

VORTEX FLOW METER

LIQUID , GAS , & STEAM

VFM - 250 Series



Wafer Connection



Flange Connection

Content

1. General Information	2
2. Technical Data.....	3
3. Model and Selection.....	6
4. Cautions for Installation	7
5. Electrical Wiring.....	12
6. Programming and Setup.....	15
7. Troubleshooting.....	19
8. Quick Installation.....	20

1. General Information

This manual will assist you in installing, using and maintaining your flow meter. It is your responsibility to make sure that all operators have access to adequate instructions about safe operating and maintenance procedure.



Warning

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

1. Use only fluids that are compatible with the housing material and wetted components of your vortex flowmeter.
2. When measuring flammable liquids, observe precautions against fire or explosion.
3. When handling hazardous liquids, always follow the liquid manufacturer's safety precautions.
4. When working in hazardous environments, always exercise appropriate safety precautions.
5. During vortex flowmeter removal, liquid may spill. Follow the liquid manufacturer's safety precautions for clean up of minor spills.
6. Handle the sensor carefully. Even small scratches or nicks can affect accuracy.
7. When tightening the vortex, use a wrench only on the wrench flats.
8. For best results, calibrate the meter at least 1 time per year.

1.1 Product Description

VFM-250 series Vortex flow meters are designed for measuring the volume/mass flow of liquids, gases and steam based on Karman vortex principle.

Adopting advanced differential algorithm along with measurement of isolation, shielding and wave filtering, VFM-250 series vortex flow meters have the advantages of immunity on vibration and noise. Meanwhile, the liabilities of VFM-250 series vortex flow meters are well guaranteed by unique sensor packaging technology.

Upon receipt, examine your meter for visible damage. The vortex flowmeter 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 vortex flow model meets your specific needs. For your future reference, it might be useful to record this information on nameplate in the manual in case it becomes unreadable on the vortex flowmeter. Refer to the nameplate for your customized product's specification.

2. Technical Data

Measuring system

Application range	(1) Gas; (2) Liquid; (3) Steam
Measured Value	
Primary measured value	Flow Rate
Secondary measured value	Volume flow ; (Pressure and Temperature is available for model with compensation)

Design

Features	
Modular construction	The measurement system consists of a flow sensor and a signal converter. It is available as compact and as separate version.
Compact version converter	N Type: Pulse output without local display
	A Type: 4-20mA Output without local display
	B Type: Local Display; Lithium Battery Power; No Output (Battery Part No.: ER26500)
	C Type: Local Display; 24V DC Power; 4-20mA Output; Optional Function: (1) Backup Power Supply: Lithium Battery (2) Modbus RS485 (3) Pulse Output
Connection	
	Flange: DN15-DN300
	Wafer: DN15-DN300
Measurement Ratio	Standard – 10:1

Measuring accuracy

Reference conditions	Flow conditions similar to EN 29104
	Medium: Water / Gas
	Electrical conductivity: $\geq 300 \mu\text{S/cm}$
	Temperature: +10...+30°C / +50...+86°F
	Inlet section: $\geq 10 \text{ DN}$
	Operating pressure: 1 bar / 14.5 psig
Flow Meter Accuracy	
	For Liquid: 1.0% of rate For Gas and Steam: 1.5% of rate

Operating conditions

Temperature	
Process temperature	T1 Level: -20...+70°C
	T2 Level: -20...+250°C
	T3 Level: -20...+350°C
Ambient temperature (all versions)	Standard (with aluminum converter housing):
	-10...+55°C
Storage temperature	-20...+70°
Pressure	
EN 1092-1	DN200...DN300: PN10
	DN100...DN200: PN 16
	DN15...DN80: PN 25
	Other pressures on request
ASME B16.5	1/2"...8": 150 lb RF
	Other pressures on request
JIS	1/2"...8": 10 K
	Other pressures on request

Installation conditions

Installation	Take care that flow sensor is always fully filled
	For detailed information see chapter "Cautions for Installation"
Flow direction	Forward
	Arrow on flow sensor indicates flow direction.
Inlet run	≥10 DN
Outlet run	≥5 DN

Materials

Sensor housing	SS304
	Other materials on request
Flanges	SS304
	Other materials on request
Converter Housing	Standard: polyurethane coated die-cast aluminum

Process connections

Flange	
EN 1092-1	DN15...300 in PN 6...25
ASME	1/2" ...12" in 150 lb RF
JIS	1/2" ...12" in 10...20K
Design of gasket surface	RF
	Other sizes or pressure ratings on request
Wafer	DN15...DN300

Measurable Flow Rate Range:

Note: The flow range as blow is for reference only. Consult the factory if you have special requirement. Refer to the nameplate or certificate for actual flow range.

Nominal Diameter		Liquid	Gas
(mm)	(in.)	Flow (m3/h)	Flow (m3/h)
15	1/2"	1.2 to 6.2	5 to 25
20	3/4"	1.5 to 10	8 to 50
25	1"	1.6 to 16	10 to 70
40	1-1/2"	2.5 to 25	22 to 220
50	2"	3.5 to 35	36 to 320
65	2-1/2"	6.5 to 65	50 to 480
80	3"	10 to 100	70 to 640
100	4"	15 to 150	130 to 1100
125	5"	25 to 250	200 to 1700
150	6"	36 to 380	280 to 2240
200	8"	62 to 650	580 to 4960
250	10"	140 to 1400	970 to 8000
300	12"	200 to 2000	1380 to 11000

3. Model and Selection

Model Selection (See Table 1)

Table 1: Model Selection Guidance for Vortex Flowmeter

Model Suffix Code									Description
VFM--250									
Connection	1								Flange
	2								Wafer
Fluid	1								Gas
	2								Liquid
	3								Steam
Diameter									Three Digitals; for example: 010: 10 mm; 015: 15 mm; 080: 80 mm; 100: 100 mm
Structure				Z					Compact Type
				F					Remote Type
Converter					N				No display; 24V DC; Pulse Output
					A				No display; 24V DC; 4-20mA Output
					B				Local display; Lithium Battery Power; No output
					C				Local display; 24V DC Power; 4-20mA Output; Optional backup power: Lithium Battery
					C1				Local display; 24V DC Power; 4-20mA Output; Modbus RS485 Communication Optional backup power: Lithium Battery
					D				Local display; 24V DC Power; 4-20mA Output; Modbus RS485 Communication Temperature and Pressure Compensation Refer to the photo on cover (Right One)
Explosion Rating					N				Safety Field without Explosion
					E				ExdIIBT6
Flange Standard							-DXX		DXX: D06, D10, D16, D25, D40 D06: DIN PN6; D10: DIN PN10 D16: DIN PN16; D25: DIN PN25 D40: DIN PN40
							-AX		AX: A1, A3, A6 A1: ANSI 150#; A3: ANSI 300# A6: ANSI 600#
							-JX		JX: J1, J2, J4 J1: JIS 10K; J2: JIS 20K; J4: JIS 40K
							-WF		Wafer Connection; Mating Flange included.
Fluid Temperature								-T1	-20...+70°C
								-T2	-20...+250°C
								-T3	-20...+350°C

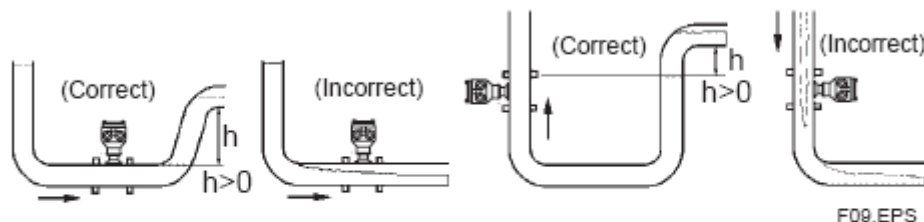
Model Code: LUGB-23-050-ZCN-WF-T2

Explanation – Wafer Connection; Fluid: Steam; Diameter: 50mm; Compact Type; Converter: 24V DC Power Supply, 4-20mA Output, Local Display; No Explosion; Fluid Temperature: -20...+250°C

4. Cautions for Installation

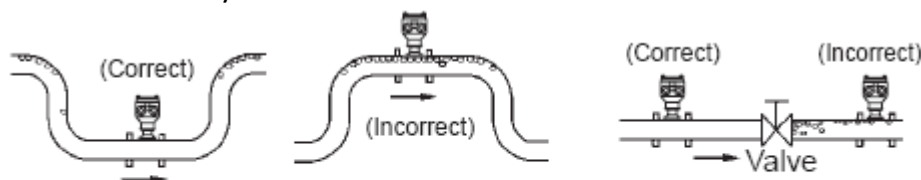
4.1 Mounting Positions

Pipes must be fully filled with liquids. It is essential that pipes remain fully filled at all times, otherwise flow rate indications may be affected and measurement errors may be caused.



Mounting Positions

Avoid Air Bubbles. If air bubbles enter a measurement pipe, flow rate indications may be affected and measurement errors may be caused.



Avoiding Air Bubbles

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

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

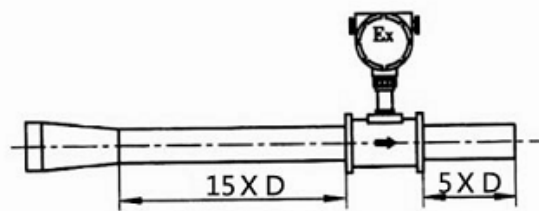
Install the meter with enough room for future access for maintenance purposes.



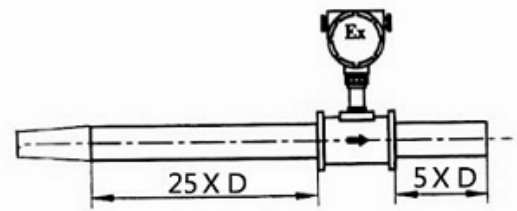
Warning: Precaution for direct sunshine and rain when the meter is installed outside.

4.2 Required Lengths of Straight Runs

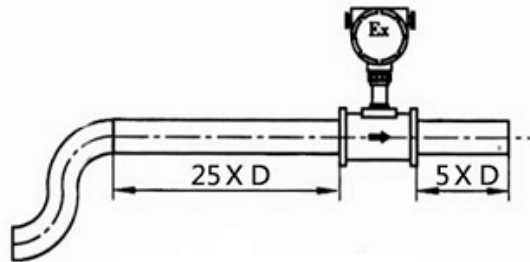
Flow altering device such as elbows, valves and reducers can affect accuracy. See diagram below for typical flow meter system installation.



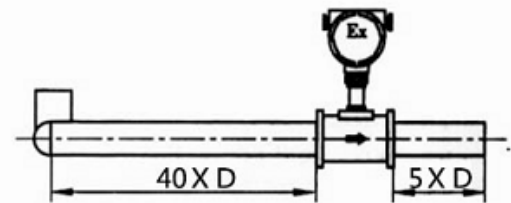
A. Reduced Pipe



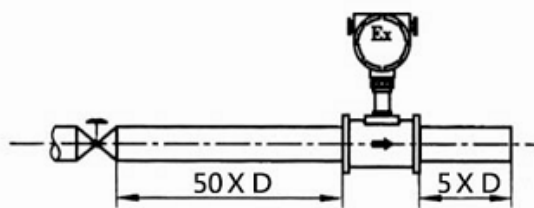
D. Expended Pipe



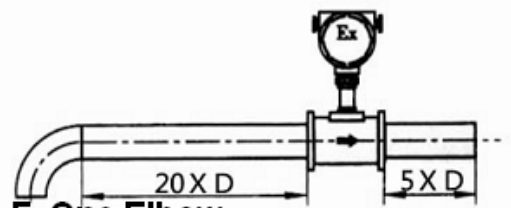
B. Two Elbows, In plane



E. Two Elbows, Out of plane



C. Regulating Valve



F. One Elbow

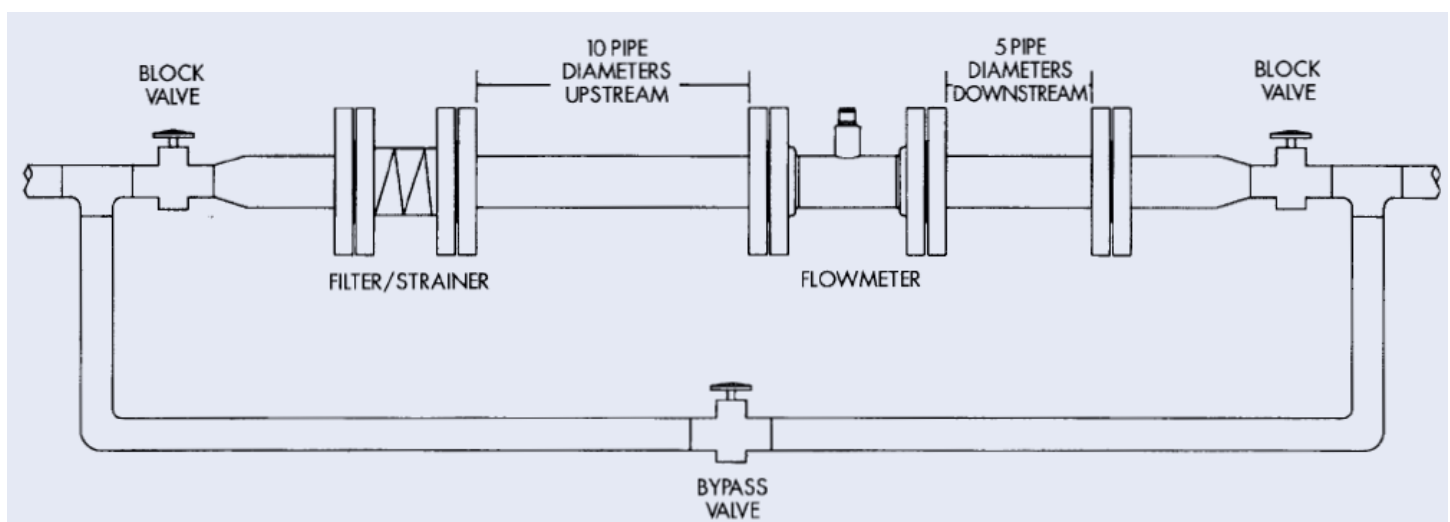


Diagram 1. Typical Flow Meter System Installation

The recommended guidelines are given to enhance accuracy and maximize performance. Distance given here are minimum requirements; double them for desired straight pipe lengths.

Upstream: allow a minimum straight pipe length at least 10 times the internal diameter of the pipe. For example, with the 50mm pipe, there should be 500mm of straight pipe immediately upstream. Desired upstream straight pipe length is 1000mm.

Downstream: allow a minimum straight pipe length at least 5 times the internal diameter of the pipe. For example, with the 50mm pipe, there should be 250mm of straight pipe immediately upstream. Desired upstream straight pipe length is 500mm.

4.3 Anti-Cavitation (When the fluid is liquid)

Cavitation can be caused by entrained air, and it can seriously damage the sensor on a vortex flow meter. An amount higher than about 100 mg/l of entrained air or gas can produce error. In addition, cavitation can be caused by too little backpressure on the flow meter. For vortex flow meters, you should provide a backpressure (downstream pressure) of at least 1.25 times the vapor pressure, plus 2 times the pressure drop through the flow meter. See formula 1.

$$\text{Formula 1: } P_b \geq 1.25 \times P_v + 2 \times (P_{in} - P_{out})$$

In formula 1: (Pb: Back pressure; Pv: Vapor Pressure; Pin: Inlet Pressure; Pout: Outlet Pressure)

Create backpressure by installing a control valve on the downstream side of the meter at the proper distance detailed above.

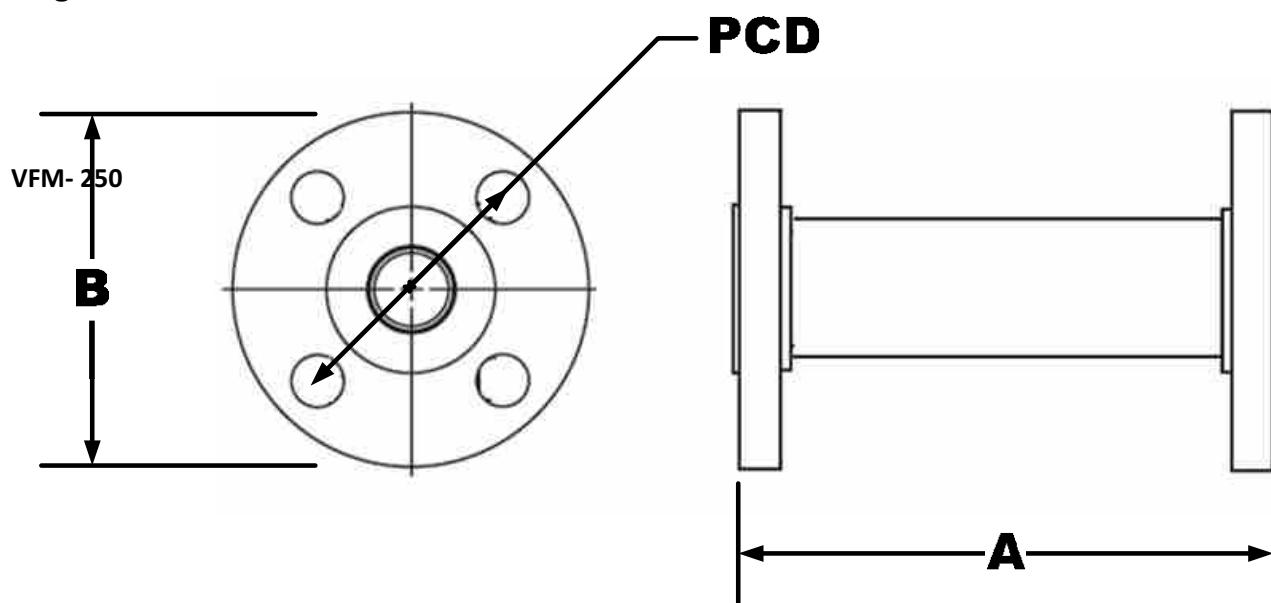


Special Notice

- ? When the fluid is liquid, to ensure accurate measurement, drain all air from the system before use.
- ? When the meter contains removable coverplates. Leave the coverplate installed unless accessory modules specify removal. Don't remove the coverplates when the meter is powered, or electrical shock and explosion hazard can be caused.

4.4 Connections

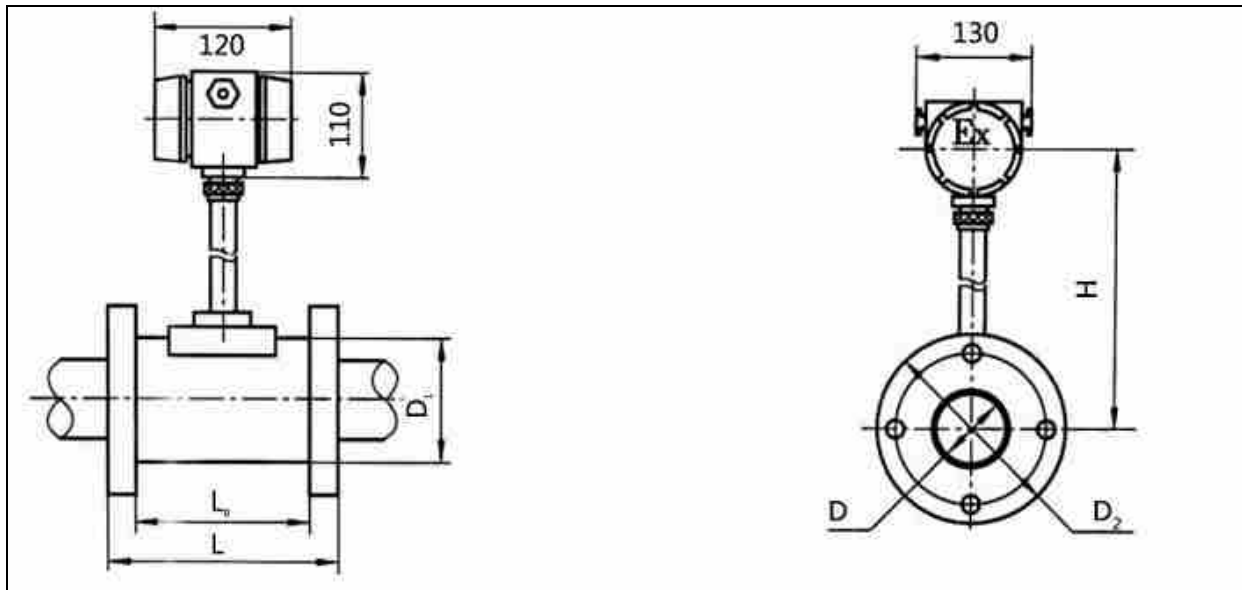
4.4.1 Flange Connection



DIN Flange Meter Dimensions							
Size Code		A	DIN Flange Pressure Rating	Flange Diameter (B)	Bolt Hole Diameter	Bolt Circle Diameter (PCD)	Bolt Hole Quantity
(inch)	(mm)	(mm)	MPa	(mm)	(mm)	(mm)	
1/2"	15	180	1.6	95	14	65	4
3/4"	20	180	1.6	105	14	75	4
1"	25	180	1.6	115	14	85	4
1-1/4"	32	180	1.6	140	14	100	4
1-1/2"	40	180	1.6	150	18	110	4
2"	50	180	1.6	165	18	125	4
2-1/2"	65	180	1.6	185	18	145	4
3"	80	200	1.6	200	18	160	8
4"	100	220	1.6	220	18	180	8
5"	125	240	1.6	250	18	210	8
6"	150	270	1.6	285	22	240	8
8"	200	300	1.6	340	22	295	12
10"	250	320	1.6	405	26	355	12
12"	300	350	1.6	460	26	410	12

Note: For model with temperature and pressure compensation, the flowmeter length should be increased 50mm compared to the value (A) in table above.

4.4.2 Wafer Connection



Diameter: D (mm)	Pipe Specification	H	L	L0	D1	D2
15	Φ19×1.5	290	116	80	68	135
20	Φ26×3	290	116	80	68	135
25	Φ32×3.5	290	116	80	68	135
40	Φ49×4.5	295	116	80	80	140
50	Φ59×4.5	300	116	80	88	145
65	Φ74×4.5	308	116	80	105	165
80	Φ89×4.5	315	116	80	120	180
100	Φ109×4.5	328	118	80	148	210
125	Φ133×4.5	340	124	85	174	235
150	Φ159×4.5	351	135	90	196	270
200	Φ219×9	378	150	105	250	325
250	Φ273×11	402	166	120	300	375
300	Φ325×12	428	185	135	350	425

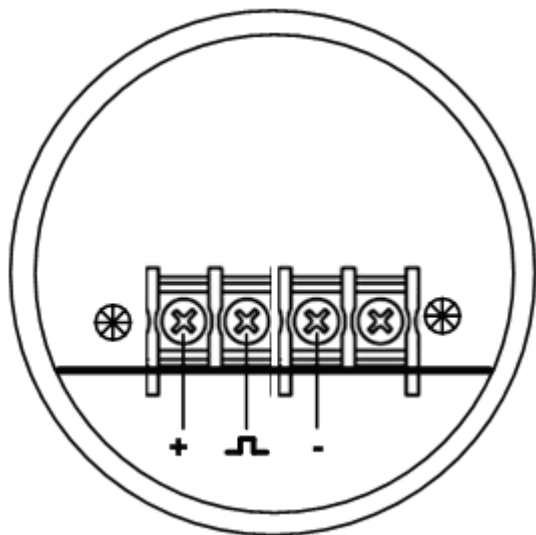
5. Electrical Wiring



Warning: Electrical Hazard
Disconnect power before beginning wiring.

5.1 VFM -250-N; Pulse Output, explosion proof model.

Terminal Configuration

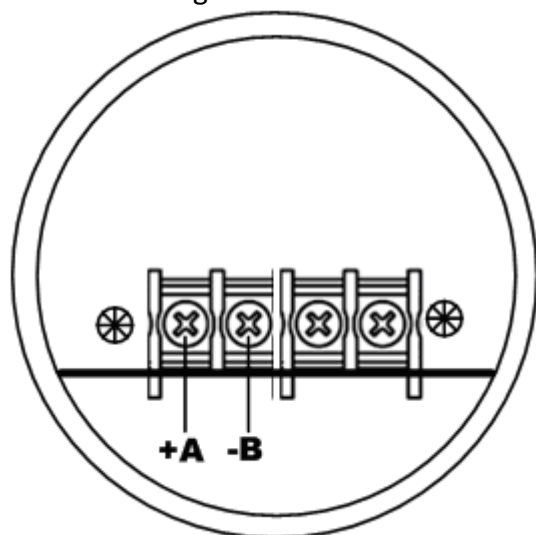


Terminal Wiring

Terminal Symbols	Description
+	Power Supply: "24V+"
-	GND
	Pulse Output

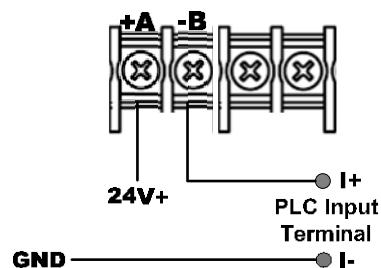
5.2 VFM - 250 -A; two-wire 4-20mA Output, No Local Display.

Terminal Configuration



Terminal Wiring

Terminal Symbols	Description
+A	Power Supply: "24V+"
-B	Current Output

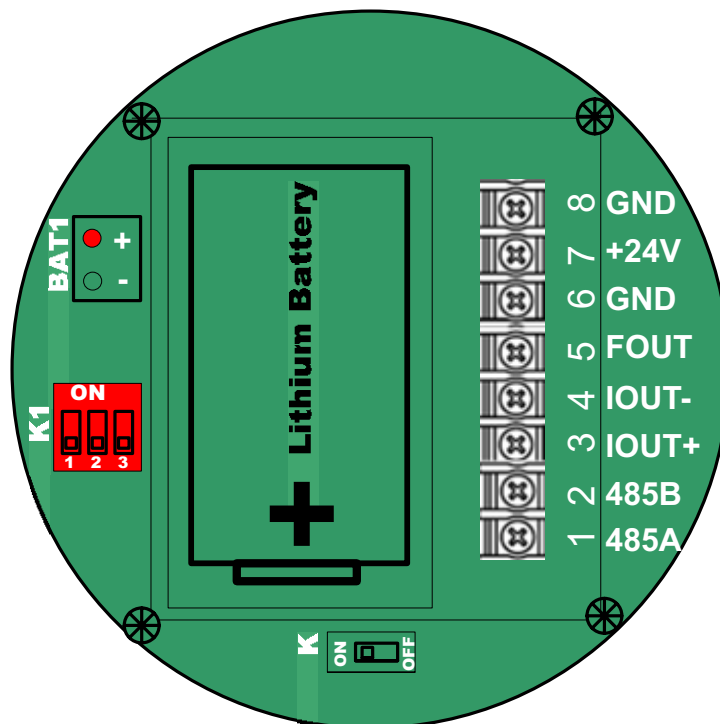


5.3 VFM-250 -B, VFM-250 -C,VFM –250 C1; Local Display

Note: Terminal configuration is same for LUGB B, LUGB C, LUGB C1, but some functions are ONLY available on specified model. The table lists the function of each model.

Function List for converter with local display						
Model	Primary Power Supply	Optional Dual Power Supply	Output	Optional Dual Output	Communication	Note
VFM-250-B	Lithium Battery	Not Available	Not Available	Not Available	Not Available	
VFM-250-B	24V DC	Lithium Battery	4-20mA	Pulse	Not Available	Output is only available when 24V Power supply is on.
VFM-250-C1	24V DC	Lithium Battery	Pulse	Not Available	Modbus RS485	

Terminal Configuration



DIP Switch: K1			
Function	1	2	3
Original Pulse Output	ON	OFF	OFF
Scaled Pulse Output: 1 m3 / Pulse	OFF	ON	OFF
Scaled Pulse Output: 1L/Pulse; 10L/Pulse; 100L/Pulse Configure it in parameter setting	OFF	OFF	ON

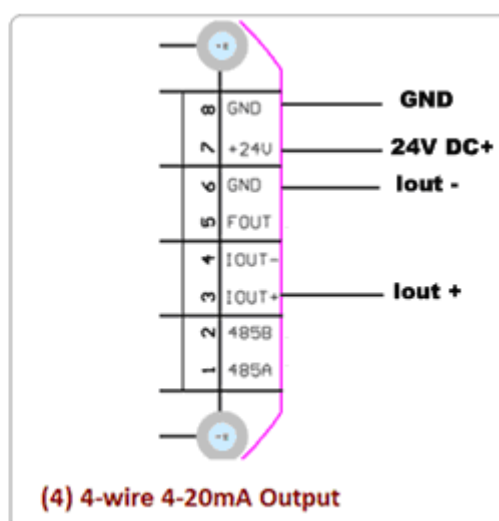
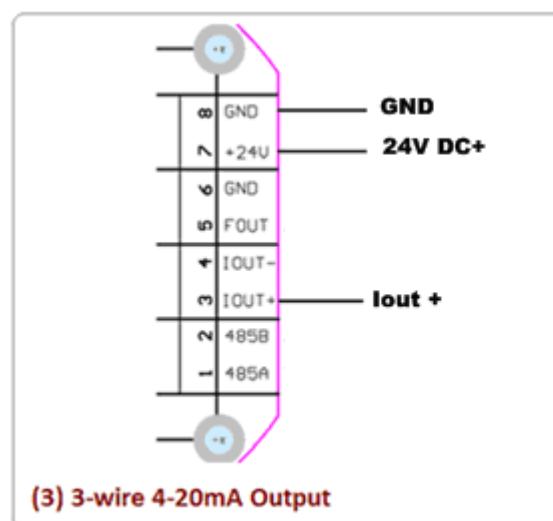
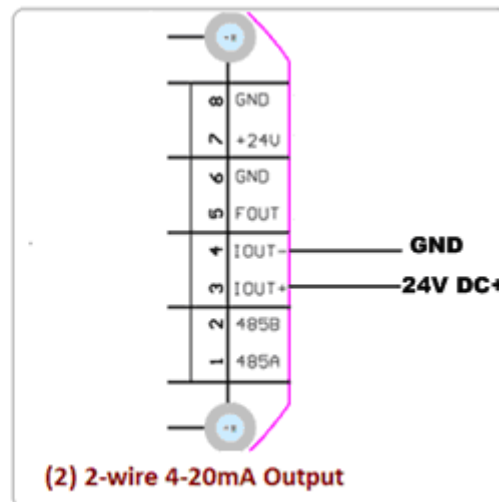
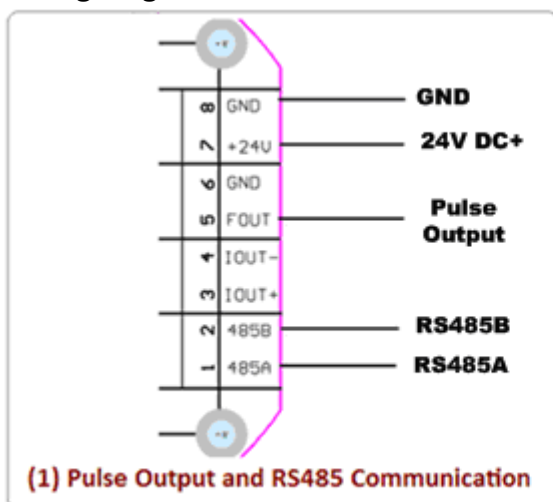
Terminal Wiring

5.3.1 VFM-250 -B:if the display is blank, put the plug of battery into the battery socket (BAT1).

5.3.2 VFM-250 -C, VFM-250 -C1

Model	Function (Optional)	Terminal Code	Terminal Symbols	Description
LUGB-C	(2 wires) 4-20mA Output	3	IOUT+	24V DC+
		4	IOUT-	GND
	(3 wires) 4-20mA Output	7	+24V	24V+ DC Power Supply
		8	GND	GND
		3	IOUT+	Current Output 4-20mA DC (+)
	(4 wires) 4-20mA Output	7	+24V	24V+ DC Power Supply
		8	GND	GND
		3	IOUT+	Current Output (+) Iout+
		6	GND	Current Output (-) Iout-
LUGB-C1	Pulse Output and RS485 Communication	7	+24V	24V+ DC Power Supply
		8	GND	GND
		5	FOUT	Pulse output+
		6	GND	Pulse output-
		1	485A	RS485+
		2	485B	RS485-

Electrical Wiring Diagram



6. Programming and Setup



All flowmeters are tested and calibrated prior to leaving the factory, and the unique K-factor is provided on the calibration certificate. Keep the calibration certificate well to avoid the loss of K-factor.

6.1 VFM-250 -N; No display; Pulse Output

Customer should set the correct K-factor into PLC or Flow totalizer in order to get the correct flow rate.

6.2 VFM-250 -A; No display; 4-20mA Output

Only perform the Zero Point Calibration where it's necessary.

6.2.1 Zero Point Calibration

- (1) Shut off the valve where the flowmeter is installed, ensure there is no flow rate in pipe.
- (2) Put high accuracy amperometer into the circuit loop as series connection.
- (3) Adjust the potentiometer W502 to make sure the display on amperometer is 4mA.

6.2.2 Full Scale Calibration: it's ONLY available for factory; return the flowmeter to factory for full scale calibration where is applicable.



6.3 VFM-250 -B, VFM-250 -C, VFM-250 -C1; Local Display

Note: all menus are present in all signal converter versions, but some parameter settings are ONLY valid for specified models.

6.3.1 Display and Keys



- ① Flow Rate
- ② Total Flow
- ③ Keys (See table below for function and representation in text)

Key	Measuring mode	Menu mode	Sub-menu or function mode	Parameter and data mode
Enter	1. Display the frequency corresponding to flow rate 2. Enter the parameter setting mode	Select menu	Press 1 time, return to menu mode, data saved	Save the value and advance to next menu
	-	-	-	For numerical values, move cursor one position to the right or left
	-	-	Select sub-menu or function	Use cursor highlighted to change number, unit, setting
Esc -		Return to measuring mode but prompt whether the data should be saved	Return to measuring mode but prompt whether the data should be saved	Return to measuring mode but prompt whether the data should be saved
Note: Data are not saved when press “Esc” to return to measuring mode. If the value need to be changed, press “Enter” to save value first				

6.3.2 Parameters Set

Press “Enter” two times at measuring mode, it leads to Password Menu “- - - -”.

- (1) Input correct password and press “Enter” can start parameter setting.
- (2) Press “Enter” again and no password is input can ONLY view all parameters

The total menus in “Parameters Set” are 16, and users can access and modify these menus depending on the input password grade. See table below for more information on password grade.

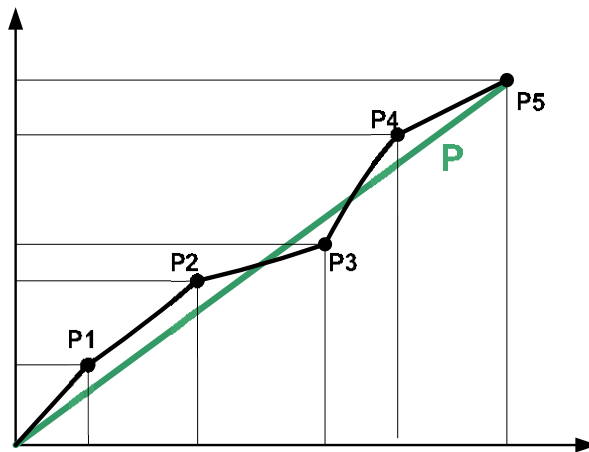
Table. Description of Password Grade

Password Grade	Password	Login Privileges
Grade 1	No Password Requirement	Read Only
Grade 2	1234	Read and Edit
Grade 3	5678	Save all data as factory defaults
Grade 4	1111	Reload factory defaults

Note: parameter setting can be ONLY performed by authorized engineer, as parameter change can affect the accuracy of the flowmeter.

Specific Menu – Parameters Set

Menu	Parameter Name	Setting Method	Grades	Range
F---01	Flow Rate Unit	Select Parameter	Factory ONLY	1; 2; 3
F---02	Scaled Pulse Output In Liters	Select Parameter	User	1: 1 Liter/Pulse 10: 10 Liter/Pulse 100: 100 Liter/Pulse
F---03	Damping Time	Input Value	User	Unit: Second Value: 1-10
F---04	Maximum Flow Rate	Input Value	User	Unit: same as Flow Rate
F---05	Minimum Flow Rate	Input Value	User	Unit: same as Flow Rate
F---06	Maximum Frequency Output	Input Value	User	0-3000 Hz Accuracy: 0.1Hz
F---07	Baud Rate	Select Parameter	User	1200; 2400; 4800; 9600; 19200 Data Format: n; 8; 1
F---08	Device Address	Input Value	User	01-99
F---09	Frequency Output Mode	Select Parameter	User	1; 2
F---10	Total Flow Reset	Input Value	User	Reset the new value and press "Enter" to confirm the change promptly.
P1	Linearization of the Flowcurve: point 1	Input Value	Factory ONLY	First Row: Frequency (P1) Second Row: K-Factor (P1)
P2	Linearization of the Flowcurve: point 2	Input Value	Factory ONLY	First Row: Frequency (P2) Second Row: K-Factor (P2)
P3	Linearization of the Flowcurve: point 3	Input Value	Factory ONLY	First Row: Frequency (P3) Second Row: K-Factor (P3)
P4	Linearization of the Flowcurve: point 4	Input Value	Factory ONLY	First Row: Frequency (P4) Second Row: K-Factor (P4)
P5	Linearization of the Flowcurve: point 5	Input Value	Factory ONLY	First Row: Frequency (P5) Second Row: K-Factor (P5)
P	Average	Input Value	Factory ONLY	First Row: Frequency (P) Second Row: K-Factor (P)



Linearization

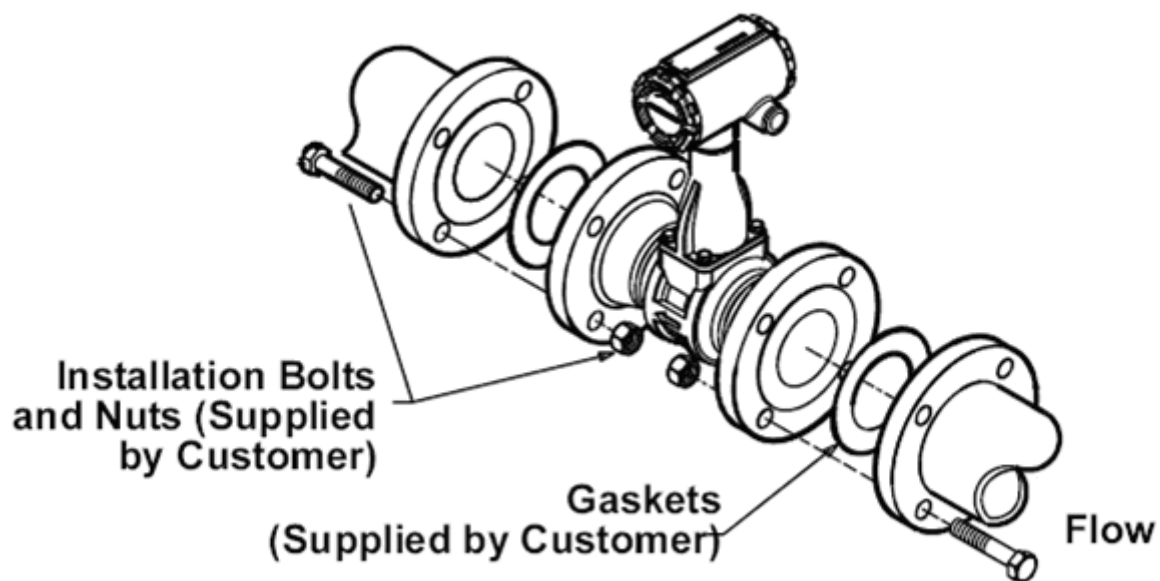
6.3.3 Parameter Function Table

No.	Function	Settings / descriptions
F---01	Flow Rate Unit	Selectable: 1, 2, 3 1: m3; 2: Liter; 3. Factory Reserved Consult the factory first to change the unit, as the K-factor should also be changed.
F---02	Scaled Pulse Output In Liters	Selectable: 1, 10, 100 1: 1 liter/Pulse; 10: 10 Liters/Pulse; 100: 100 Liters/Pulse Only valid for model supporting Pulse Output; and Position 3 of DIP Switch is ON, others two are OFF.
F---03	Damping Time	Value: 1-10 second; Recommended Value: 4 Second
Flow Range		
F---04	Maximum Flow Rate	Unit: same as Flow Rate
F---05	Minimum Flow Rate	Unit: same as Flow Rate
Frequency Output		
F---06	Maximum Frequency Output	Value: 0-3000 Hz Accuracy: 0.1Hz
RS485 Communication		
F---07	Baud Rate	Selectable: 1200; 2400; 4800; 9600; 19200 (Unit: Hz)
		Default Data Format: 9600, n, 8, 1
F---08	Device Address	Value: 01-99
F---09	Frequency Output Mode	Selectable: 1, 2
		1: Original Pulse Output without linearization
		2: Corrected Pulse Output after linearization
Reset Total Flow		
F---10	Total Flow Reset	Reset the new value and press “Enter” to confirm the change promptly.
Linearization		
P1	Linearization of the Flowcurve: point 1	First Frequency (P1) Second Row: K-Factor (P1)
P2	Linearization of the Flowcurve: point 2	First Frequency (P2) Second Row: K-Factor (P2)
P3	Linearization of the Flowcurve: point 3	First Frequency (P3) Second Row: K-Factor (P3)
P4	Linearization of the Flowcurve: point 4	First Frequency (P4) Second Row: K-Factor (P4)
P5	Linearization of the Flowcurve: point 5	First Row: Frequency (P5) Second Row: K-Factor (P5)
P	Average K-Factor	First Row: Frequency (P) Second Row: K-Factor (P)

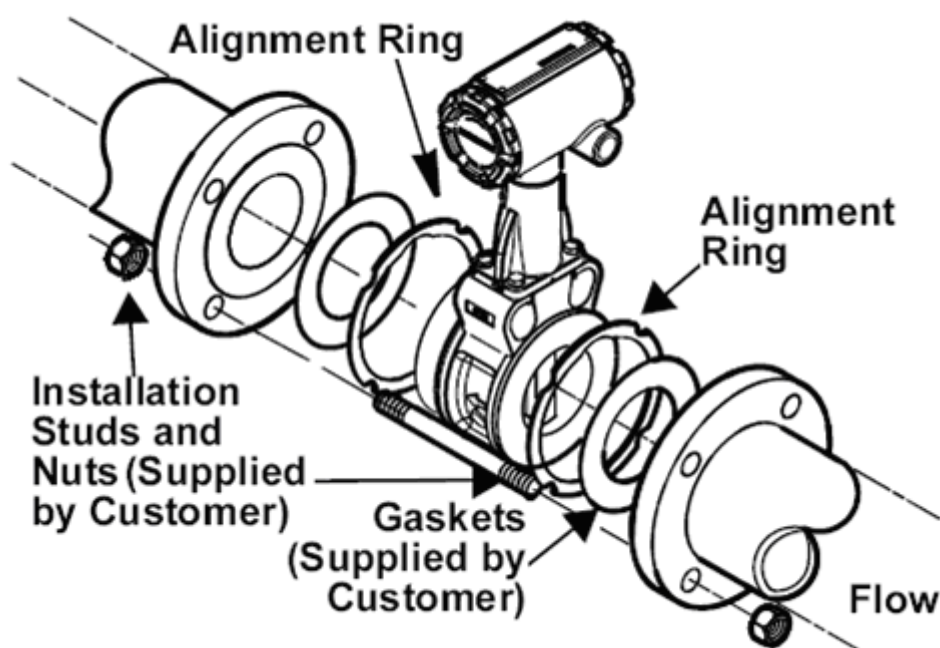
7. Troubleshooting

Symptom	Probable Cause	Solution
Measurement is not accurate	1. Parameter wrong	Check the parameters (Transmitter, detector factor and size)
	2. Pipe is not fully filled	Check if meter is fully filled
Flow rate indication is unstable	1. Vibration Problem	Add support to the line near the meter to damp the vibration
	2. Air	Make sure fluid does not contain air bubbles when fluid is liquid
	3. Amplifier location – outside electrical interference	Make sure amplifier is not too close to sources of electrical interference
No Display	1. No power	Apply correct power
	2. Incorrect power	Check power value
	3. Wiring connections	Check power input/output connections

8. Quick Installation



Flange-Style Flow Meter Installation



Wafer-Style Flow Meter Installation

Users



INDIA



SAUDI ARABIA



SINGAPORE



UAE



USA



INDONESIA



MALAYSIA

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