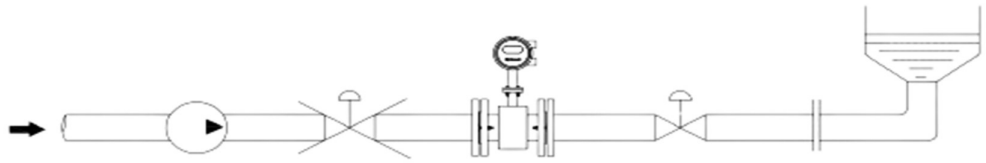
Installation of the sensor after a control valve is not recommended.



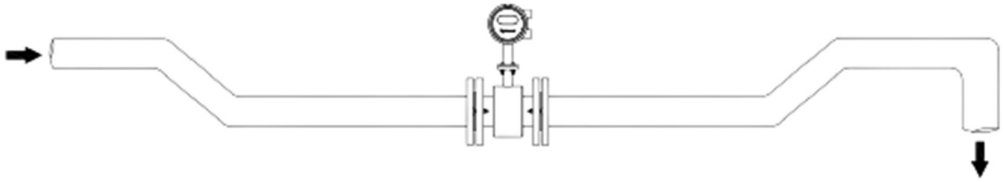
The electromagnetic flowmeter cannot be installed on the suction side of the pump.



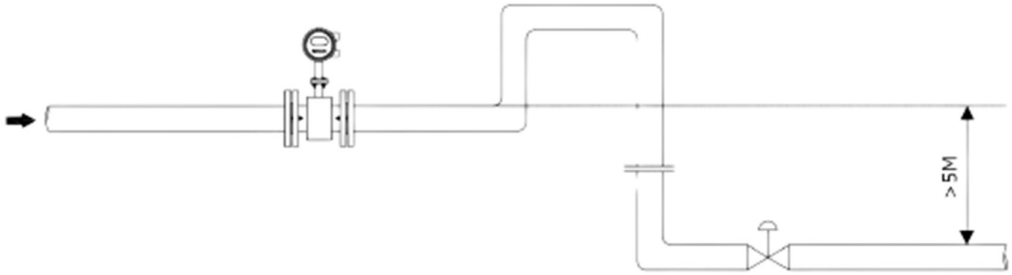
For long pipelines, control valves are generally installed on the downstream of the electromagnetic flowmeter.



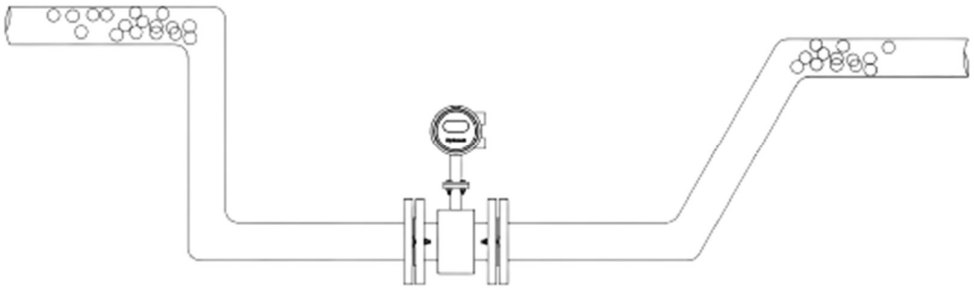
For pipes with open discharges, the electromagnetic flowmeter shall be installed at the bottom section (lower part of the pipe)



For places where fall head of pipes is over 5 m, the air valve shall be installed on the downstream of the electromagnetic flowmeter.



No bubbles shall be observed in the pipe.

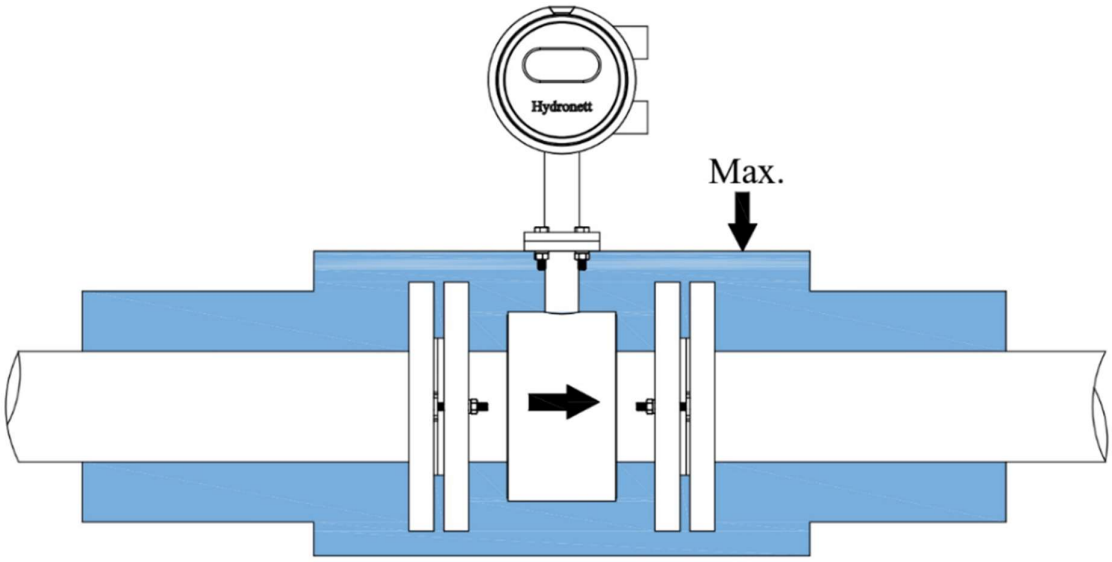


Thermal Insulation

If process fluids are very hot, it is necessary to insulate pipes in order to reduce energy loss and to prevent individuals from accidentally coming in contact with hot pipes. Please observe the applicable standards and guidelines for insulating pipes.

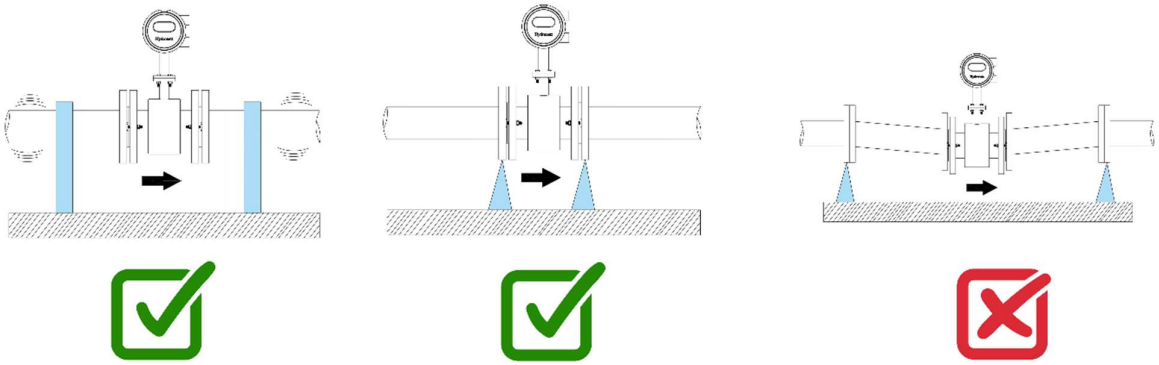
Electronics overheating on account of thermal insulation!

▶ The housing support is used for heat dissipation and must be completely free (i.e., uncovered). At the very maximum, the sensor insulation may extend as far as the upper edge of the two sensor half-shells.



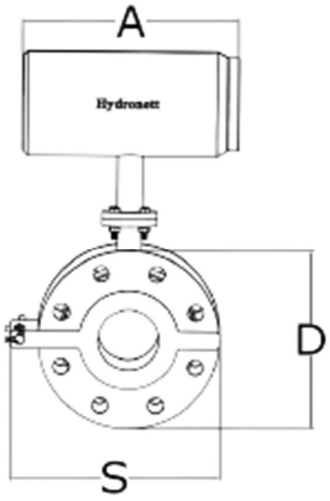
Vibrations

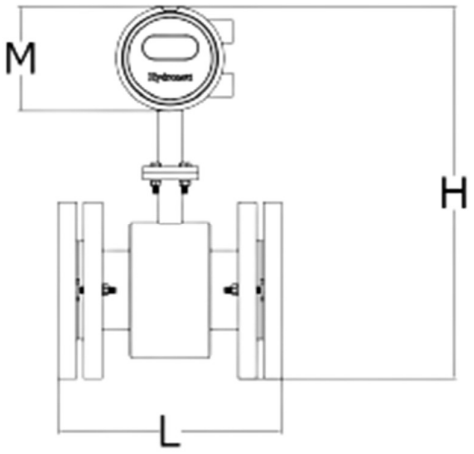
In the event of very strong vibrations, the pipe and sensor must be supported and fixed. It is also advisable to mount the sensor and transmitter separately.



Sizing charts and Dimensions

Field Mount Type

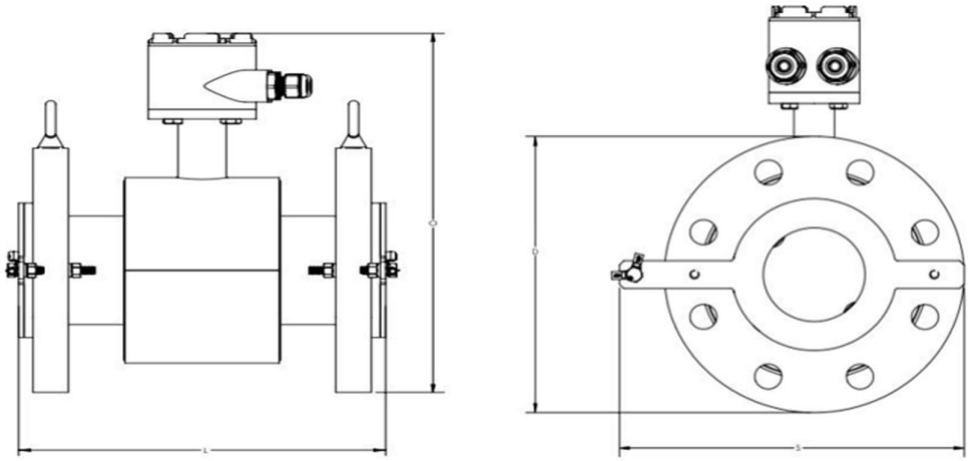




SL NO	MODEL ID	SCHEDULE	LINING	DN	PRESSURE NOMINAL	LENGTH L	OUTER DIAMETER D	TOTAL HEIGHT H	TRANSMITTER BOX LENGTH A	TRANSMITTER BOX HEIGHT M	EARTH PLATE LENGTH S
1	Hydro Master 50 Series	10	Ptfe /Rubber	50	PN6/PN 10/PN 16/PN 20/PN 25/ PN 40	206	165	387	238	120	195
2	Hydro Master 80 Series	10 & 40	Ptfe /Rubber	80	PN6/PN 10/PN 16/PN 20/PN 25/ PN 40	206	200	426	238	120	230
3	Hydro Master 100 Series	10 & 40	Ptfe /Rubber	100	PN6/PN 10/PN 16/PN 20/PN 25/ PN 40	258	220	449	238	120	264
4	Hydro Master 150 Series	10 & 40	Ptfe /Rubber	150	PN6/PN 10/PN 16/PN 20/PN 25/ PN 40	309	285	480	238	120	320
5	Hydro Master 200 Series	10 & 40	Ptfe /Rubber	200	PN6/PN 10/PN 16/PN 20/PN 25/ PN 40	356	340	595	238	120	393
6	Hydro Master 250 Series	10 & 40	Ptfe /Rubber	250	PN6/PN 10/PN 16/PN 20/PN 25/ PN 40	456	405	635	238	120	420

7	Hydro Master 300 Series	10 ,40 & STD	Ptfe /Rubber	300	PN6/PN 10/PN 16/PN 20/PN 25/ PN 40	506	460	685	238	120	505
8	Hydro Master 350 Series	10 ,40 & STD	Ptfe /Rubber	350	PN6/PN 10/PN 16/PN 20/PN 25/ PN 40	506	520	735	238	120	560
9	Hydro Master 400 Series	10 ,40 & STD	Ptfe /Rubber	400	PN6/PN 10/PN 16/PN 20/PN 25/ PN 40	606	580	790	238	120	605
10	Hydro Master 500 Series	10 ,40 & STD	Ptfe /Rubber	500	PN6/PN 10/PN 16/PN 20/PN 25/ PN 40	806	715	915	238	120	730
11	Hydro Master 600 Series	10 ,40 & STD	Ptfe /Rubber	600	PN6/PN 10/PN 16/PN 20/PN 25/ PN 40	806	840	950	238	120	855

Remote Type



SL NO	MODEL ID	SCHEDULE	LINING	DN	PRESSURE NOMINAL	LENGTH	OUTER DIAMETER D	TOTAL HEIGHT H	TRANSMITTER BOX OD	TRANSMITTER BOX HEIGHT G	EARTH PLATE LENGTH S
1	Hydro Master 50 Series	10	Ptfe /Rubber	50	PN6/PN 10/PN 16/PN 20/PN 25/ PN 40	206	165	260	61	64	195
2	Hydro Master 80 Series	10 & 40	Ptfe /Rubber	80	PN6/PN 10/PN 16/PN 20/PN	206	200	294	61	64	230

					25/ PN 40						
3	Hydro Master 100 Series	10 & 40	Ptfe /Rubber	100	PN6/PN 10/PN 16/PN 20/PN 25/ PN 40	258	220	333	61	64	264
4	Hydro Master 150 Series	10 & 40	Ptfe /Rubber	150	PN6/PN 10/PN 16/PN 20/PN 25/ PN 40	309	285	394	61	64	320
5	Hydro Master 200 Series	10 & 40	Ptfe /Rubber	200	PN6/PN 10/PN 16/PN 20/PN 25/ PN 40	356	340	365	61	64	393
6	Hydro Master 250 Series	10 & 40	Ptfe /Rubber	250	PN6/PN 10/PN 16/PN 20/PN 25/ PN 40	456	405	496	61	64	420
7	Hydro Master 300 Series	10 ,40 & STD	Ptfe /Rubber	300	PN6/PN 10/PN 16/PN 20/PN 25/ PN 40	506	460	551	61	64	505
8	Hydro Master 350 Series	10 ,40 & STD	Ptfe /Rubber	350	PN6/PN 10/PN 16/PN 20/PN 25/ PN 40	506	520	557	61	64	560
9	Hydro Master 400 Series	10 ,40 & STD	Ptfe /Rubber	400	PN6/PN 10/PN 16/PN 20/PN 25/ PN 40	606	580	609	61	64	605
10	Hydro Master 500 Series	10 ,40 & STD	Ptfe /Rubber	500	PN6/PN 10/PN 16/PN 20/PN 25/ PN 40	806	715	733	61	64	730
11	Hydro Master 600 Series	10 ,40 & STD	Ptfe /Rubber	600	PN6/PN 10/PN 16/PN 20/PN 25/ PN 40	806	840	840	61	64	855

Applications

- Boiler Feed Water
- Chilled & Cooling Water
- Effluents
- Sewage flow with high level of solids
- Paper Waste
- Sludges and Slurries
- Food Applications

Industries we served.

- Water & Wastewater
- Food & Beverage
- Pulp & Paper
- Environmental & Municipal
- Mining
- Petroleum & Chemical

Product Certification

All our Electromagnetic flow meters are calibrated in our NABL approved in-house lab facility.

OIML –R49 certifications
ISO 4064