VorTek Series Pro-M
Electromagnetic Flow Meters

Instruction Manual

M-000-00100

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Hardware

1. General Information

This manual will assist you in installing, using, and maintaining the Pro-M Electromagnetic Flow Meter. It is your responsibility to make sure that all operators have access to adequate instructions about safe operating and maintenance procedures.

WARNING

For your safety, review the major warnings and cautions before operating your equipment.

1. Use only fluids that are compatible with the housing material and wetted components of your flow meter.
2. When handling hazardous liquids, always exercise appropriate safety precautions.
3. When measuring flammable liquids, observe precautions against fire or explosion.
4. When working in hazardous environments, always exercise appropriate safety precautions.
5. Handle the sensor carefully. Even small scratches or nicks can affect accuracy.
6. For best results, calibrate the meter at least once per year.
7. Do not purge the flow meter with compressed air.
8. During flow meter removal, liquid may spill. Follow the manufacturer's safety precautions for clean-up of minor spills.

1.1 Product Description

Electromagnetic flow meters are intended for fluid measurement in most industries including water, wastewater, food and beverage, pharmaceutical, petroleum, slurry/pulp, and chemical.

There are two basic components of the Pro-M Electromagnetic Flow Meter: 1) The Detector, which includes the flow tube, isolating liner, and measuring electrodes, and 2) The Converter, which is the electronic device responsible for signal processing, flow calculation, display, and output signals.

The materials of construction of the wetted parts (liner and electrodes) should be appropriate for the specifications on the intended type of service. Review of the compatibilities consistent with the specifications is recommended.

The Pro-M Electromagnetic Flow Meter is factory tested and calibrated. A calibration certificate is included in the shipment of each meter.

1.2 Product Features

- Measurement is not affected by changes in fluid density, viscosity, temperature, pressure, or conductivity.
- There is no obstruction component in the measuring tube, no pressure loss, and reduced straight run requirements. It has unique adaptability to slurry measurement.
- It has good corrosion and wear resistance when suitable electrodes and lining materials are chosen.
- It has fully digital processing, strong anti-interference ability, reliable measurement, high precision, and a wide flow range.
- It has digital communication signal output options including RS485, RS232, Hart and Modbus Profibus-DP.
- It has self-test and self-diagnostic functions.

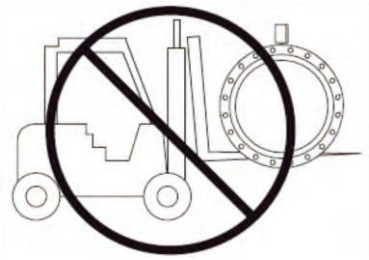
1.3 Unpacking and Inspection

Upon receipt, examine the flow meter for visible damage. The meter is a precision measuring instrument and should be handled carefully. Remove the protective plugs and caps for a thorough inspection. If any items are damaged or missing, contact us.

Make sure the flow meter model meets your specific needs. For future reference, it might be useful to record this information on the nameplate in the manual in case it becomes unreadable on the meter.

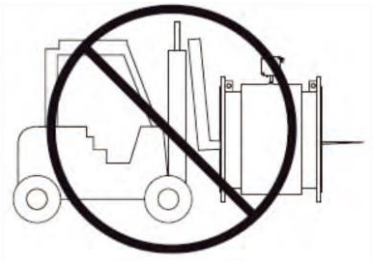
Transportation and Handling

Do not lift the Detector from the Converter housing, the junction box, or the connecting cable. We recommend using lifting lugs for larger sizes. Very large meter sizes are packed and crated with the meter laying on its side for shipping safety and stability reasons. To lift the meter in a vertical position, it is recommended to use a sling rigged method, as shown below.



WARNING: Never introduce the forklift, chains, wire stings, or any other sharp object inside the flow tube for lifting or handling purposes. This could permanently damage the isolating liner and could render the meter inoperable

If using a forklift, do not lift the detector from its body between the flanges. The housing could be accidentally dented, and permanent damage could be caused to the internal coil assemblies.



2. Technical Data

2.1 Measuring System

Measuring Principle	Faraday's Law
Application range	Electrically conductive fluids
Measured Value	
Primary measured value	Flow velocity
Secondary measured value	Volume flow

2.2 Design

Features	Fully welded maintenance-free sensor
	Flanged version with full bore flow tube
	Standard as well as higher pressure ratings
	Large diameter range from DN25 – DN3000 with rugged liners approved for drinking water
Modular Construction	The measurement system consists of a flow sensor and a signal converter. It is available as a compact and as a remote version.
Compact Version	With 511B converter: 110-240V AC Power
	With 521B converter: 18-36V DC Power
	With W800L/W800W: Battery Power
Remote Version	In wall mount version with 211B converted (110-240V AC) or 221B converter (18-36V DC)
	With W800F converter: Battery Power
Measurement Range	0.3 – 10 m/s

2.3 Measuring Conditions

Reference Conditions	Flow conditions similar to EN 29104
	Medium: Water
	Electrical conductivity: ≥ 20 µS/cm
	Temperature: +10 - +50 °C (+50 - +120 °F)
	Inlet section: ≥ 5DN
	Operating pressure: 1 bar (14.5 psig)
Flow Meter Accuracy	Standard: ±0.5% of rate
	Optional: ±0.2% of rate

2.4 Operating Conditions

Temperature	
Process Temperature	Hard rubber liner: -5 - +60°C or 90°C
	Polypropylene liner: -5 - +90°C
	PTFE liner: -5 - +120°C; PFA: 180°C
Ambient Temperature (all versions)	Standard (with aluminum converter housing)
	-20 - +60°C (Protect electronics against self-heating with ambient temperatures above 55°C)
Storage Temperature	-20 - +70°C
Pressure	
EN 1092-1	DN2200 – DN3000: PN2.5
	DN1200 – DN2000: PN6
	DN200 – DN1000: PN10
	DN65 – DN150: PN16
	DN10 – DN50: PN40
	Other pressures on request
ASME B16.5	½" – 8": 150 lb RF
	Other pressures on request
JIS	½" – 8": 10K
	Other pressures on request
Pressure Drop	Negligible
Fluid	
Physical condition	Conductive liquids
Electrical conductivity	≥ 20µS/cm
Permissible gas content (volume)	≤ 5%
Permissible solid content (volume)	≤ 30%

2.5 Installation Conditions

Installation	Take care that the flow tube is always fully filled
	For detailed information, see chapter "Cautions for Installation"
Flow Direction	Forward and reverse
	Arrow on flow sensor indicates positive flow direction
Inlet Run	≥ 5 DN
Outlet Run	≥ 2 DN

2.6 Materials

Sensor Housing	Sheet Steel, Polyurethane Coated
	Other materials on request
Measuring Tube	Austenitic Stainless Steel
Flanges	Carbon Steel: Polyurethane Coated
	Other materials on request
Liner	Standard
	DN10 – DN40: PTFE
	DN50 – DN300: PTFE or Hard Rubber
	DN300 – DN2200: Hard Rubber or PTFE Option
Connection Box (only remote versions)	Standard: Polyurethane Coated Die-cast Aluminum
Measuring Electrodes	Standard: Stainless Steel 316L
	Option: Hastelloy C, Titanium, Tantalum
	Other materials on request
Grounding Rings	Standard: Stainless Steel
Grounding Electrodes (option)	Same material as measuring electrodes

2.7 Flow Range

Diameter		**Flow Rate (m^3/h)**		
		V = 0.3 m/s	V = 6 m/s	V = 10 m/s
(mm)	(inch)	(Min)	(Calibrated)	(Max)
6	1/4	0.0306	0.611	1.018
10	3/8	0.0849	1.696	2.827
15	1/2	0.1909	3.817	6.362
20	3/4	0.3393	6.786	11.31
25	1	0.5301	10.60	17.67
32	1-1/4	0.8686	17.37	28.95
40	1-1/2	1.357	27.14	45.24
50	2	2.121	42.14	70.69
65	2-1/2	3.584	71.68	119.5
80	3	5.429	108.6	181.0
100	4	8.482	169.6	282.7
125	5	13.25	265.1	441.8
150	6	19.09	381.7	636.2
200	8	33.93	678.6	1131
250	10	53.01	1060	1767
300	12	76.34	1527	2545
350	14	103.9	2078	3465
400	16	135.7	2714	4524

450	18	171.8	3435	5726
500	20	212.1	4241	7069
600	24	305.4	6107	10179
700	28	415.6	8310	13850
800	32	542.9	10860	18100
900	36	662.8	13740	22900
1000	40	848.2	16962	28270

3. Model Selection

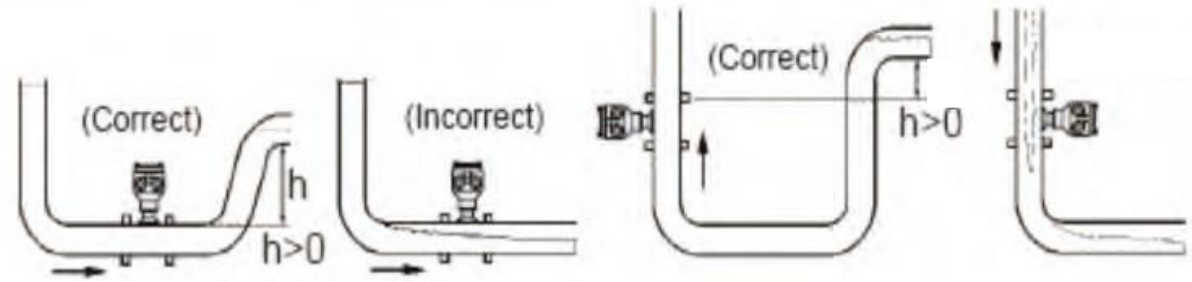
Pro-M Model Number Information						
Model	1	Volumetric Flow Model				
	2	Energy Model (Must select RTD option or provide your own)				
Accuracy	1	Standard Accuracy: ± 0.5% of Rate				
	2	High Accuracy: ± 0.2% of Rate				
Flow Body	04	64	1/2-inch Nominal Bore (15mm)	8-inch Nominal Bore (200mm)		
	06	80	3/4-inch Nominal Bore (20mm)	10-inch Nominal Bore (250mm)		
	08	96	1-inch Nominal Bore (25mm)	12-inch Nominal Bore (300mm)		
	12	112	1.5-inch Nominal Bore (40mm)	14-inch Nominal Bore (350mm)		
	16	128	2-inch Nominal Bore (50mm)	16-inch Nominal Bore (400 mm)		
	24	144	3-inch Nominal Bore (80mm)	18-inch Nominal Bore (450 mm)		
	32	160	4-inch Nominal Bore (100mm)	20-inch Nominal Bore (500mm)		
	48	192	6-inch Nominal Bore (150mm)	24-inch Nominal Bore (600mm)		
	***		Consult factory for meters larger than 24”			
Meter Body Material	C	Carbon Steel				
	S	304 Stainless Steel				
Process Connection	150	ANSI 150# Flange				
Electronics Enclosure	L	NEMA 4X IP68 Enclosure				
	R1	Remote Electronics, IP68 Body, IP65 Transmitter, 10 meters				
	R2	Remote Electronics, IP68 Body, IP65 Transmitter, 15 meters				
	R3	Remote Electronics, IP68 Body, IP65 Transmitter, 20 meters				
	R4	Remote Electronics, IP68 Body, IP65 Transmitter, 25 meters				
	R5	Remote Electronics, IP68 Body, IP65 Transmitter, 30 meters				
Power Supply	AC	110-240 VAC				
	DC	20-36 VDC				
Communications	1	Analog Output (One), Pulse				
	2	Analog Output (One), Pulse, Modbus RTU (RS485)				
	3	Analog Output (One), Pulse, HART (HART communications are unregistered)				
Electrode Material	S	316L Stainless Steel				
	T	Titanium				
	L	Tantalum				
	H	Hastelloy C				
	P	Platinum-Iridium				
Liner Material	R	Rubber				
	P	Polyurethane				
	T	PTFE				
	F	PFA				
Grounding	1	Grounding Ring				
	2	Grounding Electrode				
Options & Accessories	CRTD	Clamp-On RTDs (Two), (Must select “Energy Model” in Feature 1)				
	IRTD	Insertion RTDs (Two), (Must select “Energy Model” in Feature 1)				

* HART communications are unregistered

4. Installation Cautions

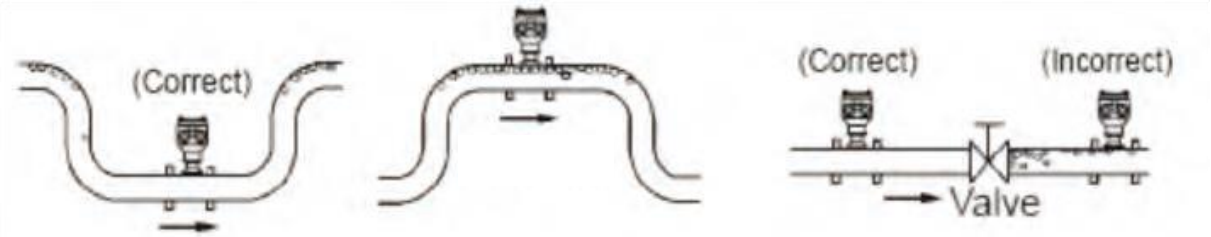
4.1 Mounting Positions

It is essential that pipes remain fully always filled with liquid. Otherwise, flow rate indications may be affected, and measurement errors can occur.



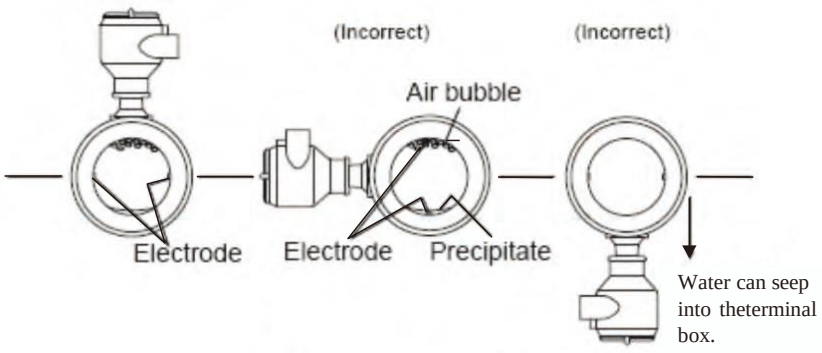
Mounting Positions

If any air bubbles are present in the pipe, flow rate indications may be affected, and measurement errors can occur.



Avoiding Air Bubbles

If the electrodes are vertical to the ground, air bubbles near the top or solids near the bottom may cause measurement error. Ensure that the terminal box is mounted above the piping to prevent water from entering the electronics.



Mounting Orientation

Avoid all pipe locations where the flow is pulsating, such as the outlet side of piston or diaphragm pumps.

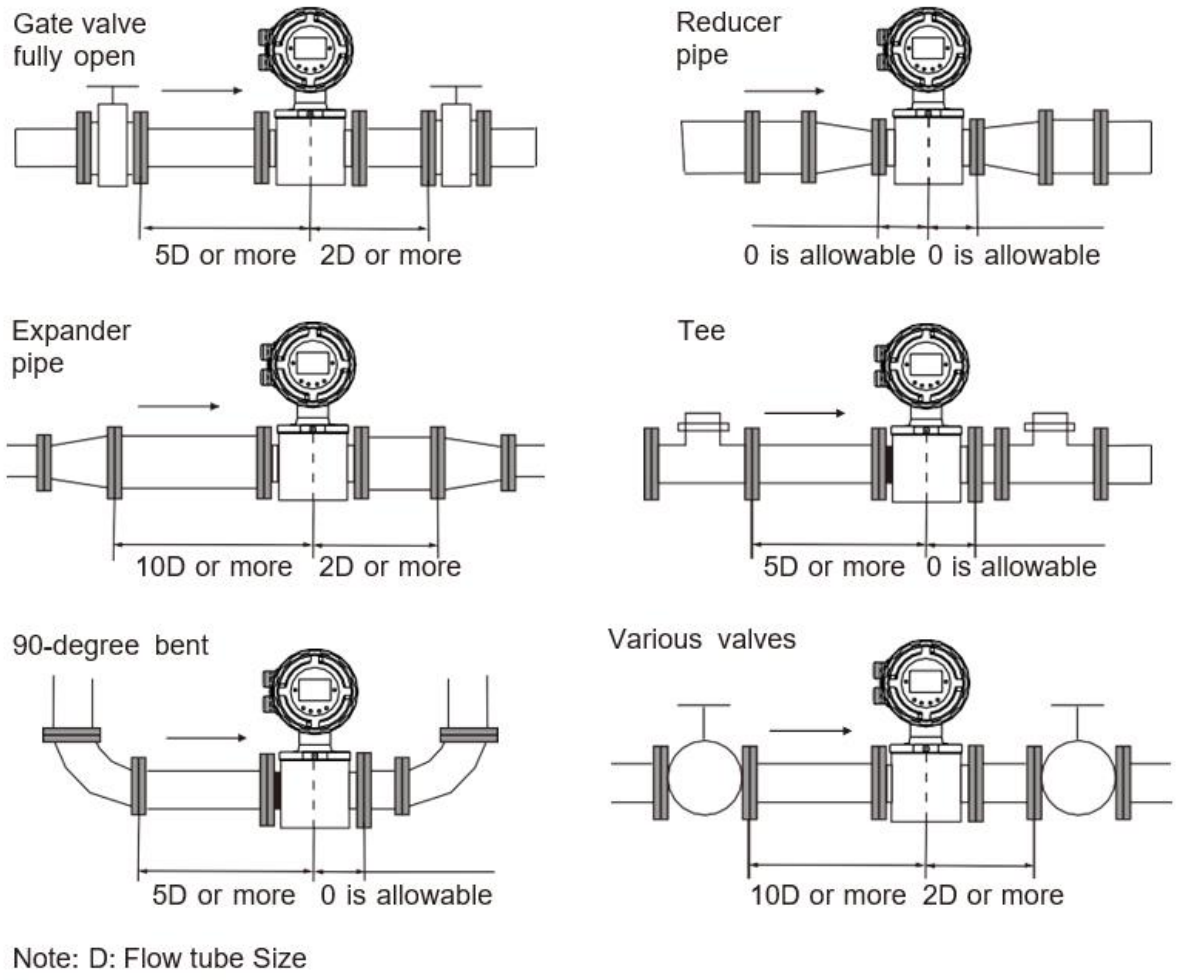
Avoid pipe locations near equipment producing electrical interference such as electric motors, transformers, variable frequency, etc.

Install the meter with enough room for future access for maintenance purposes.

The meter's liner, whether it is PTFE or rubber, is not intended to be used as a gasket. Standard gaskets (not provided) should be installed to ensure a proper hydraulic seal. When installing the gaskets, make sure they are properly centered to avoid flow restriction or turbulence. Do not use graphite or any electrically conductive sealing compound to hold the gaskets in place during installation. This could affect the reading accuracy of the measuring signal.

4.2 Straight Run Requirements

For optimum accuracy performance, sufficient inlet and outlet straight pipe runs are required. An equivalent to 3 diameters of straight pipe is required on the inlet side, and 2 diameters on the outlet side. There are no special requirements for standard concentric pipe reducers. See Diagram 2 for required straight runs when there is an altering device.



Required straight runs

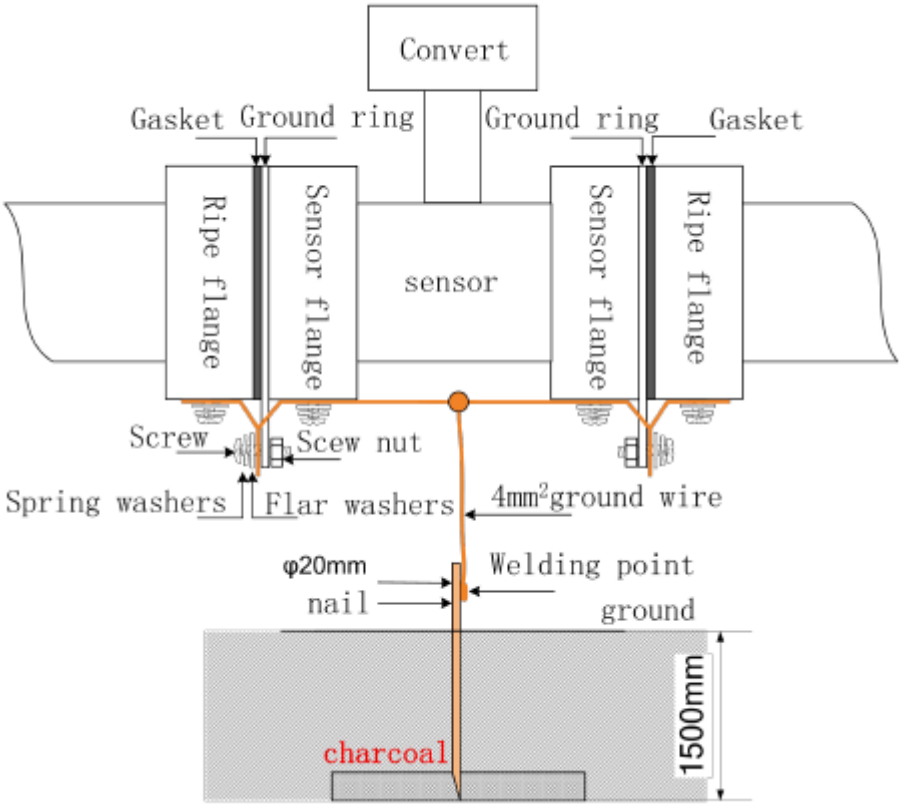
4.3 Grounding

In this section, the term “grounding” will be defined as: the arrangement of process wetted metal materials (piping, ground rings, and ground electrodes), cabling (ground straps and ground wires), and connections to stable references (often, but not always earth ground) required to achieve satisfactory operation of a magnetic flowmeter. As such, it applies to the instrumentation aspect of grounding, rather than to “safety grounding”.

Proper installation and grounding of magnetic flowmeters is important for accurate, reliable measurement performance. Stray AC or DC currents through the fluid or instrument can produce noise signals that may, in turn, interfere with the relatively low flow signals generated in today’s modern pulsed DC mag meter.

Manufacturers provide a variety of elements (ground straps, ground electrodes, and ground rings) and directions for the standard grounding of the mag meter.

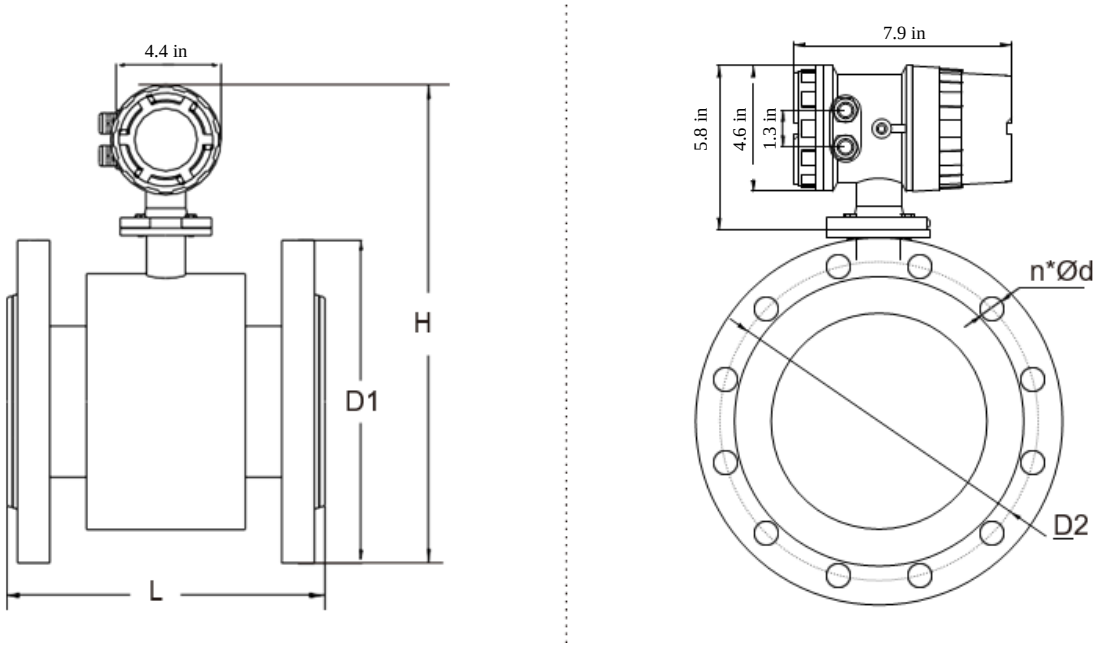
Applications exist in which the user cannot or should not make use of the traditional grounding connection to adjacent piping or to earth ground. These flow measurement applications are frequently encountered in electrolytic processes. In this case, the fluid passing through the mag meter flow tube may be at a potential significantly higher or lower than earth ground, and connection to earth ground may be detrimental to the performance and even the reliability of the mag meter. These applications are typically compounded by the use of non-conductive or lined pipe and may feature acid or caustic flow, which may necessitate the use of expensive wetted electrodes and grounding materials such as titanium, platinum, or tantalum. Grounding wiring can be seen below.



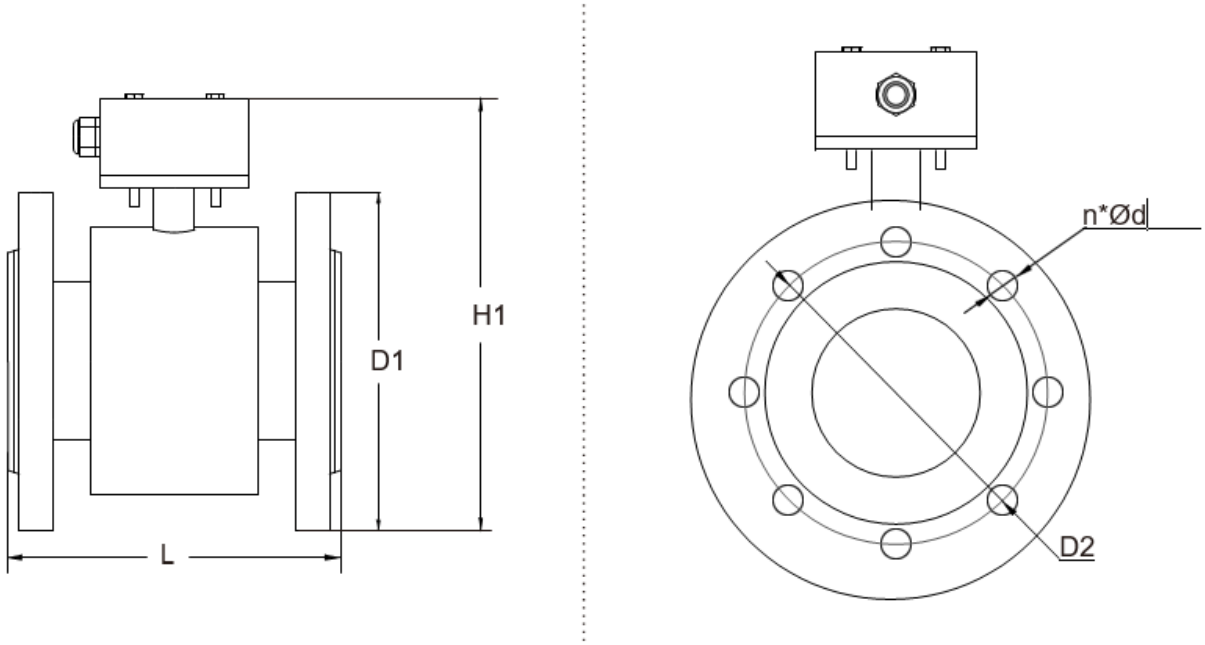
4.4 Connections

Use a gasket between the meter flange and mating flange. Determine the material of the gasket based on the operating conditions and type of fluid.

Note: Do not over tighten the flange bolts. This may cause the gasket to be compressed into the flow stream and may decrease the accuracy of the meter.



Drawings of Compact Electromagnetic Flowmeter



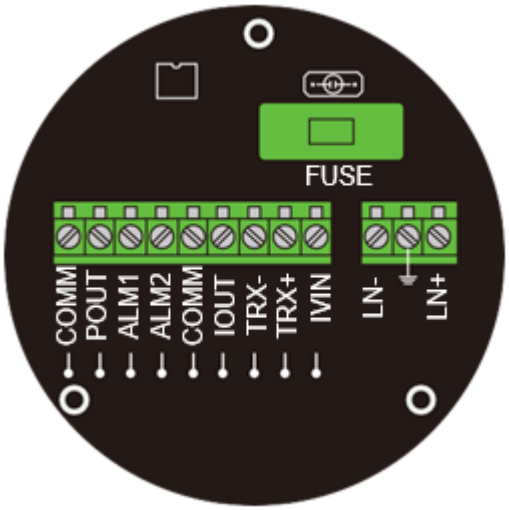
Drawings of Remote Electromagnetic Flow Meter

Size	L	H	H1	D1	D2	n*Ød
½ inch (15 mm)	7.9 inch (200 mm)	11.8 inch (300 mm)	8.9 inch (227 mm)	3.5 inch (88.9 mm)	2.4 inch (60.45 mm)	4 x 0.62 in
¾ inch (20 mm)	7.9 inch (200 mm)	12.2 inch (310 mm)	9.5 inch (240 mm)	3.9 inch (98.6 mm)	2.8 inch (69.85 mm)	4 x 0.62 in
1 inch (25 mm)	7.9 inch (200 mm)	12.6 inch (320 mm)	9.6 inch (243 mm)	4.3 inch (108 mm)	3.1 inch (79.25 mm)	4 x 0.62 in
1 ¼ inch (32 mm)	7.9 inch (200 mm)	13.6 inch (345 mm)	10 inch (253 mm)	4.6 inch (117.3 mm)	3.5 inch (88.9 mm)	4 x 0.62 in
1 ½ inch (40 mm)	7.9 inch (200 mm)	14.0 inch (355 mm)	10.2 inch (260 mm)	5 inch (127 mm)	3.9 inch (98.6 mm)	4 x 0.62 in
2 inch (50 mm)	7.9 inch (200 mm)	14.6 inch (370 mm)	10.8 inch (275 mm)	6 inch (152.4 mm)	4.8 inch (120.7 mm)	4 x 0.75 in
2.5 inch (65 mm)	9.8 inch (250 mm)	15.4 inch (390 mm)	11.4 inch (290 mm)	7 inch (177.8 mm)	5.5 inch (139.7 mm)	4 x 0.75 in
3 inch (80 mm)	9.8 inch (250 mm)	16.0 inch (405 mm)	12.2 inch (310 mm)	7.5 inch (190.5 mm)	6 inch (152.4 mm)	4 x 0.75 in
4 inch (100 mm)	9.8 inch (250 mm)	16.7 inch (425 mm)	13 inch (330 mm)	9 inch (228.6 mm)	7.5 inch (190.5 mm)	8 x 0.75 in
5 inch (125 mm)	9.8 inch (250 mm)	17.9 inch (455 mm)	14.6 inch (370 mm)	10 inch (254 mm)	8.5 inch (215.9 mm)	8 x 0.88 in
6 inch (150 mm)	11.8 inch (300 mm)	19.3 inch (490 mm)	15.6 inch (395 mm)	11 inch (279.4 mm)	9.5 inch (241.3 mm)	8 x 0.88 in
8 inch (200 mm)	13.8 inch (350 mm)	22.2 inch (565 mm)	19.1 inch (485 mm)	13.5 inch (342.9 mm)	11.8 inch (298.5 mm)	8 x 0.88 in
10 inch (250 mm)	17.7 inch (450 mm)	23.6 inch (600 mm)	19.7 inch (500 mm)	16 inch (406.4 mm)	14.3 inch (362 mm)	12 x 1 inch
12 inch (300 mm)	19.7 inch (500 mm)	25.6 inch (650 mm)	21.7 inch (550 mm)	19 inch (482.6 mm)	17 inch (431.8 mm)	12 x 1 inch

5. Electrical Wiring

5.1 Terminal Configuration Diagram

5.1.1 Compact Converter (110-240V AC; 18-24V DC)

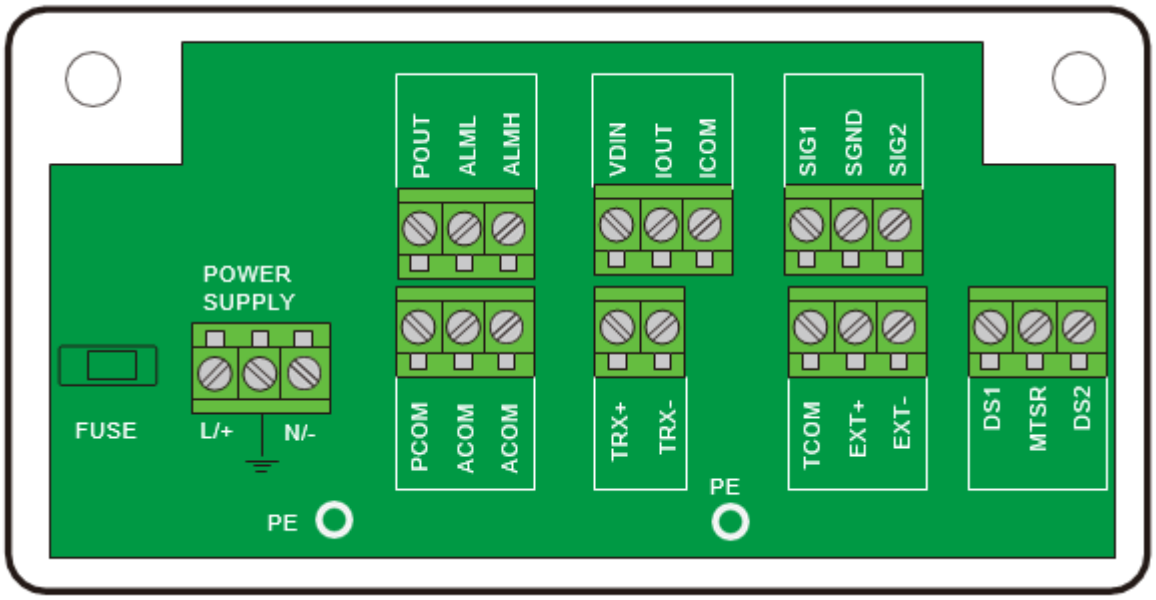


Terminal Configuration

COMM	Frequency, Pulse, and Current Common (GND)
POUT	Frequency (Pulse) Output for Bi-directional Flow
ALM1	Alarm Output for Upper Limit
ALM2	Alarm Output for Lower Limit
COMM	Frequency, Pulse, and Current Common (GND)
IOUT	Current Output of Flow Rate
TRX-	- Communication RS485(-)
TRX+	+ Communication RS485(+)
IVIN	24V DC Power Supply for 2-wire 4-20mA Output
LN-	N: Naught Wire of 110-240V AC; -24V DC Power Supply
LN+	L: Live Wire of 110-240V AC; +24V DC Power Supply

Note: Don’t connect 110-240V AC Power on 521B converter, which is DC Power Supply Type.

5.1.2 Remote Converter (110-240V AC; 18-24V DC)



Terminal Configuration

PCOM	Pulse Output Ground
POUT	Frequency (Pulse) Output for Bi-Directional Flow
ACOM	Alarm Output Ground
ALML	Alarm Output for Lower Limit
ACOM	Alarm Output Ground
ALMH	Alarm Output for Upper Limit
TRX+	Communication RS485 +
VDIN	24VDC Power Supply for 2-wire 4-20 mA Output
TRX-	Communication RS485 -
IOUT	Analog Current Output
ICOM	Analog Current Output Ground
TCOM	Reserved
SIG1	Signal 1
EXT+	Exciting Current +
SGND	Signal Ground
EXT-	Exciting Current -
SIG2	Signal 2
DS1	Shielded Exciting 1
MTSR	Reserved
DS2	Shielded Exciting 2

Note: Don’t connect 110-240V AC Power on 221B converted, which is DC Power Supply Type.

6. Description of Outputs

6.1 Digital Frequency Output

Frequency Output Range	1 to 5000 Hz
Output Electric Isolate	Photoelectric Isolate > 1000V
Frequency Output Capacity	Field-effect Transistors Output Maximum Voltage: 36V DC Maximum Current: 250 mA

6.2 Digital Pulse Output

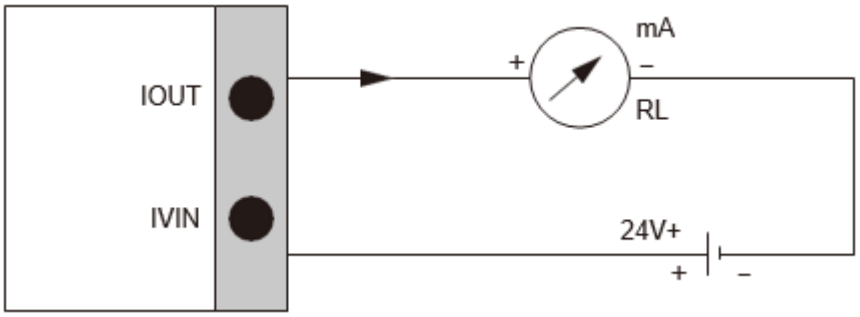
Pulse Output Range	1 to 100 pulses/sec
Pulse Output Value	0.001 – 1.000 m^3/cp; 0.001 – 1.000 liter/cp
Pulse Output Capacity	Field-effect Transistors Output Maximum Voltage: 36 V DC Maximum Current: 250 mA

6.3 Alarm Output

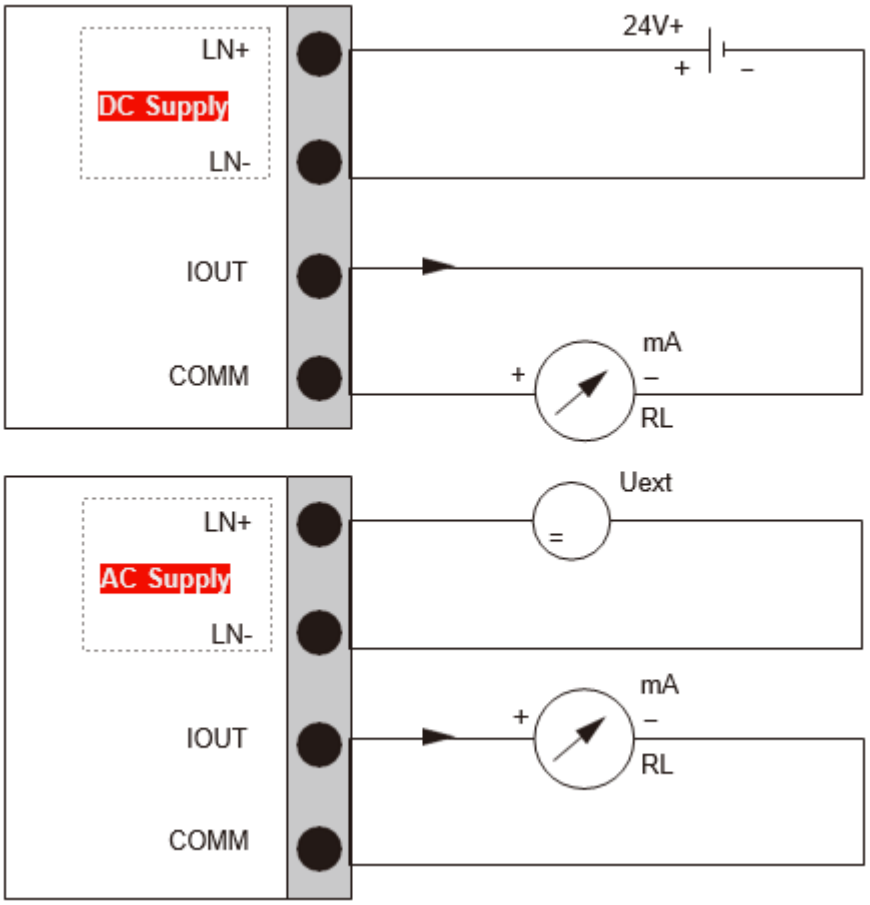
Alarm Output Junction	ALMH: Upper Limit ALML: Lower Limit
Alarm Output Capacity	Field-effect Transistors Output Maximum Voltage: 36 V DC Maximum Current: 250 mA

6.4 Connection Diagrams of Outputs

6.4.1 Current Output (On Special Request)

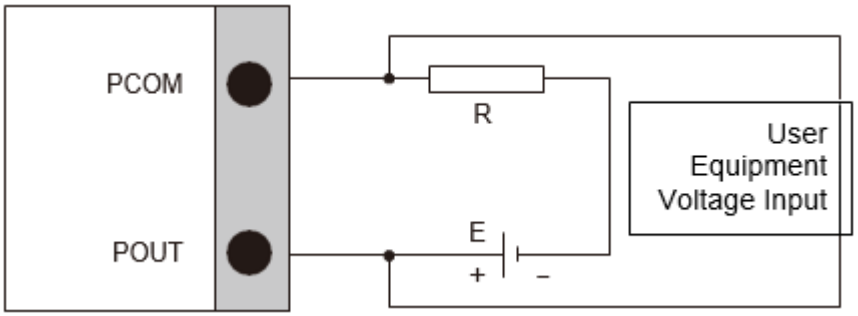


Current Output – Two Wire Connection

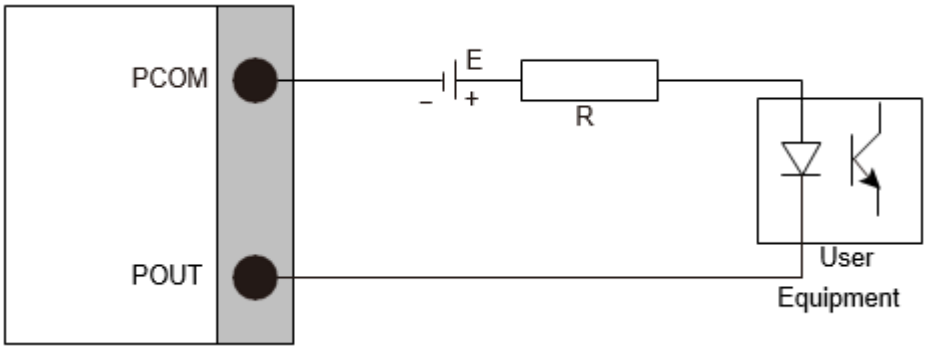


Current Output – Four Wire Connection (Isolated)

6.4.2 Digital Voltage Output

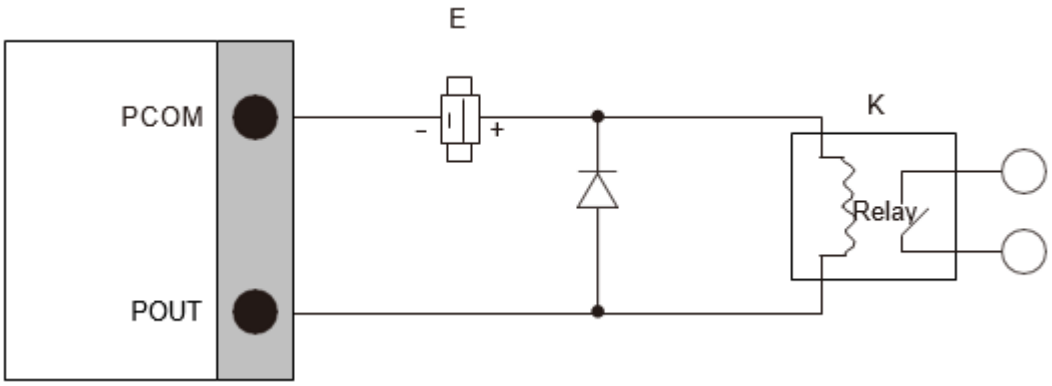


6.4.3 Digital Output to Photoelectricity Coupling



Generally, photoelectricity coupling current is about 10mA. When E/R=10mA, E=5~24V.

6.4.4 Digital Output to Relay



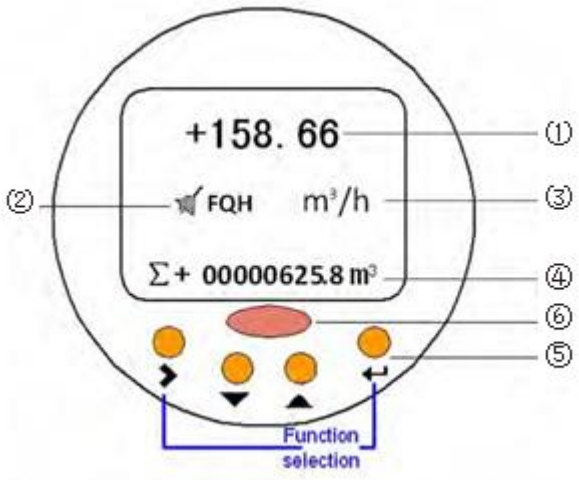
Generally, E (Voltage) of the relay is 12V or 24V; D is the extended diode, most middle relays have this diode inside. If not, the user should connect one outside.

Parameter	Test Condition	Min	Typical	Max	Unit
Voltage	IC = 100mA	3	24	36	V
Current	Vol = 1.4V	0	300	350	mA
Frequency	IC = 100mA Vcc = 24V	0	5000	7500	Hz
High Voltage	IC = 100mA	Vcc	Vcc	Vcc	V
Low Voltage	IC = 100mA	0.9	1.0	1.4	V

7. Operation and Setup

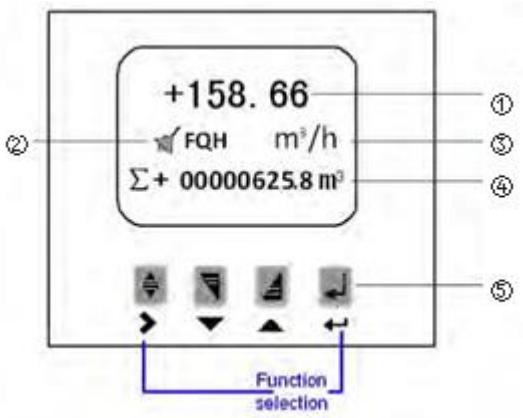
7.1 Display and Keys

7.1.1 Compact Type



1	Flow Rate
2	Alarm Symbol and Message: FQH; FQL; FGP; SYS
3	Flow Rate Unit
4	Flow Velocity; Percentage; Positive, Negative, or Net Total (Switchable)
5	Keys (See table below for function and representation in text)
6	Infrared Sensor (not present in all signal converter versions)

7.1.2 Remote Type



1	Flow Rate
2	Alarm Symbol and Message: FQH; FQL; FGP; SYS
3	Flow Rate Unit
4	Flow Velocity; Percentage; Positive, Negative, or Net Total (Switchable)
5	Keys (See table below for function and representation in text)

7.1.3 Keys

Key	Measuring Mode	Menu Mode	Sub-menu or Function Mode	Parameter and Data Mode
→ + ↵	Function Selection (1) Parameters Set (2) Clr Total Rec (3) Fact Modif Rec			
↵ (Enter Key)	Enter the function selection.	Return to measuring mode but will be prompted to save data.	Press 1 time to return to menu mode with data saved.	Press 1 time to return to sub-menu or function with data saved.
	In any mode, press and hold Enter for 3 seconds to return to measuring mode.			
▼ or ▲	Switch between display pages: Flow Velocity Percentage Positive Total Negative Total Net Total	Select menu.	Select sub-menu or function.	Use the cursor highlighted to change a number, unit setting, or to move the decimal point.
→ + ▲ or → + ▼	Adjust LCD Contrast			For numerical values, move one cursor position to the right or left.

The display will return to measuring mode automatically after 3 minutes of inactivity.

7.2 Function Selection Menu

While in measuring mode, press → + ↵ to view the function selection menu, which includes three sub-menus.

Key (Measuring Mode)	Function Selection	Description
→ + ↵	(1) Parameters Set	Choose this menu and one page with password protection will be displayed. Input the correct password and press → + ↵ to change the parameters.
	(2) Clr Total Rec	Choose this menu and one page with password protection will be displayed. Input the correct password and press → + ↵ to reset the total flow.
	(3) Fact Modif Rec	Track the modification record on factor.

7.3 Parameters Set

When [>] + [↵] is pressed, the function selection menu will be displayed. The first menu is "Parameters [↵]. Press [↵] to confirm this selection. Input the passwo[>] + [↵]ress [↵].
There are 54 menus in this section and users can access/modify these menus, depending on the input password grade. See the table below for more information on password grade.

Password Grade	Password	Login Privileges	Menu Access
Grade 1	00521	Read Only	Menu 1 to 54
Grade 2	03210	Read and Edit	Read: Menu 1 to 54 Edit: Menu 1 to 24
Grade 3	06108	Read and Edit	Read: Menu 1 to 54 Edit: Menu 1 to 25
Grade 4	07206	Read and Edit	Read: Menu 1 to 54 Edit: Menu 1 to 38
Grade 5	Please consult your representative	Read and Edit	Read: Menu 1 to 54 Edit: Menu 1 to 52

Menu	Parameter Name	Setting Mode	Grade	Range
M1	Language	Select Parameter	2	English
M2	Comm Address	Input Value	2	0 ~ 99
M3	Baud Rate	Select Parameter	2	600 ~ 14400
M4	Snsr Size	Select Parameter	2	3 ~ 3000
M5	Flow Unit	Select Parameter	2	L/h, L/m, L/s, m^3/h, m^3/m, m^3/s
M6	Flow Range	Input Value	2	0 ~ 99999
M7	Flow Rspsns	Select Parameter	2	1 ~ 50
M8	Flow Direct	Select Parameter	2	Plus/Reverse
M9	Flow Zero	Input Value	2	0 ~ ±9999
M10	Flow Cutoff	Input Value	2	0 ~ 599.99%
M11	Cutoff Ena	Select Parameter	2	Enable/Disable
M12	Total Unit	Select Parameter	2	0.001 m^3 ~ 1m^3, 0.001L ~ 1L
M13	SegmaN Ena	Select Parameter	2	Enable/Disable
M14	Analog Type	Select Parameter	2	0 ~ 10 mA / 4-20mA
M15	Pulse Type	Select Parameter	2	Freque/Pulse
M16	Pulse Fact	Select Parameter	2	0.001 m^3 ~ 1m^3, 0.001L ~ 1L
M17	Freque Max	Select Parameter	2	1 ~ 5999 Hz
M18	Mtsnsr Ena	Select Parameter	2	Enable/Disable
M19	Mtsnsr Trip	Input Value	2	59999%
M20	Alm Hi Ena	Select Parameter	2	Enable/Disable
M21	Alm Hi Val	Input Value	2	000.0 ~ 599.99%
M22	Alm Lo Ena	Select Parameter	2	Enable/Disable
M23	Alm Lo Val	Input Value	2	000.0 ~ 599.99%
M24	Sys Alm Ena	Select Parameter	2	Enable/Disable
M25	Clr Sum Key	Input Value	3	0-99999
M26	Snsr Code 1	User Set	4	Finished Y M
M27	Snsr Code 2	User Set	4	Product Number
M28	Field Type	Select Parameter	4	Type 1,2,3
M29	Sensor Fact	Input Value	4	0.0000 – 5.9999
M30	Line Crc Ena	Select Parameter	4	Enable/Disable
M31	Lineary CRC 1	User Set	4	Set Velocity
M32	Lineary Fact 1	User Set	4	0.0000 – 1.9999
M33	Lineary CRC 2	User Set	4	Set Velocity

M34	Lineary Fact 2	User Set	4	0.0000 – 1.9999
M35	Lineary CRC 3	User Set	4	Set Velocity
M36	Lineary Fact 3	User Set	4	0.0000 – 1.9999
M37	Lineary CRC 4	User Set	4	Set Velocity
M38	Lineary Fact 4	User Set	4	0.0000 – 1.9999
M39	FwdTotal Lo	Correctable	5	00000 – 99999
M40	FwdTotal Hi	Correctable	5	00000 – 9999
M41	RevTotal Lo	Correctable	5	00000 – 99999
M42	RevTotal Hi	Correctable	5	00000 – 9999
M43	PlsntLmtEna	Select Parameter	5	Enable/Disable
M44	PlsntLmtVal	Select Parameter	5	0.010 – 0.800 m/s
M45	Plsnt Delay	Select Parameter	5	400 – 2700 ms
M46	PassWord 1	User Correct	5	00000 - 99999
M47	PassWord 2	User Correct	5	00000 – 99999
M48	PassWord 3	User Correct	5	00000 – 99999
M49	PassWord 4	User Correct	5	00000 – 99999
M50	Analog Zero	Input Value	5	0.0000 – 1.9999
M51	Anlg Range	Input Value	5	0.0000 – 3.9999
M52	Meter Fact	Input Value	5	0.0000 – 5.9999
M53	MeterCode 1	Factory Set	6	Production Date: Y/M
M54	MeterCode 2	Factory Set	6	Product Serial No.

7.4 Parameter Function Table

No.	Function	Setting/Description
Language		
M1	Language	English/Chinese language selection depends on the device version.
RS485 Communication		
M2	Comm Address	Value: Integer 01 to 99 Devise Address for RS485 (Not present in all converters)
M3	Baud Rate	Selectable: 600, 1200, 2400, 4800, 9600, 19200
Sensor Diameter		
M4	Sensor Size	Select the sensor size (see the nameplate)
Flow Parameters		
M5	Flow Unit	Selectable: L/h, L/m, L/s, m^3/h, m^3/m, m^3/s
M6	Flow Range	Value: 0 – 99999 (This parameter represents the maximum flow rate of the meter)
		Changing this value will affect M10 and current output value.
M7	Flow Rspns	Damping time / time constant – default value: 3 seconds
		Setting a large value can enhance the stability of the flow display and digital output, which is suitable for the totalizer. A smaller value means a faster response rate, which is suitable for production control.
M8	Flow Direct	Selectable: Plus / Reverse
		Define polarity of flow direction. Plus / Forwards (according to the arrow on the measuring sensor) or Reverse / Backwards (in the opposite direction to the arrow)

M9	Flow Zero	Zero Calibration First row: FS-new zero calibration value Second row: Zero-point correction value. To ensure the flow meter's accuracy, FS should be 0. Change the value in the second row to make sure FS is 0. Note: Only perform "Flow Zero" when pipe is full, and fluid is static.
M10	Flow Cutoff	Sets output value for all outputs to 0. For example: Flow cutoff = 20% Then the minimum flow rate = 20% of maximum flow rate. Note: This function is only effective if M11 is enabled.
M11	Cutoff Ena	Selectable: Enable / Disable
M12	Total Unit	Selectable: 0.001 m^3, 0.01 m^3, 0.1 m^3, 1 m^3, 0.001 L, 0.01 L, 0.1 L, 1 L
Outputs		
M13	SegmaN Ena	Selectable: Enable / Disable The switch to control current or pulse outputs of reverse flow. The output function is only effective for reverse flow if M13 is enabled.
M14	Analog Type	Selectable: 4-20 mA / 0 – 10 mA Select the correct current output mode based on the application.
M15	Pulse Type	Selectable: Freque / Pulse Freque: Frequency Output Pulse: Scaled Pulse Output
M16	Pulse Fact	Selectable: 0.001 m^3, 0.01 m^3, 0.1 m^3, 1 m^3, 0.001 L, 0.01 L, 0.1 L, 1 L The scaled pulse output value for each pulse is only effective if M15 is selected as "Pulse". For example: M16 = "0.1 L", each pulse is 0.1 L. Maximum pulse output: 100 pulses / sec
M17	Freque Max	Value: 1 – 5000 Hz Maximum frequency corresponds to M6
Alarms		
M18	Mtsnsr Ena	Selectable: Enable / Disable Empty pipe detection is only valid if M18 is enabled
M19	Mtsnsr Trip	First row: measured conductivity value (V1) Second row: the value (V2), which can trigger the Empty Pipe Alarm. Generally, set V2 as 3-5 times the value of V1. Flow indication, pulse output, and current output are 0 when the alarm is triggered. Note: perform this parameter set when the pipe is fully filled with fluid.
M20	Alm Hi Ena	Selectable: Enable / Disable

		Upper flow limit alarm is only valid if M20 is enabled
M21	Alm Hi Val	Value: 0% - 199.9% (The value to trigger the Upper Flow Limit Alarm)
		Upper flow limit alarm is only triggered when M20 is enabled and the flow rate > M21*M6
M22	Alm Lo Ena	Selectable: Enable / Disable Lower flow limit alarm is only valid if M22 is enabled.
M23	Alm Lo Val	Value: 0% to 199.9% (The value to trigger the Low Flow Limit Alarm)
		Lower flow limit alarm is only triggered if M22 when M22 is enabled and the flow rate < M10*M6
M24	Sys Alm Ena	Selectable: Enable / Disable System exciting alarm is only valid if M24 is enabled.
Reset Totalizer Password		
M25	Clr Sum Key	The password is used to reset the totalizer.
Sensor		
M26	Snsr Code 1	User can set the sensor production date in M26 to track whether the sensor factor is correct.
M27	Snsr Code 2	Sensor Serial Number
M28	Field Type	Selectable: 1/16; 1/20; 1/25
		Three types of excitation frequency Usually, 1/16 for smaller sized sensors and the other two for larger sized sensors
M29	Sensor Fact	Input measuring sensor constant: GK User can get this factor from the calibration certificate.
Linearity Correction		
M30	Line Crc Ena	Selectable: Enable / Disable
		This parameter is used to control the linearity correction function.
M31	Lineary CRC 1	Correction Point 1: Velocity of Point 1
M32	Lineary Fact 1	Linear Fact 1: Correction Factor of Point 1
M33	Lineary CRC 2	Correction Point 2: Velocity of Point 2
M34	Lineary Fact 2	Linear Fact 2: Correction Factor of Point 2
M35	Lineary CRC 3	Correction Point 3: Velocity of Point 3
M36	Lineary Fact 3	Linear Fact 3: Correction Factor of Point 3
M37	Lineary CRC 4	Correction Point 4: Velocity of Point 4
M38	Lineary Fact 4	Linear Fact 4: Correction Factor of Point 4
Set Value for Total Flow **For flow meter maintenance or replacement, the previous total flow might need to be set.**		
M39	FwdTotal Lo	Set value: 00000 – 99999
		Low byte of positive total flow
M40	FwdTotal Hi	Set Value: 0000 – 9999
		High byte of positive total flow
M41	RevTotal Lo	Set value: 00000 – 99999
		Low byte of negative total flow
M42	RevTotal High	Set value: 0000 - 9999

		High byte of negative total flow
Peak Suppression Function		
M43	PlsntLmtEna	Selectable: Enable / Disable The switch for peak suppression.
M44	PlsntLmtVal	This parameter determines the change rate of peak interference, based on the percentage of flow velocity in ten grades: Grade 1 - 0.010 m/s, 0.020 m/s, 0.030 m/s, 0.050 m/s, 0.080 m/s, 0.100 m/s, 0.200 m/s, 0.300 m/s, 0.500 m/s, 0.800 m/s – Grade 10 The sensitivity of peak suppression is highest for Grade 1.
M45	Plsnt Delay	This parameter can determine the width of time to restrain peak interference in ms. If the duration of one signal is less than the value of M45, this signal can be determined as peak interference and will be suppressed; otherwise, it will be determined as normal signal.
Password Management		
M46	PassWord 1	M46 to M49 can be changed using Grade 5 password to enter parameter setting
M47	PassWord 2	
M48	PassWord 3	
M49	PassWord 4	
Factory Use ONLY		
M50	Analog Zero	Zero-point calibration for current output to make sure the zero point is 0 mA / 4 mA
M51	Anlg Range	Full scale calibration for current output to make sure the full scale is 10 mA / 20 mA
M52	Meter Fact	Factory Use ONLY
M53	MeterCode 1	Converter Production Date
M54	MeterCode 2	Converter Serial Number

8. Communications

8.1 Introduction

Pro-M electromagnetic flowmeter MODBUS communication port uses electric isolation in the physical structure. The isolation voltage is 1500V and it has ESD protection. It can overcome various interferences from the industrial scene to ensure the reliable service of communications.

Supported Baud Rates:
1200
2400
4800
9600
19200

Serial Port Parameters:
Data Bits = 8
Start Bit = 1
Stop Bit = 1
Parity = None

8.2 Network Structure and Wiring

Pro-M electromagnetic flowmeter's standard MODBUS communication network is a bus network. At the farthest device in the network, it usually needs a 120Ω matched termination resistor to connect the two ports of communication wired in parallel. The standard communication connection media is shielded twisted pair. See Figure-1 where communication wiring is shown in detail.

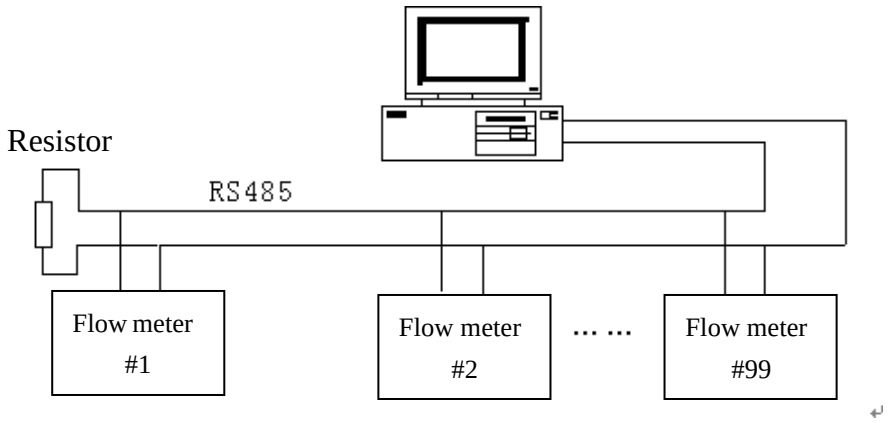


Figure-1 Electromagnetic flowmeter network structure

8.3 RTU Frame Format

Pro-M electromagnetic flowmeter uses the MODBUS RTU frame format (hexadecimal format). Its frame format is shown in Figure-2 and Figure-3.

Start	Device Address	Function Code	Register Address	Register Length	CRC	Stop
T1-T2-T3-T4	8Bits	8Bits	16Bits	16Bits	16Bits	T1-T2-T3-T4

Figure 2 Master RTU message frame

Start	Device Address	Function Code	Data	CRC	Stop
T1-T2-T3-T4	8Bits	8Bits	n 8Bits	16Bits	T1-T2-T3-T4

Figure 3 Slave RTU message frame

T1-T2-T3-T4 is start or stop frame. MODBUS protocol sets that every twoframes must have 3.5 char delay at least a is shown in Figure-4.

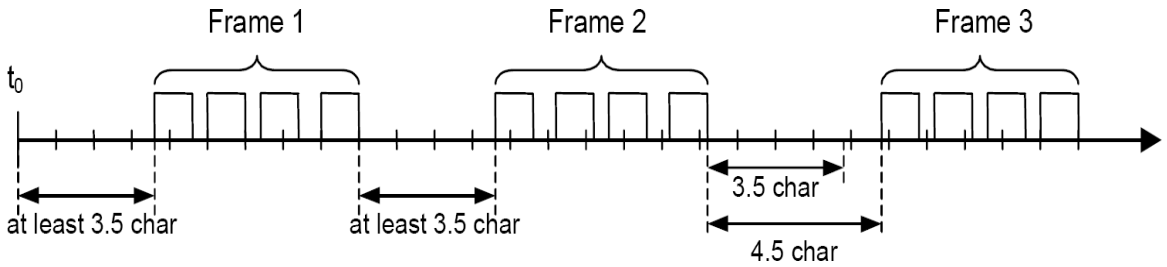


Figure-4 MODBUS frame interval

Device address: Pro-M electromagnetic flowmeter's communication address. Device address needs to be unique within the network trunk.

Function code: Pro-M electromagnetic flowmeter uses function code 4, Read Input Register. MODBUS Code Definitions are shown below in Table-1.

Function Code	Name	Function
01	Read coil status	Reservation
02	Read input status	Reservation
03	Read holding registers	Reservation
04	Read input register	Read Electromagnetic Flowmeter real-time information
05	Strong set single coil	Reservation
06	Preset single register	Reservation
07	Read abnormal status	Reservation
08	Loopback diagnostic check	Reservation
09	Program (only used for 484)	Reservation
10	Control exercise (only used for 484)	Reservation
11	Read events count	Reservation
12	Read communication events record	Reservation
13	Program (184/384 484 584)	Reservation
14	Inquire (184/384 484 584)	Reservation
15	Strong multi-coil set	Reservation

Table-1 MODBUS Code Definitions

Registers: Table-3 show the available data registers that are available from the Pro-M electromagnetic flowmeter.

Protocol Addresses (Decimal)	Protocol Addresses (HEX)	Data format	Resister Definition
4112	0x1010	Float Inverse	Instantaneous Flow
4114	0x1012	Float Inverse	Instantaneous Velocity
4116	0x1014	Float Inverse	Flow Percentage
4118	0x1016	Float Inverse	Fluid Conductivity Ratio
4120	0x1018	Long Inverse	Integer part of the cumulative Forward Total
4122	0x101A	Float Inverse	Decimal part of the cumulative Forward Total
4124	0x101C	Long Inverse	Integer part of the cumulative Reverse Total
4126	0x101E	Float Inverse	Decimal part of the cumulative Reverse Total
4128	0x1020	Unsigned short	Instantaneous Flow Unit (Table-3)
4129	0x1021	Unsigned short	Total Units (table-4 or table-5)
4130	0x1022	Unsigned short	Upper limit alarm
4131	0x1023	Unsigned short	Lower limit alarm
4132	0x1024	Unsigned short	Empty pipe alarm
4133	0x1025	Unsigned short	System alarm

Table-2 MODBUS Registers

If there isn't a function code setting option when you configure your PLC, you should add 3 in front

of register address when you are using function code 04. If PLC register address's basic address is from 1, you should add 1 to original address when configuring register address.

Example: Pro-M electromagnetic flowmeter MODBUS register address is 4112(0x1010) and MODBUS function code is 4. The PLC register address is 34113.

Float format:
Pro-M electromagnetic flowmeter MODBUS uses IEEE754 which is 32 bits float format. Its structure is shown as follows: (take Instantaneous flow for an example

0X1010 (34113)		0x1011 (34114)	
BYTE1	BYTE2	BYTE3	BYTE4
S EEEEEEE	E MMMMMMM	MMMMMMMM	MMMMMMMM

S- Mantissa symbol; 1 = Negative, 0 = Positive.
E- Exponent; expressed by the difference with decimal number 127.
M- Mantissa; low 23 bits and the decimal part.
When not all of the E is "0" and "1", the conversion formula between float andthe decimal number is $V = (-1)^S 2^{(E-127)}(1+M)$

Code	Unit	Code	Unit	Code	Unit
0	L/S	3	M3/S	6	UKG
1	L/M	4	M3/M	7	GPM
2	L/H	5	M3/H		

Table-3 Instantaneous Flow Unit

Code	0	1	2	3
Cumulative unit	L	M3	T	USG

Table-4 Total Flow Unit

Alarm: Upper limit alarm, lower limit alarm, empty pipe alarm, system alarm
0 = No alarm
1 = Alarm

8.4 Communication Data Analysis

Instantaneous flow, instantaneous velocity, flow percentage, fluid conductivity ratio, decimal part of positive and reverse total, format conversion of float, integer part of the cumulative positive and reverse flow, transmission of long.

Read Instantaneous Flow

Master sends command (hexadecimal number)

01	04	10	10	00	02	74	CE
Device address	Function code	Register high address	Register high address	Register high length	Register low length	CRC high	CRC low

Data that master receives

01	04	04	C4	1C	60	00	2F	72
Device address	Function code		Data length	4 bytes float (instantaneous flow)		CRC high	CRC low	

Float:	C4	1C	60	00
	1100 0100 float byte 1	0001 1100 float byte 2	0110 0000 float byte 3	0000 0000 float byte 4

S=1: if mantissa symbol is 1, it is a negative.E=10001000: Exponent is 136

M=001 1100 0110 0000 0000 0000,
The mantissa is:
= -625.5

$$V = (-1)^1 2^{(136-127)}\left(1+\frac{1}{8}+\frac{1}{16}+\frac{1}{32}+\frac{1}{512}+\frac{1}{1024}\right)$$

Read Instantaneous Velocity

Master sends command (hexadecimal number)

01	04	10	12	00	02	D5	0E
Device address	Function code	Register high address	Register high address	Register high length	Register low length	CRC high	CRC low

Data that master receives

01	04	04	C1	B0	80	00	A6	5F
Device address	Function code	Data length	4 bytes float (instantaneous velocity)				CRC high	CRC low

Float: C1 B0 80 00
1100 0001 1011 0000 1111 1000 0000 0000
S=1
E= 10000011
M= 011 0000 1111 1000 0000 0000

$$V = (-1)^1 2^{(131-127)}(1+\frac{1}{4}+\frac{1}{8}+\frac{1}{256})$$

= -22.0

Read Total Flow

To express the 9 bits cumulative value of electromagnetic flowmeter total, integer part and decimal part of total flow are expressed respectively. The integer part uses long variable, and the decimal uses float variable.

Cumulative flow is 1578m^3

Master sends command to collect the integer value of cumulative flow

01	04	10	18	00	02	F5	0C
Device address	Function code	Register high address	Register high address	Register high length	Register low length	CRC high	CRC low

Data that master receives

01	04	04	00	00	70	71	1E	60
Device address	Function code	Data length	4 bytes float (integer value of cumulative flow)				CRC high	CRC low

Integer value of cumulative flow is 28785

Master sends command to collect the decimal value of cumulative flow

01	04	10	1A	00	02	54	CC
Device address	Function code	Register high address	Register high address	Register high length	Register low length	CRC high	CRC low

Data that master receives

01	04	04	3F	00	00	00	3B	90
Device address	Function code	Data length	4 bytes float (decimal value of cumulative flow)				CRC high	CRC low

Float: 3F 00 00 00

0011 1111 0000 0000 0000 0000 0000 0000
S=0

E= 0111111 126

M= 000 0000 0000 0000 0000 0000

$$V = (-1)^1 2^{(126-127)} = 0.5$$

Read instantaneous flow unit

Master sends 8 bytes command to read instantaneous flow unit

01	04	10	20	00	01	34	C0
Device address	Function code	Register high address	Register high address	Register high length	Register low length	CRC high	CRC low

7 bytes data that master receives from slave

01	04	02	00	05	79	33
Device address	Function code	Data length	2 bytes integer (instantaneous flow unit)		CRC high	CRC low

Flow unit is M^3/H from Table-3.

Read the unit of the total flow

Master sends 8 bytes command to read instantaneous flow unit

01	04	10	21	00	01	65	00
Device address	Function code	Register high address	Register high address	Register high length	Register low length	CRC high	CRC low

7 bytes data that master receives from slave

01	04	02	00	01	78	F0
Device address	Function code	Data length	2 bytes integer (cumulative flow unit)		CRC high	CRC low

Flow unit is M^3 from Table-4.

Read alarm status

Master sends 8 bytes command to read instantaneous flow unit

01	04	10	24	00	01	75	01
Device address	Function code	Register high address	Register high address	Register high length	Register low length	CRC high	CRC low

7 bytes data that master receives from slave

01	04	02	00	01	78	F0
Device address	Function code	Data length	2 bytes integer (alarm)		CRC high	CRC low

Empty pipe is in alarm status if status is 1. Other alarm status is the same and so on.

9. Troubleshooting

Symptom	Probable Cause	Solution
Measurement is not accurate	Parameters input incorrectly	Check the parameters programmed. (Transmitter, K-Factor, and size)
	Pipe is not fully filled	Check if meter is fully filled
Flow rate indication is unstable	Grounding issue	1. Make sure meter is properly grounded to a good earth ground. 2. Please use grounding rings when the pipe is not conductive, such as PVC or other plastic pipe.
	Air	Make sure fluid does not contain air bubbles.
	Converter location outside electrical interference	Make sure converter is not too close to sources of electrical interference.
No display	No power	Apply correct power
	Incorrect power	Check power supply
	Wiring connections	Check power input / output connections
	Fuse blown	Replace fuse
	Contrast of LCD is too low	Increase the contrast
Empty pipe alarm	Fluid does not fully fill the pipe	Increase the flow rate
	Electrode was polluted	Clean the electrode if the voltage of Ds1 and Ds2 > 1V
	Fluid's conductivity is too low	If you connect to the three terminals SIG1, SIG2, and SGND and the alarm disappears, the fluid's conductivity is too low. Another flow measurement principle needs to be used.

10. Energy Appendix

10.1 Parameter Set

Parameter No.	Meaning	Range	Range
1.1	Operat. Mode	Heat meter mode Cold meter mode Cold-Heat mode	Choose
1.2	Snsr Size	10～2000 (DN)	Choose
1.3	Heat Unit	GJ/h、MJ/h、KWh/h、MWh/h	Choose
1.4	Cold Unit	GJ/h、MJ/h、KWh/h、MWh/h	Choose
1.5	Flow Rspns	1～60S	Choose
1.6	Flow Direct	FORWARD、REVERSE	Choose
1.7	Flow Zero	0～±9999	Number set
1.8	Flow Cutoff	Based on flow setting	Number set
1.9	Temp. Cutoff	0～199.9	Number set
1.10	Total Unit	0.001m_3～1m_3	Choose
1.11	HeatTotUnit	MJ、GJ、KWh、MWh	Choose
1.12	ColdTotUnit	MJ、GJ、KWh、MWh	Choose
2.1	Current Mode	Flow output Heat output Cold output Heat Cold output Status output Flow direction	Choose
2.2	Flow Range	0～59999	Number set
2.3	Heat Range	0～59999	Number set
2.4	Cold Range	0～59999	Number set
2.5	Data Output	Flow Frequency Flow Pulse Lt Flow Pulse m3 Heat Pulse MJ Heat Pulse GJ Heat Pulse KWh Heat Pulse MWh Cold Pulse MJ Cold Pulse GJ Cold Pulse KWh Cold Pulse MWh Cold Heat P MJ Cold Heat P GJ Cold Heat P KWh Cold Heat P MWh WorkStatus Mark Flow direction	Choose
2.6	FrequencyMax	0～59999	Number set
2.7	Pulse Factor	0.001～59.999	Number set
2.8	Pulse Width	0.3ms～499.9ms	Number set
3.1	Sensor Fact	0.0000～5.9999	Number set
3.2	Field Type	Type1/Type2	Choose

3.3	Snsr Code1	0～99999	User set
3.4	Snsr Code2	0～99999	User set
3.5	Sensor Post.	Flow Inlet Flow export	Choose
4.1	Heat Start T	0～199.9	Number set
4.2	Cold Start T	0～199.9	Number set
4.3	Pres. Range	0.6MP/6MP	Choose
4.4	TempA Zero	0～59999	Number set
4.5	TempA Range	0～5.999	Number set
4.6	TempB Zero	0～59999	Number set
4.7	TempB Range	0～5.999	Number set
5.1	Mtsnsr Ena	ENABLE/DISABLE	Choose
5.2	MtsnsrTrip	59999	Number set
5.3	Sys Alm Ena	ENABLE/DISABLE	Choose
6.1	Line Crc Ena	ENABLE/DISABLE	Choose
6.2	Lineary CRC1	Based on flow setting	User set
6.3	Lineary Fact 1	0.0000～9999	User set
6.4	Lineary CRC2	Based on flow setting	User set
6.5	Lineary Fact 2	0.0000～9999	User set
6.6	Lineary CRC3	Based on flow setting	User set
6.7	Lineary Fact 3	0.0000～9999	User set
6.8	Lineary CRC4	Based on flow setting	User set
6.9	Lineary Fact 4	0.0000～9999	User set
7.1	Comm Addres	0～99	Number set
7.2	Baud Rate	300～38400	Choose
8.1	YEAR	0～99	Number set
8.2	MONTH	0～99	Number set
8.3	DAY	0～99	Number set
8.4	HOUR	0～99	Number set
8.5	MINUTE	0～99	Number set
8.6	SECOND	0～99	Number set
9.1	Meter Fact	0.0000～5.9999	Number set
9.2	AnalogZero	0.0000～9999	Number set
9.3	Anlg Range	0.0000～3.9999	Number set
9.4	Clr Sum Key	0～99999	Modify available
9.5	MeterCode1	0～99999	Factor set
9.6	MeterCode2	0～99999	Factor set
9.7	Password 1	0～59999	Modify available
9.8	Language	Chinese/English	Choose
10.1	Heat Test	ENABLE/DISABLE	Choose
10.2	TempA value	0～199.9	Number set
10.3	TempB value	0～199.9	Number set
10.4	Speed value	0～19.999	Number set
11.1	TotalWordLo	0～99999	Modify available
11.2	TotalWordHi	0～9999	Modify available
11.3	HeatTotalLo	0～99999	Modify available
11.4	HeatTotalHi	0～9999	Modify available

11.5	ColdTotalLo	0～99999	Modify available
11.6	ColdTotalHi	0～9999	Modify available

10.2 Constraints/Features

Damping Time	Ability to enhance stability of flow display and output signal.
Integrating Unit	9-bit calculator, upper limit is 999999999. Note: Cole Meter (R) integrating has one bit less.
Frequency Output	Flow percent output 1-5000. Meter Frequency Output = (measured flow/flow range)*frequency full range
Frequency 1/10 (mode 1)	Applied to small caliber. The chosen mode is determined by excitation calibration mode.
Frequency 1/12 (mode 2)	Applied to big caliber. The chosen mode is determined by excitation calibration mode.
Installation Place of Meter	“Inlet” if sensor is installed in pipe entrance. “Export” if sensor is installed in pipe outlet.

10.3 Working Modes

Working Modes	
Heat Meter (H)	Default mode, measure on heat.
Cold Meter (R)	Measure on cold.
Heat & Cold Meter (H/R)	Measure on both heat and cold. Measuring results display separately.

10.4 Current Output

Flow Output	Instant flow percent
Heat Output	Instant heat percent
Cold Output	Instant cold percent
Heat & Cold Output	Instant heat or cold percent
Status Output	Instant heat or cold status. For heat status, output is 20mA. For cold status, output is 4mA.
Flow Direction Output	Instant flow direction. Reverse direction when 20mA and forward direction when 4mA.

10.5 Impulse Output

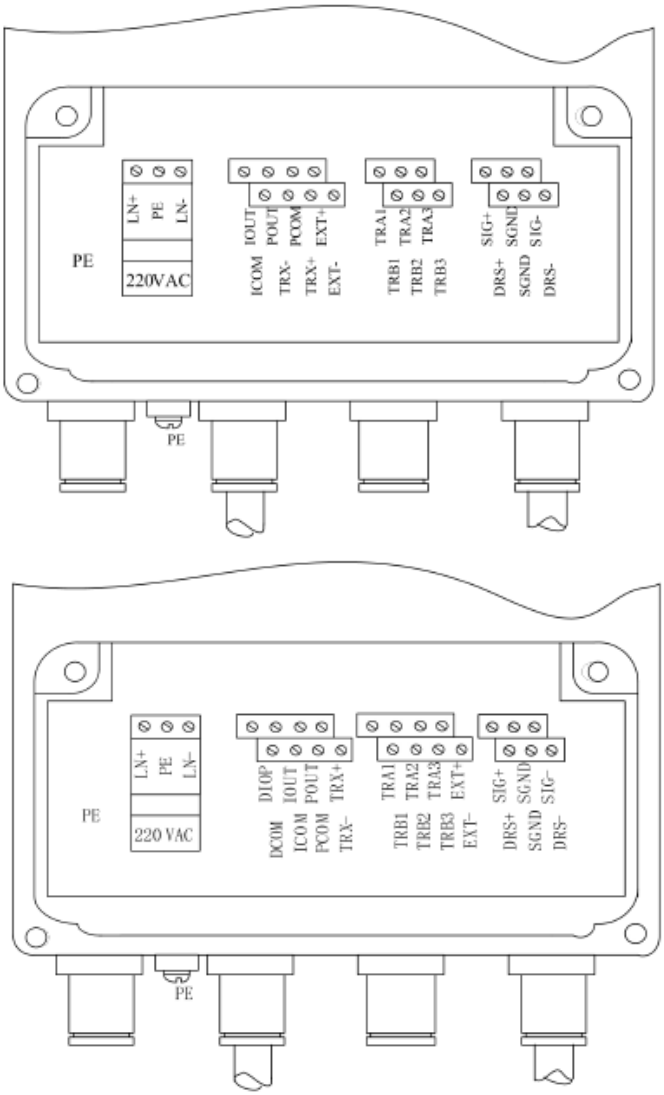
Impulse Output Range	0.001-59.999 units (impulse output type unit)
Impulse Width Range	0.3-499.9 ms

Impulse width and maximum output pulse number correspond and can be seen in the table below.

No.	Impulse Width (ms)	Maximum Output Pulse Number per Hour (p/h)
1	1	1800000
2	5	360000
3	10	180000
4	50	36000
5	100	18000
6	200	9000
7	500	3600

10.6 Operation and Setup

10.6.1 Terminal Configuration Diagram



Terminal Configuration

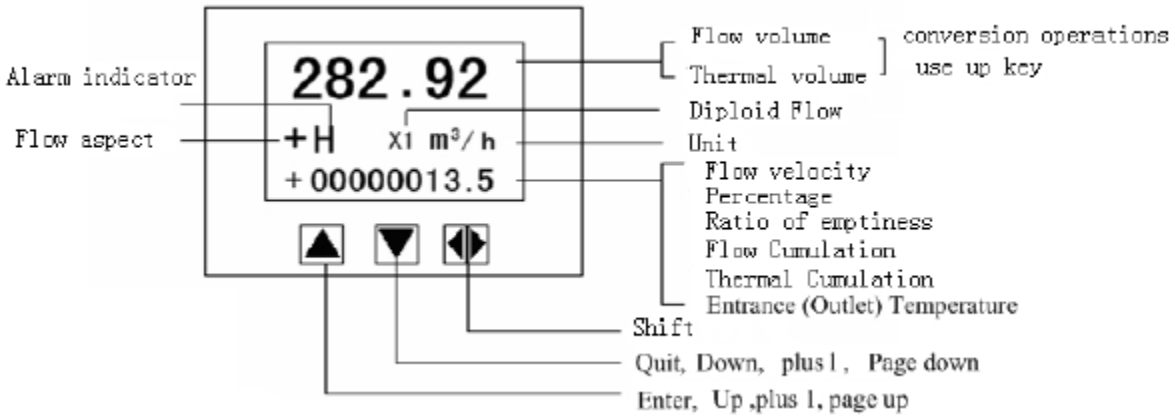
TRA1	Supply Temperature Input
TRA2	Supply Temperature Input
TRA3	Supply Temperature Input

TRB1	Return Temperature Input
TRB2	Return Temperature Input
TRB3	Return Temperature Input
SIG+	Signal 1
SGND	Signal Ground
SIG-	Signal 2
DRS+	Exciting Shielding 1
DRS-	Exciting Shielding 2
MTDR	Reserve
EXT+	Exciting Current +
EXT-	Exciting Current -
POUT	Frequency Output +
PCOM	Frequency Output Ground
IOUT	Current Output +
ICOM	Current Output Ground
TRX-	Communication Interface (RS485-B)
TRX+	Communication Interface (RS485-A)
LN-	220V (24V) Power Supply Input
LN+	220V (24V) Power Supply Input
DIOP	Reserve
DCOM	Reserve

Note: Don’t connect 110-240V AC Power on 221B converted, which is DC Power Supply Type.

10.6.2 Display and Keys

Display

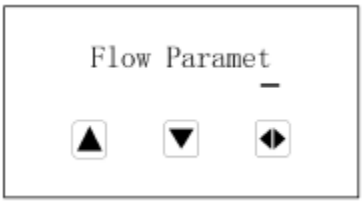


Keys

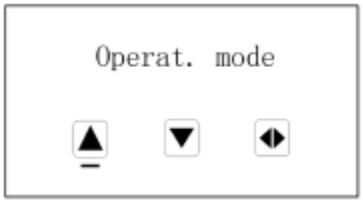
Key	Automatic Testing Mode	Parameter Setting Mode
Shift	Press key once and function choosing will display	Moves curser to “Up” or “Down” key. Press “Up” to see submenu. Press “Down” to see father menu.
Up	Instantaneous heat or cold and flow transfer displays. Heat displays as “H” and cold displays as “R.”	Subtract 1 from the number at curser area. Returns to Front Page.
Down	Circular selection screen displays content. Heat accumulating displays as “H” and cold accumulating displays as “C.”	Plus 1 from number at curser area. Returns to After Page.

10.6.3 Parameter Setting Key Operation

Press “Shift” key once to go into the parameter setting function and move the cursor above the “Up” key. Press “Up” key to go into “00000” status and enter password. This is shown below.



To change the main menu, press “Up” key. To change the sub-menu parameter, move the cursor below the “Up” key. This is shown below.



10.6.4 Function Selection Menu

To set functions, press “Shift” key once and then press “Enter” key. The five function options can be seen below.

Function Set

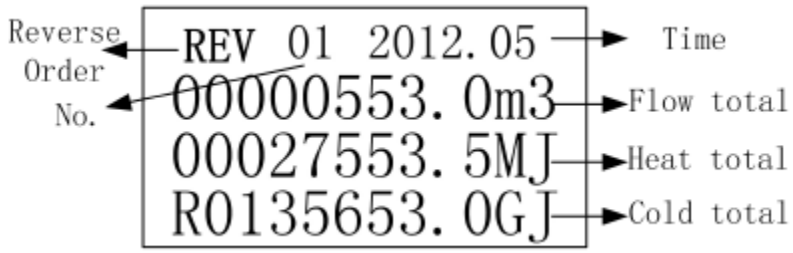
Number	Function	Specifications
1	Parameters Set	Parameter setting functions is available by choosing this function
2	Clr total rec	Gross cleaning is available by choosing this function
3	Month total rec	32 months gross can be checked by choosing this function
4	Power down rec	32 times power-down records can be checked choosing this function
5	Parameter changing record	Reserved

Gross Cleaning

To set gross cleaning, press “Shift” key once and go into parameter setting function. Press “Up” to select “Gross Cleaning” and type in password. Press “Shift” to move curser to “Enter” and press “Enter.” When “00000” displays, gross cleaning is set up and the gross in the meter becomes 0.

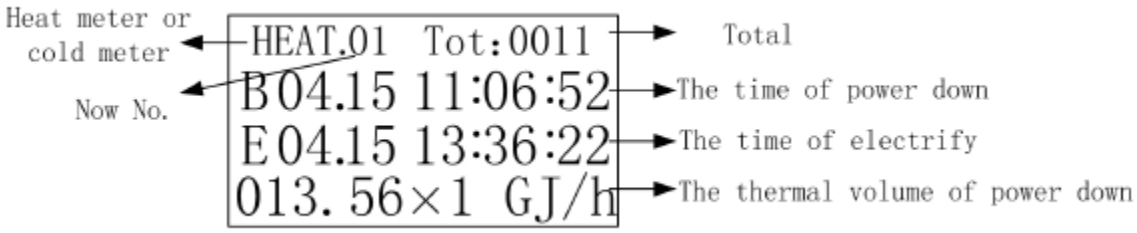
Monthly Gross

Monthly gross can record 32 months of data, however, when the time is longer than 32 months, new data will overwrite first month data. Make sure the clock is set correctly as seen below in order to collect data.



Power-Down Timing Display

Power-down records can be recorded 32 times with a maximum of 9999 times. See below set-up.



10.7 Communication Parameter

Communication Parameter	Specifications
Address	01-99 range, 0 is reserved when communicating
Speed	300, 600, 1200, 4800, 9600, 19200, and 38400 baud rate range
Terminal Resistance Switch	ON means RS485 communication terminal resistance (120Ω) is connected
	OFF means communication terminal resistance is not connected

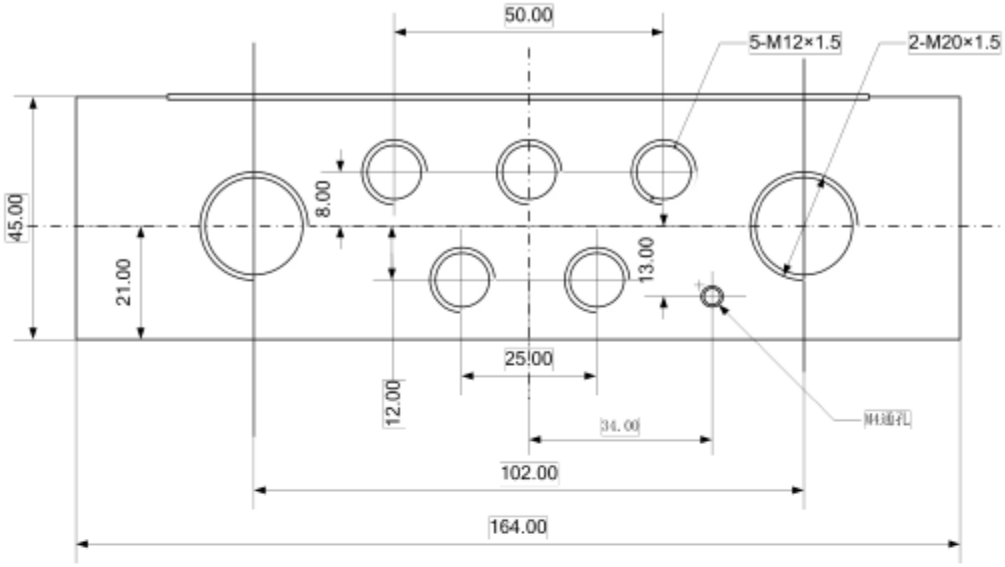
10.8 Modbus Register Address Definitions

Protocol Addresses (Decimal)	Protocol Addresses (HEX)	Data Format	Register Definition
4112	0x1010	Float Inverse	Instantaneous flow floating-point (M3/h)
4114	0x1012	Float Inverse	Instantaneous flow velocity floating-point
4116	0x1014	Float Inverse	Reserved
4118	0x1016	Float Inverse	Flow conductance ratio Floating-point
4120	0x1018	Long Inverse	Gross integer part
4122	0x101A	Float Inverse	Gross decimal value
4124	0x101C	Unsigned short	Instant cold unit 0： MJ/h; 1： GJ/h 2： KWh/h; 3 MWh/h
4125	0x101D	Unsigned short	Cold gross unit 0： MJ； 1： GJ 2： KWh; 3 MWh
4128	0x1020	Unsigned short	Instantaneous heat unit 0： MJ/h; 1： GJ/h 2： KWh/h; 3 MWh/h
4129	0x1021	Unsigned short	Flow gross unit (m3)
4130	0x1022	Unsigned short	Pressure range 0: 0.6MPa 1: 1.6MPa
4131	0x1023	Unsigned short	Gross heat unit 0: MJ 1: GJ; 2: KWh 3: MWh
4132	0x1024	Unsigned short	Empty pipe alarming 0: Normal 1: Alarming
4133	0x1025	Unsigned short	System alarming 0: Normal 1: Alarming
4134	0x1026	Float Inverse	Instantaneous heat flow
4136	0x1028	Long Inverse	Heat gross
4138	0x102A	Float Inverse	Heat gross decimal value
4140	0x102C	Unsigned short	Entrance temperature (℃)

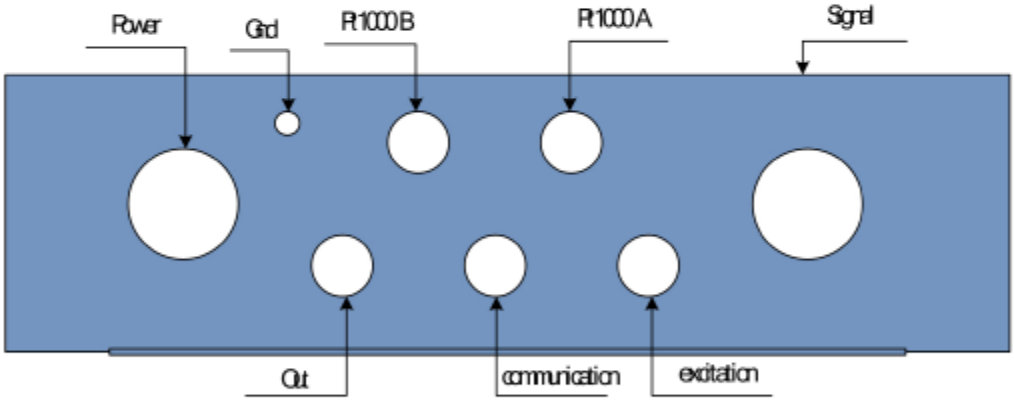
4141	0x102D	Unsigned short	Outlet temperature (℃)
4142	0x102E	Long Inverse	Cold gross accumulating value
4144	0x1030	Float Inverse	Cold gross accumulating small amount
4146	0x1032	Float Inverse	Instant cold value

10.9 Wiring In and Out Line Hole

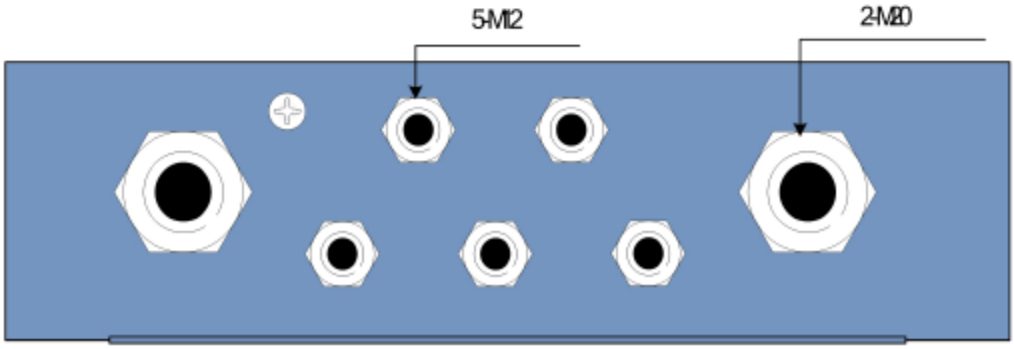
1 Bolt Size



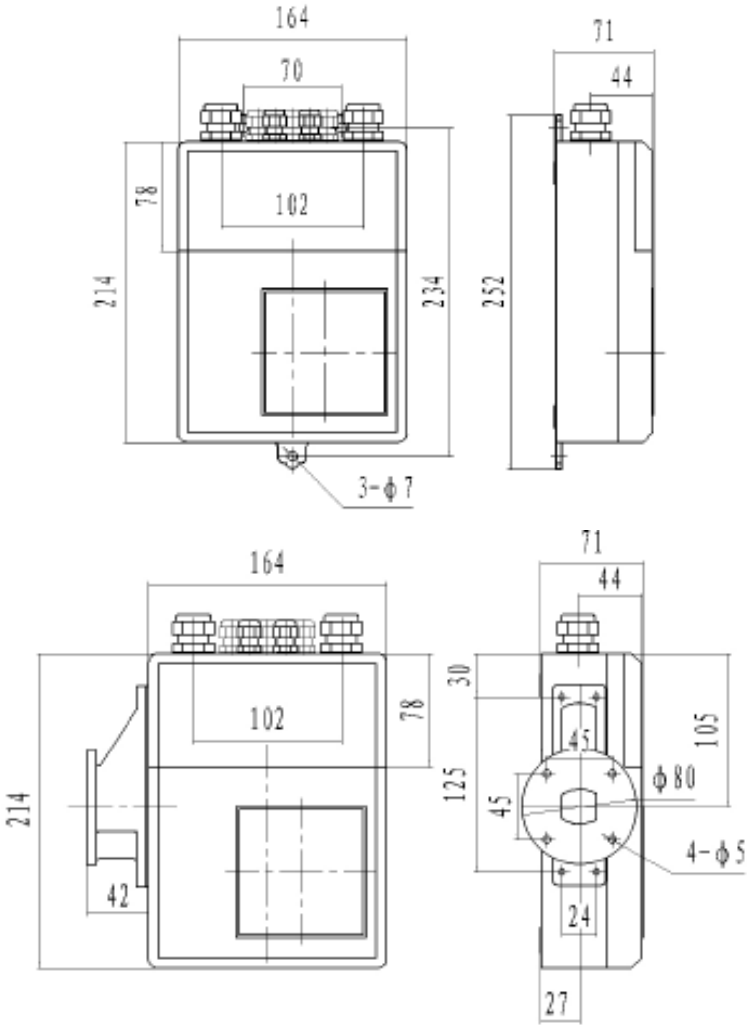
2 Hole Definition



3 Bolt Definition



10.10 Installation Dimensions



10.11 Troubleshooting

Symptom	Probable Cause	Solution
No Flow/ Measurement is inconsistent	Parameters input incorrectly	Check the flow direction parameter programmed and reset if needed.
Heat and cold integrating is not measuring	Flow is reverse, which means reverse measurement is set to “Forbidden”	Change the reverse measurement to “Allowed”