Technical Data Sheet

BTF-2100
Liquid Turbine Flow Sensor

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 meter.
2. When measuring flammable liquids, observe precautions against fire or explosion.
3. When handling hazardous liquids, always follow the fluids manufacturer's safety precautions.
4. When working in hazardous environments, always exercise appropriate safety precautions.
5. During meter removal, fluids may spill. Follow the fluids manufacturer's safety precautions for clean up of minor spills.
6. Do not blow compressed air through the turbine.
7. Handle the rotor carefully. Even small scratches or nicks can affect accuracy.
8. When tightening the turbine, use a wrench only on
9. For best results, calibrate the meter at least 1 time the wrench flats per year.

1.1 Product Description

Operating Principle:

Liquid flows through the turbine housing causing an internal rotor to spin. As the rotor spins, an electrical signal is generated in the pickup coil. This signal is converted into engineering units (liters, cubic meters,gallons etc.) on the local display where is applicable. Optional accessory modules can be used to export the signal to other equipment.

Upon receipt, examine your meter for visible damage. The turbine is a precision measuring instrument andshould 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 turbine 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 turbine. Refer to the nameplate for your customized product's specification.

2. Technical data

Measuring system:

Application range	Liquid: water; diesel; gasoline
	(1) Without Impurity
	(2) Low viscosity
Measured Value	
Primary measured value	Flow Rate
Secondary measured value	Volume flow

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
	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	Thread: DN4-DN50
	Flange: DN15-DN200 (DIN, ANSI, JIS)
	Wafer: DN15-DN100
Measurement Ratio	Standard – 10:1; Optional– 20:1

Process connections:

Flange	
EN 1092-1	DN15...200 in PN 6...40
ASME	1/2"...8" in 150 lb RF
JIS	1/2"...8" in 10...20K
Design of Gasket Surface	RF
Other sizes or pressure ratings on request	
Thread	DN4...DN50 in PN63

Measuring range table:

Nominal Diameter	Standard Flow Range	Extended Flow Range	
(mm)	(In.)	(m^3/h)	(m^3/h)
4	0.15	0.04 to 0.25	0.04 to 0.4
6	0.25	0.1 to 0.6	0.06 to 0.6
10	0.4	0.2 to 1.2	0.15 to 1.5
15	0.5	0.6 to 6	0.4 to 8
20	0.75	0.8 to 8	0.45 to 9
25	1	1 to 10	0.5 to 10
32	1.25	1.5 to 15	0.8 to 15
40	1.5	2 to 20	1 to 20
50	2	4 to 40	2 to 40
65	2.5	7 to 70	4 to 70
80	3	10 to 100	5 to 100
100	4	20 to 200	10 to 200
125	5	25 to 250	13 to 250
150	6	30 to 300	15 to 300

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

Measuring accuracy:

Reference Conditions	Flow conditions similar to EN 29104
	Medium: Water
	Electrical conductivity: ≥ 300 µS/cm
	Temperature: +10...+30°C / +50...+86°F
	Inlet section: ≥ 10 DN
	Operating pressure: 1 bar / 14.5 psig
Flow Meter Accuracy	Standard: 1.0% of rate
	Optional: 0.5% of rate

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		
Rotor			
Standard: 2Cr13	EN10088-3	1. 4021	X20Cr13
	ANSI	420	
	BS	420S37	
	JIS	SUS410J1	
Optional: CD4MCU	DN15...DN80		
Bearing and Shaft	Tungsten Carbide		
Converter Housing	Standard: polyurethane coated die-cast aluminum		

3. Cautions for installation

3.1 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.

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

★ 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.

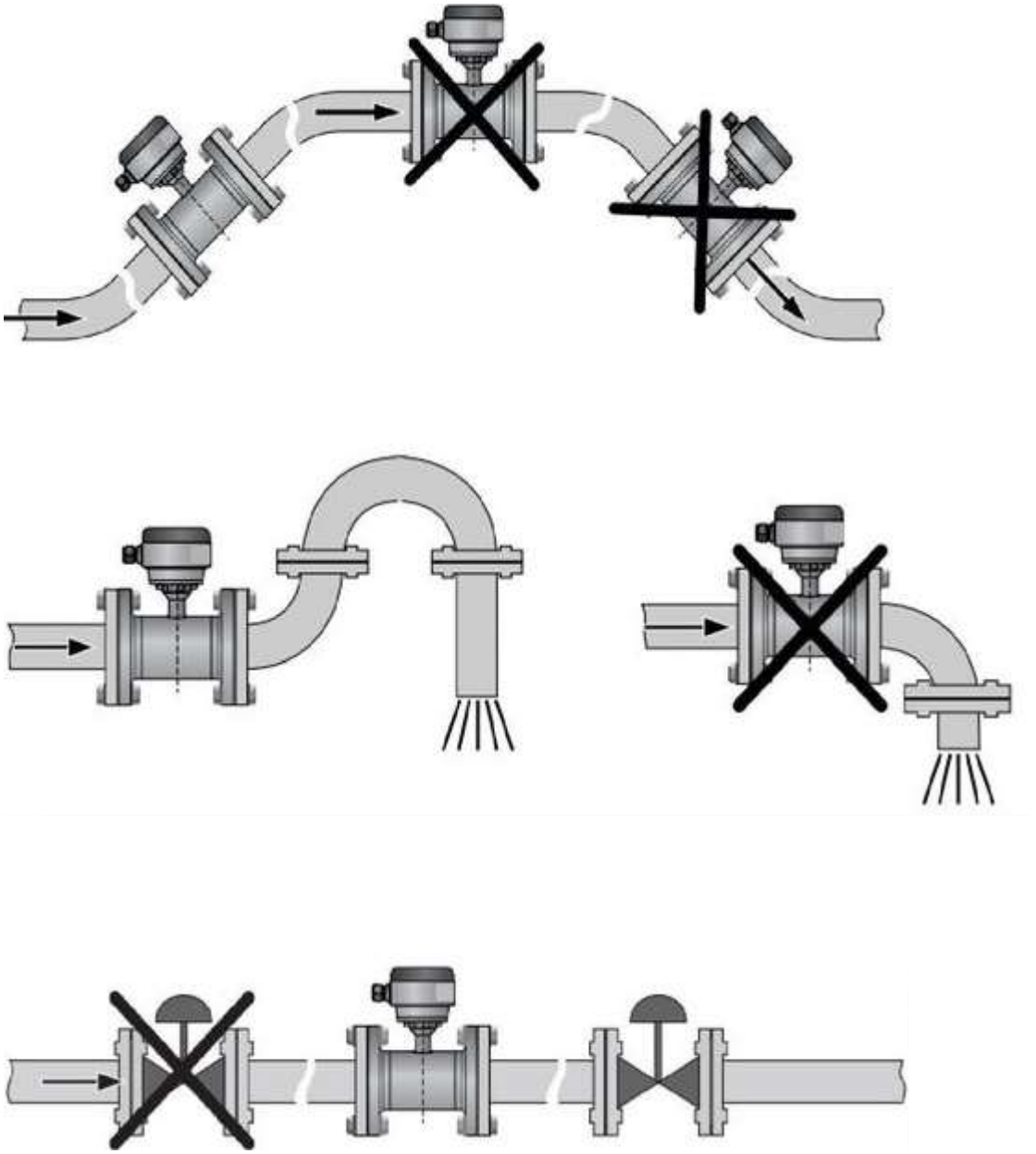
★ Install the meter with enough room for future access for maintenance purposes.

Warning

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

3.2 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.



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

★ 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 downstream straight pipe length is 500mm.

★ 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 downstream straight pipe length is 1000mm.

3.3 Anti-Cavitation

Cavitation can be caused by entrained air. 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 our turbine 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.

Formula 1: Pb ≥ 1.25×Pv + 2× (Pin – Pout)

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 Notes:

Foreign material in the liquid being measured can clog the meter's rotor and adversely affect accuracy. If this problem is anticipated or experienced, install screens to filter impurities from incoming liquids.

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.

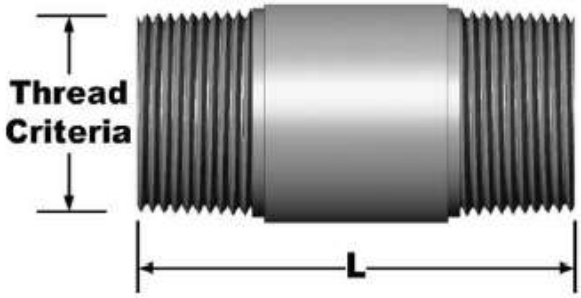
3.4 Connections

3.4.1 Thread Connection

Note:

Default Thread is Male G Thread, other thread are available on request. For example: Female NPT Thread, Male NPT Thread; Consult us for more information.

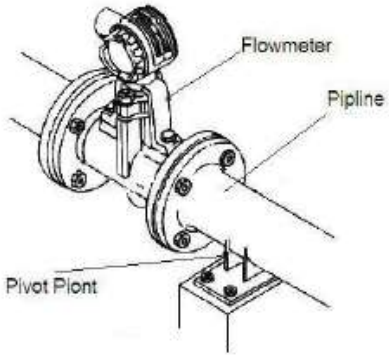
DN4…DN10: Straight runs and filter are included in the length for DN4 to DN10

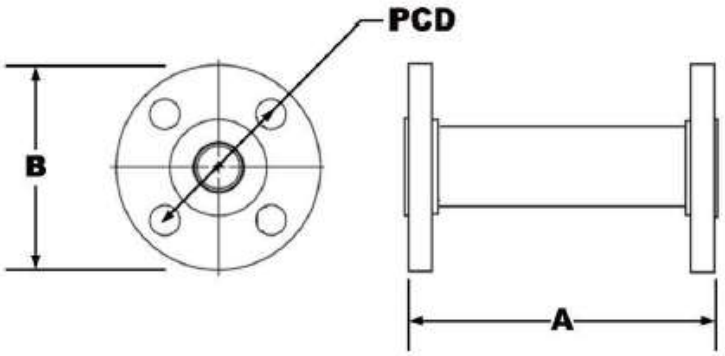


Diameter (mm)	L (mm)	Thread Criteria
4	270	G½"
6	270	G½"
10	390	G½"
15	75	G1"
20	80	G1"
25	100	G1-¼"
32	140	G2"
40	140	G2"
50	150	G2-½"

3.4.2 Flange Connection

Flange	
EN1092-1	DN15...200 in PN 6...40
ASME	1/2″. . 8″ in150lb RF
JIS	1/2"...8" in 10...20k
Design of gasket surface	RF
	Other sizes or pressure ratings on request



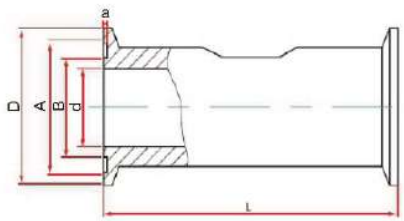


ANSI Flange Meter Dimensions							
Size Code		A	ANSI Flange Rating Class	Flange Diameter (B)	Bolt Hole Diameter	Bolt Circle Diameter (PCD)	Bolt Hole Quantity
(Inch)	(mm)	(mm)		(mm)	(mm)	(mm)	
1/2"	15	75	150	89	16	60	4
3/4"	20	80	150	99	16	70	4
1"	25	100	150	108	16	79	4
1-1/4"	32	140	150	115	16	89	4
1-1/2"	40	140	150	127	16	99	4
2"	50	150	150	152	19	121	4
2-1/2"	65	170	150	180	19	140	4
3"	80	200	150	191	19	152	4
4"	100	220	150	229	19	191	8
5"	125	250	150	255	22	216	8
6"	150	300	150	279	22	241	8
8"	200	360	150	343	22	298	8

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	75	2.5	95	14	65	4
3/4"	20	80	2.5	105	14	75	4
1"	25	100	2.5	115	14	85	4
1-1/4"	32	140	2.5	140	14	100	4
1-1/2"	40	140	2.5	150	18	110	4
2"	50	150	2.5	165	18	125	4
2-1/2"	65	170	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	250	1.6	250	18	210	8
6"	150	300	1.6	285	22	240	8
8"	200	360	1.6	340	22	295	12

3.4.2 Sanitary Connection

a	DN4-DN40	1mm
	DN50-DN80	1.5mm
	DN100	2mm



Inch / Diameter (mm)	D (mm)	A (mm)	B (mm)	d (mm)	L (mm)
DN4	50.5	46	40.5	4	100
DN6				6	
DN10				10	
DN15				15	
DN20				20	
DN25				25	
DN32				32	120
DN40	64	59	54	40	140
DN50	77	73.5	68.5	50	150
DN65	91	86	80.5	65	170
DN80	106	94	94	80	200
DN100	119	106	106	100	220

4. Electrical wiring

Warning

Disconnect power supply before beginning wiring.

Pulse Output, Basic Model

Cable Color	Terminal Symbols	Description
Red Wire	Power (+)	Power Supply: "24V+"
White Wire	Common	GND
Yellow Wire	Pulse(+)	Pulse Output

Pulse Output, Explosion Proof Model.

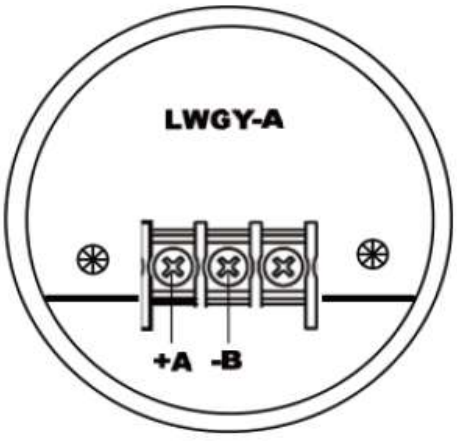
Terminal Configuration

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

Terminal Wiring

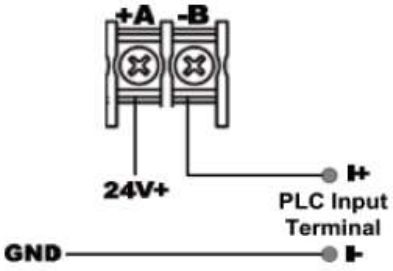
Two-wire 4-20mA Output, No Local Display

Terminal Configuration

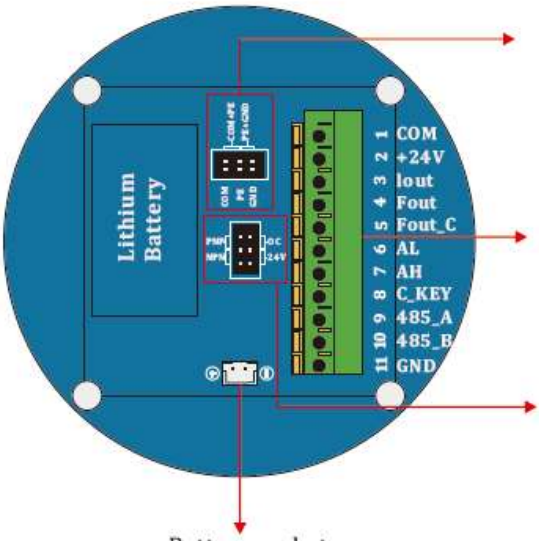


Terminal Wiring

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

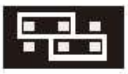


Terminal board of E type



If the signal is interfered at working site, please try to short the terminals as following drawing(a). After "a" step, if the situation is not improved, please short the terminals as drawing(b)

a



b

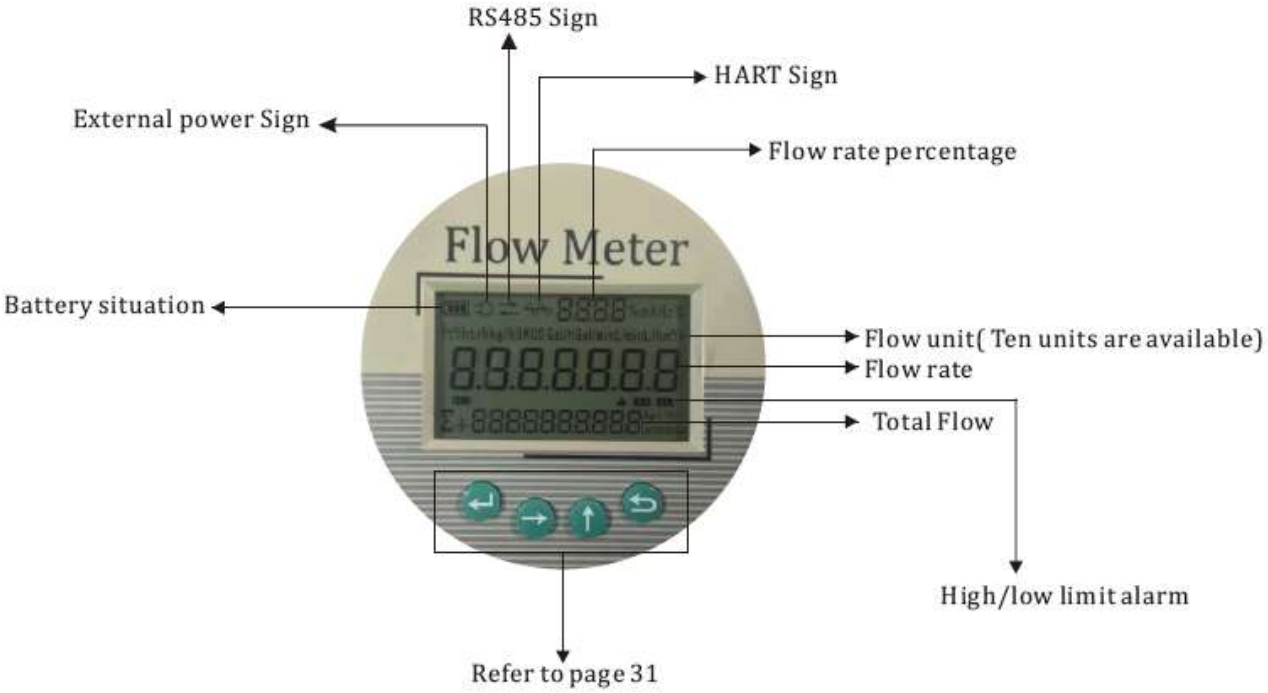
Wire terminals

The PNP, NPN and OC output could be chosen by shorten the followingterminals.

PNP output **NPN output** **OC output**

Battery socket

5. Display and keys



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				

5.1 Parameter Settings

Menu	Parameter name	Setting Method	Grades	Range		
				Value	Flow Rate Unit	Total Rate Unit
P--1	Unit	Select Parameter	User	0	m^3/h	m^3
				1	L/h	L
				2	L/min	m^3
				3	US Gal/min	US Gal
				4	UK Gal/min	UK Gal
				5	US Gal/h	US Gal
				6	UK Gal/h	UK Gal
				7	Kg/h	Kg
				8	t/h	t
				9	ft^3/h	ft^3
P--2	Damping Time	Input Value	User	Unit: Second Value: 0-9		
P--3	Maximum Flow Rate	Input Value	User	Unit: The same as Flow Rate		
P--4	Minimum Flow Rate	Input Value	User	Minimum flow rate(when the flow rate is lower than it, the flow rate will show 0); Unit: The same as Flow Rate		

Menu	Parameter name	Setting Method	Grades	Range	
P--5	Maximum Frequency output	Input Value	User	Accuracy: 0.1Hz	
P--6	Relative density	Input Value	User	Relative density: 1(water density at 4 ℃)	
P--7	Frequency Output Mode	Select Parameter	User	0: No Frequency output	
				1: Corrected Pulse output after	
				2: Scaled Pulse output	
P--8	Scaled-pulse output	Select Parameter	User	0.01	0.01L/Pulse
				0.1	0.1L/Pulse
				1	1L/Pulse
				10	10L/Pulse
				100	100L/Pulse
P--9	Pulse width	Input Value	User	The value should be multiple of 10; The units is ms	
P--10	Communication	Select Parameter	User	0: RS485	
				1: Hart	

Menu	Parameter Name		Setting Method	Grades	Range
P--11	RS485	Address:	Input	User	Max is 255
		Baud Rate:	Select Parameter	User	1200, 2400, 4800, 9600, 19200
		Verification:	Select Parameter	User	N(No verify)
					O(Odd verify)
					E(Even Verify)
		Data Length	Select Parameter	User	7,8
		Stop bits length	Select Parameter	User	1, 2
	Hart	Device Address	Select Parameter	User	
P--12	High Limit Alarm		Select Parameter	User	Yes: On
					1%-100%: Percentage of upper limit flow rate
P--13	Low Limit Alarm		Select Parameter	User	1%-100%: Percentage of upper limit flow rate
P--14	Backlight		Select Parameter	User	0: Off Backlight
					1: Automatic mode
					2: ON mode
P--15	Total Rate		Input value	User	It could be modified with right code

Menu	Parameter Name	Setting Method	Grades	Range
P--16 F--1	Linearization of the Flowcurve: point 1	Input value	Factory ONLY	First Row: Frequency (P1) Second Row: K-Factor (P1)
P--17 F--2	Linearization of the Flowcurve: point 2	Input value	Factory ONLY	First Row: Frequency (P2) Second Row: K-Factor (P2)
P--18 F--3	Linearization of the Flowcurve: point 3	Input value	Factory ONLY	First Row: Frequency (P3) Second Row: K-Factor (P3)
P--19 F--4	Linearization of the Flowcurve: point 4	Input value	Factory ONLY	First Row: Frequency (P4) Second Row: K-Factor (P4)
P--20 F--5	Linearization of the Flowcurve: point 5	Input value	Factory ONLY	First Row: Frequency (P5) Second Row: K-Factor (P5)
P--21 F--6	Linearization of the Flowcurve: point 6	Input value	Factory ONLY	First Row: Frequency (P6) Second Row: K-Factor (P6)
P--22 F--7	Linearization of the Flowcurve: point 7	Input value	Factory ONLY	First Row: Frequency (P7) Second Row: K-Factor (P7)
P--23 F--8	Linearization of the Flowcurve: point 8	Input value	Factory ONLY	First Row: Frequency (P8) Second Row: K-Factor (P8)
P--24 F--9	Average K-Factor	Input value	Factory ONLY	First Row: Frequency (P) Second Row: K-Factor (P)

6. Troubleshooting

Symptom	Probable Cause	Solution
More Volume/ Output than displayed or registered	1. Rotor may drag due to foreign matter obstruction.	Check for debris inside the meter. Clean and reassemble.
	2. Magnetic pickup not screwed down all the way into the turbine flowmeter body. This causes it not to detect all the rotor blades as they pass	Screw the magnetic pickup all the way down into the turbine flow-meter body. Hand-tighten only.
	3. Turbine flowmeter rotor installed backward	Install the flowmeter in accordance with the process flow direction
	4. Turbine flowmeter rotor installed backwards	Install the flowmeter rotor in accordance with the process flow direction
	5. K-factor is too high in electronic/readout device	Verify K-factor used. K-factor should be decreased.
Less volume/ Output than displyed or registered	1. Caused by trapped air in the process line	Install an air eliminator upstream of turbine flowmeter
	2. K-factor is too low in electronic/readout device	Verify K-factor used. K-factor should be increased.
Flow rate indication is unstable	1. Battery Power Type: Bad contact on the connector between battery and PCB	Open back cover and repower the flow meter
	2. DC Power Type: supply voltage is abnormal	Check and ensure power supply is 24V DC