

USER MANUAL
FLOW MEASUREMENT

HOLYKELL.COM

Liquid Turbine Flow Meter

User Manual



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Warning

When the flow meter is installed at explosion hazard field, **DON'T remove the COVERPLATE when the meter is powered.** Please make parameter setting at safe filed prior to installation.



Special Notices

Pictures & Descriptions are for your information only, please refer to the actual product. Parameters are subjected to changes without notice.

1.0 GENERAL INFORMATION

This manual will assist you in installing, using and maintaining your turbine flow meter. It is your responsibility to make 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

Use only fluids that are compatible with the housing material and wetted components of your turbine.

When measuring flammable liquids, observe precautions against fire or explosion.

When handling hazardous liquids, always follow the liquid manufacturer's safety precautions.

When working in hazardous environments, always exercise appropriate safety precautions.

During turbine removal, liquid may spill. Follow the liquid manufacturer's safety precautions for clean up of minor spills.

Do not blow compressed air through the turbine.

Handle the rotor carefully. Even small scratches or nicks can affect accuracy.

When tightening the turbine, use a wrench only on the wrench flats.

For best results, calibrate the meter at least 1 time per year.

Product Description

HLY series turbine flow meters have the features: high accuracy, good repeatability, convenient installation/maintenance, simple structure etc.

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 and should be handled carefully. Remove the protective plugs and caps for a thorough inspection. If any items are damaged or missing, contact

Make 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.

2.0 SPECIFICATIONS

Performance

Repeatability:	±0.2%
Accuracy:	Standard: ±1% of reading; Optional: ±0.5% of reading

Wetted Components

Housing:	Standard - 304 Stainless Steel Optional - 316 Stainless Steel
Bearings and Shaft:	Tungsten Carbide
Rotor:	Standard - 2Cr13 Stainless Steel (Optional Alloy CD4Mcu)
Retaining Rings:	316 Stainless Steel

Output Signal: (Where applicable)

Sensor:	Pulse signal (Low Level: ≤0.8V; High Level: ≥8V)
Transmitter:	4 to 20 mA DC current signal

Signal Transmission Distance: ≤1,000 m

Electrical Connections:

Basic Type:	Hirschmann Connector or three-core cable
Explosion Proof Type:	ISO M20×1.5 Female

Explosion Proof Level:

Standard:	None
Optional:	ExdIICT6

Protection Level: IP65

3.0 OPERATION CONDITIONS

Ambient:

Temperature:	-10°C to +55°C
Pressure:	86 to 106 KPa
Relative Humidity:	5% to 90%

Power Supply:

Sensor:	+12V DC (Optional: +24V DC)
Transmitter:	+24V DC
Field Display Type B:	Integral 3.2V Lithium Battery (Others available on request)
Field Display Type C:	+24V DC

Fluid Temperature and Pres:

Temperature:	-20°C to +110°C
Pres:	Fluid pres should be limited according to rating.

Measurable Flow Rate Range and Pres Level: (See table 1)

Table 1. Measurable Flow Range and Pressure Rating

Nominal Diameter		Standard Flow Range (SFR)	Extended Flow Range (EFR)	Standard Pres Rating	Customized Pres Rating
(mm)	(in.)	(m ³ /h)	(m ³ /h)	(MPa)	(MPa) - Flange Fitting
4	0.15	0.04 to 0.25	0.04 to 0.4	Thread: 6.3	12, 16, 25
6	0.25	0.1 to 0.6	0.06 to 0.6	Thread: 6.3	12, 16, 25
10	0.4	0.2 to 1.2	0.15 to 1.5	Thread: 6.3	12, 16, 25
15	0.5	0.6 to 6	0.4 to 8	Thread: 6.3; Flange: 2.5	4.0, 6.3, 12, 16, 25
20	0.75	0.8 to 8	0.45 to 9	Thread: 6.3; Flange: 2.5	4.0, 6.3, 12, 16, 25
25	1	1 to 10	0.5 to 10	Thread: 6.3; Flange: 2.5	4.0, 6.3, 12, 16, 25
32	1.25	1.5 to 15	0.8 to 15	Thread: 6.3; Flange: 2.5	4.0, 6.3, 12, 16, 25
40	1.5	2 to 20	1 to 30	Thread: 6.3; Flange: 2.5	4.0, 6.3, 12, 16, 25
50	2	4 to 40	2 to 40	Flange: 2.5	4.0, 6.3, 12, 16, 25
65	2.5	7 to 70	4 to 70	Flange: 2.5	4.0, 6.3, 12, 16, 25
80	3	10 to 100	5 to 100	Flange: 2.5	4.0, 6.3, 12, 16, 25
100	4	20 to 200	10 to 200	Flange: 1.6	4.0, 6.3, 12, 16, 25
125	5	25 to 250	13 to 250	Flange: 1.6	2.5, 4.0, 6.3, 12, 16
150	6	30 to 300	15 to 300	Flange: 1.6	2.5, 4.0, 6.3, 12, 16
200	8	80 to 800	40 to 800	Flange: 1.6	2.5, 4.0, 6.3, 12, 16

Model Selection

Model No.										Definition
HLY-	☐	/ ☐	/ ☐	/ ☐	/ ☐	/ ☐	/ ☐	/ ☐	/ ☐	
Nominal diameter (mm)	4									DN4
	6									DN6
	10									DN10
	15									DN15
	20									DN20
	25									DN25
	32									DN32
	40									DN40
	50									DN50
	65									DN65
	80									DN80
	100									DN100
	125									DN125
	150									DN150
	200									DN200
Connection	FL									Flanged
	LW									Threaded
	JZ									Clamp-on by flange
Meter type	N									24V power supply, no field display, pulse output
	A									24V power supply, field display, 4-20mA output
	G1									Battery powered, field display, no output
	GX									External power supply, field display, RS485/current/pulse output
	E1									(Explosion-proof type) Battery powered, field display, no output
	EX									(Explosion-proof type) External power supply, field display, RS485/current/pulse output
Range	05									Standard range
	10									Extended range
	02									Special range
Accuracy	S									0.5
	W									1.0
	Z									0.2(by customized, long production period)
Meter material	S									304 SS
	L									316(L) SS
Impeller material	S									2Cr13 impeller
	L									Duplex steel impeller
Explosion-proof grade	N									Non-explosion proof
	E									Exd II CT6 Gb
Temperature and pressure resistant	N									Standard
	H(x)									High pressure

Notes: DN20, DN32, DN65, DN125 are custom. X refers to number(s), standing for different functions. Contact us for details.

4.0 CAUTIONS FOR INSTALLATION

Mounting Positions

Turbine flow meters should be installed at the place in compliance with the requirements below:

- ◆ Easy maintenance
- ◆ No vibration
- ◆ No electromagnetic interface
- ◆ Away from heat source

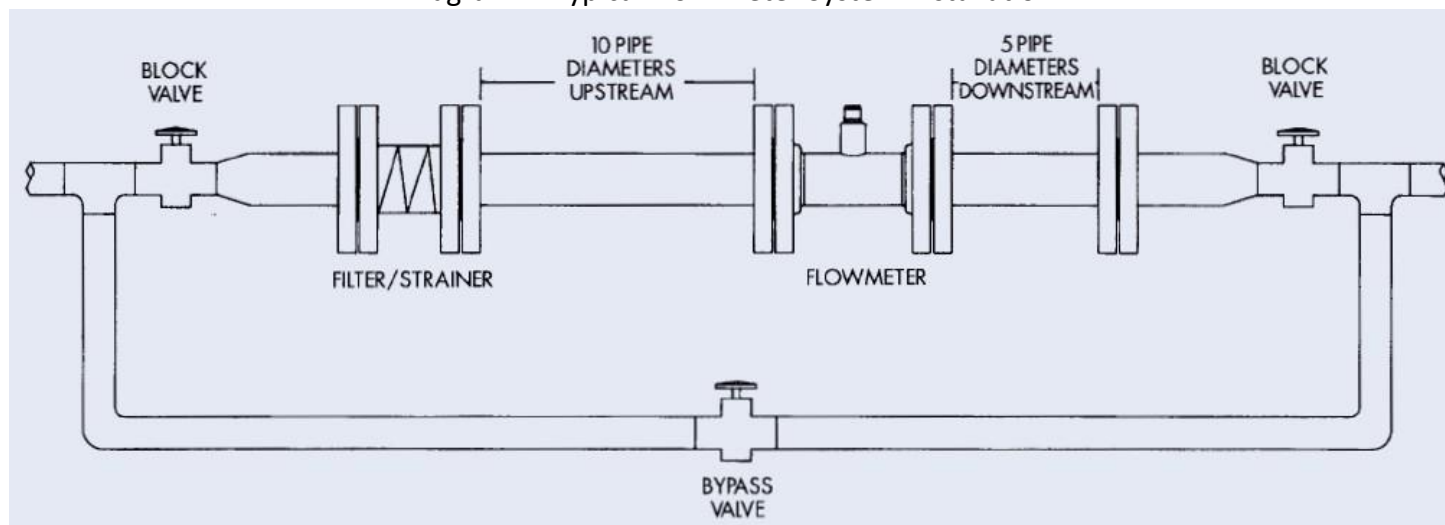
Mounting Orientation

All turbine flow meters are designed to measure flow in only one direction. The direction is indicated by the arrow on the body.

Required Lengths of Straight Runs

Flow altering device such as elbows, valves and reducers can affect accuracy. See diagram 1 for typical flow meter system installation.

Diagram 1. Typical Flow Meter System Installation

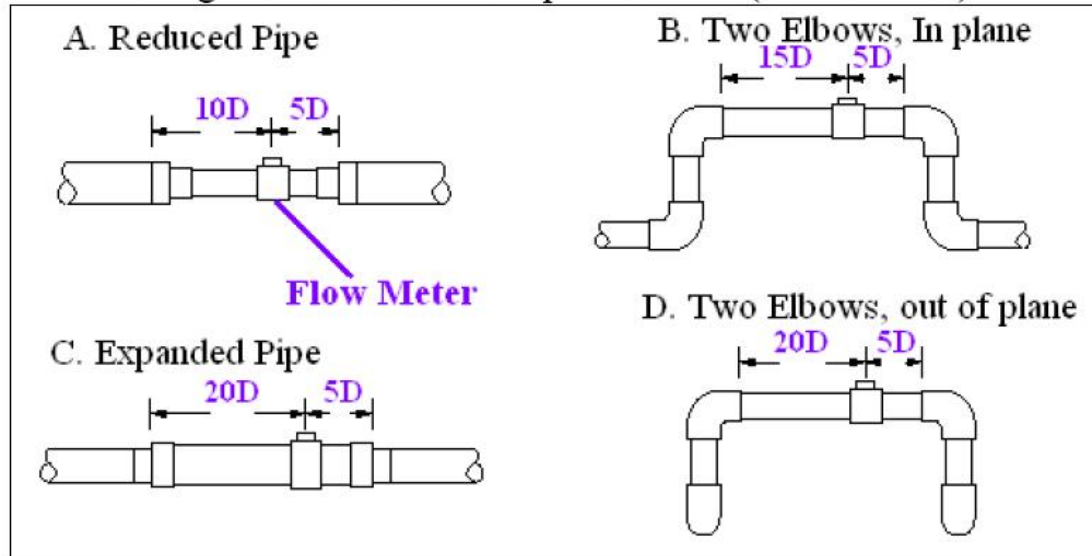


The recommended guidelines are given to enhance accuracy and maximize performance. Distance given here are minimum requirements; double them for desired straight pipe lengths.

- 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

See diagram 2 for straight pipe length requirement when there is altering device.

Diagram 2. Number of Pipe Diameter (D=Diameter)



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

Anti-Cavitation

Cavitation can be caused by entrained air, and it can seriously damage the rotor on a turbine flow meter. An amount higher than about 100 mg/l of entrained air or gas can produce error. In addition, cavitations can be caused by too little back pres on the flow meter. For turbine flow meters, you should provide a back pres (downstream pres) of at least 1.25 times the vapor pres, 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: (P_b : Back pres; P_v : Vapor Pres; P_{in} : Inlet Pres; P_{out} : Outlet Pres)

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



Special Notice

- ◆ Foreign material in the liquid being mead 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 en accurate measurement, drain all air from the system before use.
- ◆ **When the meter contain removable cover plates. Leave the cover plate installed unless accessory modules specify removal. Don't remove the cover plates when the meter is powered, or electrical shock and explosion hazard can be caused.**

Thread Connections

1. To protect against leakage, seal all threads with an appropriate sealing compound. Make the sealing compound does not intrude into the flow path.
2. Make the arrow on the outlet is pointed in the direction of the flow.
3. Tighten the turbine onto the fittings. Use a wrench only on wrench flats.

Flange Connections

For standard product, the flange follows GB/T 9119-2000 (ISO 7005-1) RF (Raised Face).

Note: flange can be customized following other criteria.

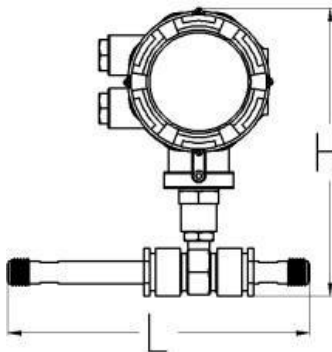
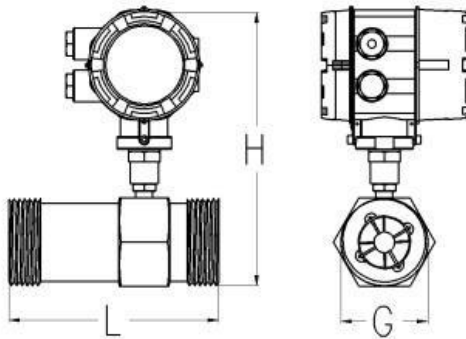
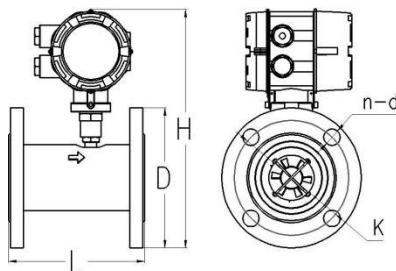
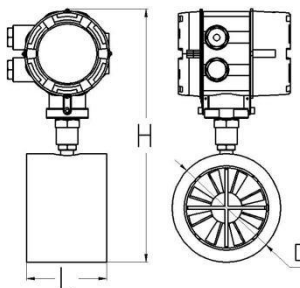
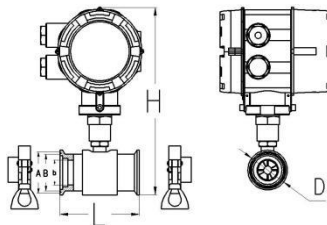
Use a gasket between the meter flange and mating flange. Determine the material of the gasket based on the operating conditions and type of fluid.

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.

5. INSTALLATION DIMENSIONS

Thread or flange connection is used according to different flow models.

Liquid Turbine Flow Meter

Reference picture	N1(Pulse)		G(Intelligent)					
	N2(Pulse+4-20mA)/ A(4~20mA)		E(Explosion-proof)					
Connection diagram	 DN4-10 threaded connection sensor(straight pipe section included)				 >DN15 threaded connection sensor			
	Thread type							
								
	Flange type		Wafer type		Clamp type			

Threaded and flanged type of liquid turbine flow meter

Threaded connection	DN(mm)	L (mm)	H(mm)				G (Male)			
			N1(Pulse)	N2(Pulse+4-20mA)/ A(4~20mA)	G(Intelligent)	E(Explosion-proof)				
	4	225	145	145	190	210	G1/2			
	6	225	145	145	190	210	G1/2			
	10	345	150	150	190	210	G1/2			
	15	75	150	150	195	215	G1			
	20	85	155	155	200	220	G1			
	25	100	160	160	205	225	G11/4			
	32	140	180	180	225	245	G2			
	40	140	185	185	230	250	G2			
50	150	190	190	235	255	G21/2				
Note: for DN4~DN10, when connecting the filter, the overall length should be increased by 50mm on the basis of L..										
Flanged Connection	DN (mm)	L (mm)	D (mm)	K (mm)	H(mm)			d (mm)	n (Qty of holes)	
					N1 (Pulse)	N2(Pulse+4-20mA)/ A(4~20mA)	G(Intelligent)	E(Explosion-proof)		
	15	75	95	65	175	180	225	245	14	4
	20	80	105	75	185	190	235	255	14	4
	25	100	115	85	200	195	240	260	14	4
	32	140	140	100	210	215	260	280	18	4
	40	140	150	110	195	220	265	285	18	4
	50	150	165	125	230	235	280	300	18	4
	65	170	185	145	255	260	305	325	18	4
	80	200	200	160	260	265	310	330	18	8
	100	220	220	180	285	285	330	350	18	8
	125	250	250	210	310	315	360	380	18	8
	150	300	285	240	345	345	390	410	22	8
200	350	340	295	395	400	445	465	22	12	

Wafer and clamp types of liquid turbine flow meter

Wafer connection	<table><tr><th rowspan="2">DN(mm)</th><th rowspan="2">L (mm)</th><th rowspan="2">D (mm)</th><th colspan="4">H(mm)</th></tr><tr><th>N2(Pulse+4-20mA)</th><th>A(4~20mA)</th><th>G(Intelligent)</th><th>E(Explosion-proof)</th></tr><tr><td>4</td><td>50</td><td>38</td><td colspan="2" rowspan="9">X</td><td>265</td><td>215</td></tr><tr><td>6</td><td>50</td><td>38</td><td>265</td><td>215</td></tr><tr><td>10</td><td>50</td><td>38</td><td>265</td><td>215</td></tr><tr><td>15</td><td>55</td><td>47</td><td>275</td><td>225</td></tr><tr><td>20</td><td>60</td><td>53</td><td>280</td><td>230</td></tr><tr><td>25</td><td>60</td><td>58</td><td>285</td><td>235</td></tr><tr><td>32</td><td>70</td><td>66</td><td>290</td><td>240</td></tr><tr><td>40</td><td>70</td><td>72</td><td>300</td><td>250</td></tr><tr><td>50</td><td>70</td><td>92</td><td>315</td><td>265</td></tr><tr><td>65</td><td>80</td><td>100</td><td>210</td><td>210</td><td>255</td><td>275</td></tr><tr><td>80</td><td>90</td><td>112</td><td>225</td><td>225</td><td>270</td><td>290</td></tr><tr><td>100</td><td>100</td><td>137</td><td>250</td><td>250</td><td>295</td><td>315</td></tr><tr><td>125</td><td>120</td><td>165</td><td>275</td><td>275</td><td>320</td><td>340</td></tr><tr><td>150</td><td>150</td><td>190</td><td>300</td><td>300</td><td>345</td><td>365</td></tr><tr><td>200</td><td>150</td><td>243</td><td>350</td><td>350</td><td>395</td><td>415</td></tr></table>							DN(mm)	L (mm)	D (mm)	H(mm)				N2(Pulse+4-20mA)	A(4~20mA)	G(Intelligent)	E(Explosion-proof)	4	50	38	X		265	215	6	50	38	265	215	10	50	38	265	215	15	55	47	275	225	20	60	53	280	230	25	60	58	285	235	32	70	66	290	240	40	70	72	300	250	50	70	92	315	265	65	80	100	210	210	255	275	80	90	112	225	225	270	290	100	100	137	250	250	295	315	125	120	165	275	275	320	340	150	150	190	300	300	345	365	200	150	243	350	350	395	415														
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100	220	127	113	106	100	240	240	285	305																																																																																																																
Remark	1. The product is subject to the actual supply. 2. The above dimensions are conventional pressure-resistant dimensions.																																																																																																																								

6.0 ELECTRICAL WIRING



Warning: Electrical Hazard

Disconnect power before beginning installation.

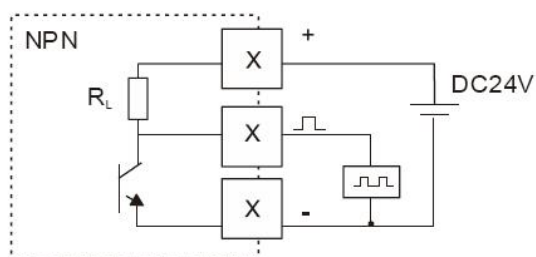
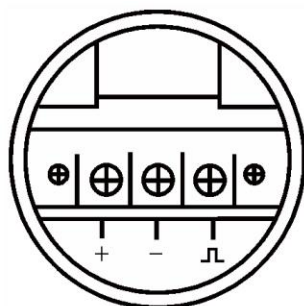
Turbine Flow Sensor/Transmitter

◆ 1. Pulse Type without Explosion Proof

Terminal wiring

Terminal Symbols	Description
Red Wire 	Power Supply: "24V+"
White Wire 	Power Supply: "24V-"
Yellow Wire 	Pulse Output

◆ 2. Pulse with Explosion Proof:



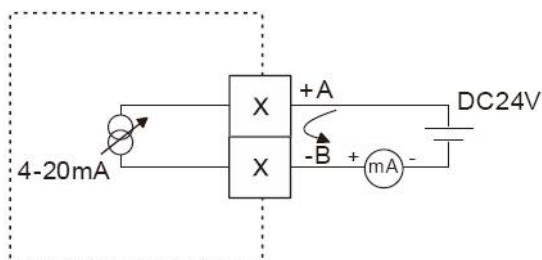
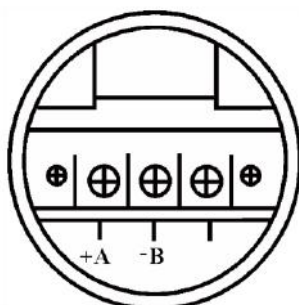
Notice: (1) High level amplitude >22V

(2) Low level amplitude <0.8V

(3) Load capacity >1100Ω

(4) Pulse frequency ≤3000Hz

◆ 3. 4-20mA Output with Explosion Proof Type



Notice: Load resistor is <

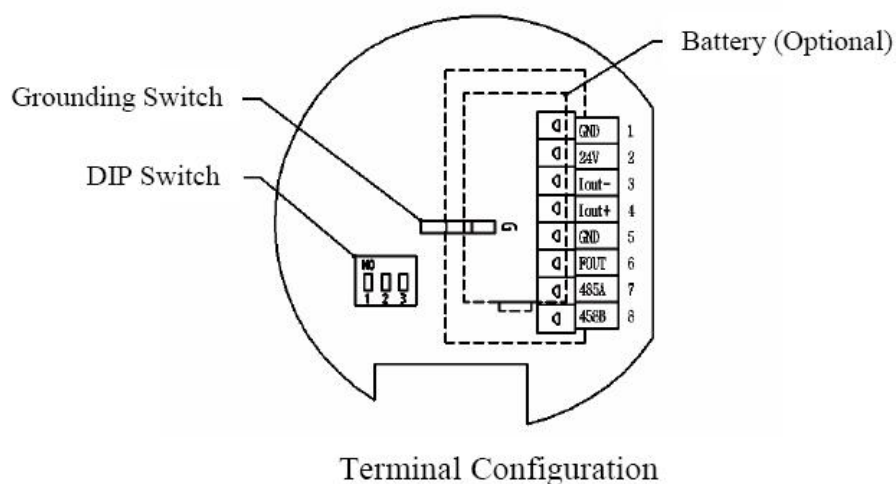
◆ 4. Function table for the Intelligent display type

Main Power	Display	Output						
		Pulse * 1	Scaled Pulse *2	Current				Modbus RS485
				2-wire 4~20 mA	3-wire 4-20 mA	4-wire 0 -20m	4-wire 4~20m A	
Battery*3	●	●						
24V DC	●	●	●	●	○			●
24V C+Battery*4	●	●	●	●	○			●
220Vac	●	●	●			○	●	●
Description of the symbols: ● Default Function ○ Optional								

Notice:

1. The pulse means the signal which is in direct proportion to the impeller speed.
2. The scaled Pulse means the signal when the flow rate reach ONE unit volume(m3, L, 0.01L...)
3. The batter model is ER34615
4. The battery model is ER26500

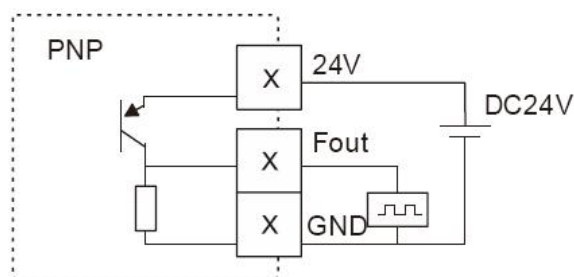
4.1 24V DC powered type



Terminal Configuration

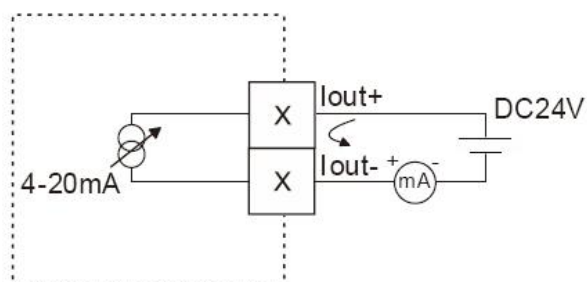
Terminal No.	Terminal Symbols	Description
1	GND	
2	24V	24V+ DC Power Supply
3	Iout-	Current Output 4 to 20 mA DC (+) (2Wire)
4	Iout+	
5	GND	24V- DC Power Supply
6	-FOUT	F-OUT: Pulse output
7	485A	RS485-
8	485B	RS485+

4.1.1 Pulse / Scaled Pulse output

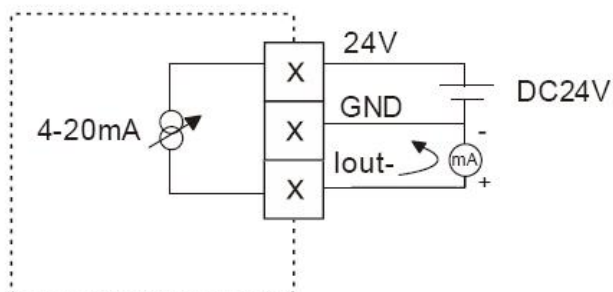


- Notice:
- (1) High level amplitude $>22V$
 - (2) Low level amplitude $<0.8V$
 - (3) Load capacity $>1100\Omega$
 - (4) Pulse frequency $\leq 3000Hz$

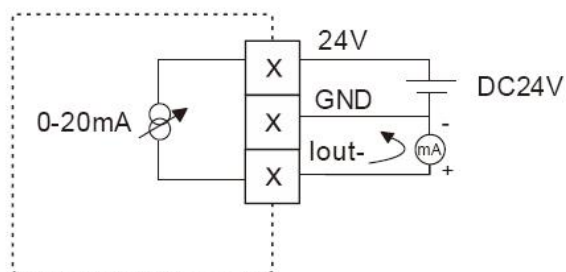
4.1.2 (2 Wire) 4-20mA Output



4.1.3 (3 Wire) 4-20mA Output

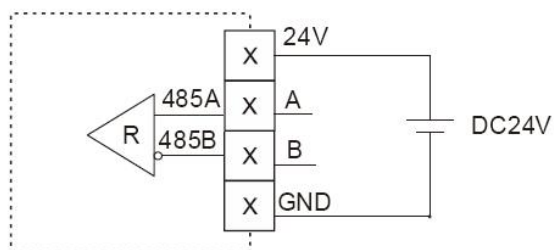


4.1.4 (3 Wire) 0-20mA Output



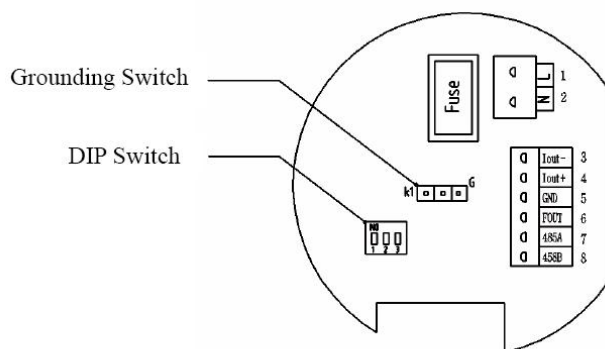
Notice: Load resistor is $<500\Omega$

4.1.5 RS485 communication



Notice: The communication format is Modbus-RTU protocol

4.2 220Vac powered type

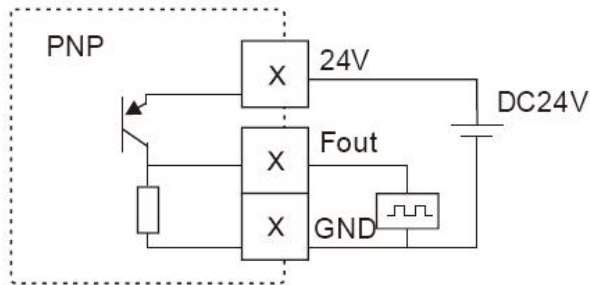


Terminal Configuration

Terminal Configuration

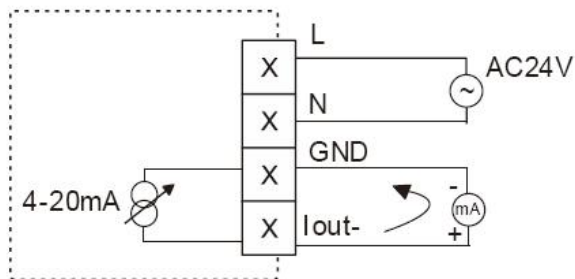
Terminal No.	Terminal Symbols	Description
1	L	AC 220V Power Supply
2	N	AC 220V Power Supply
3	Iout-	Current Output
4	Iout+	Current Output
5	GND	Current / Pulse output -
6	FOUT	FOUT: Pulse output
7	485A	RS485-
8	485B	RS485+

4.2.1 Pulse / Scaled Pulse output

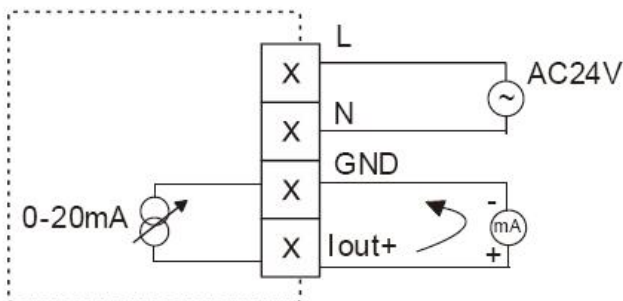


Notice: Three conditions are necessary for pulse output High level amplitude $>22V$
 Low level amplitude $<0.8V$ Load capacity $>1100\Omega$ Pulse frequency $\leq 3000H$

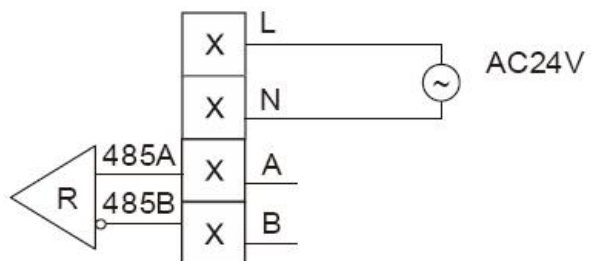
4.2.2 (4 Wire) 4-20mA Output



4.2.3 (4 Wire) 0-20mA Output



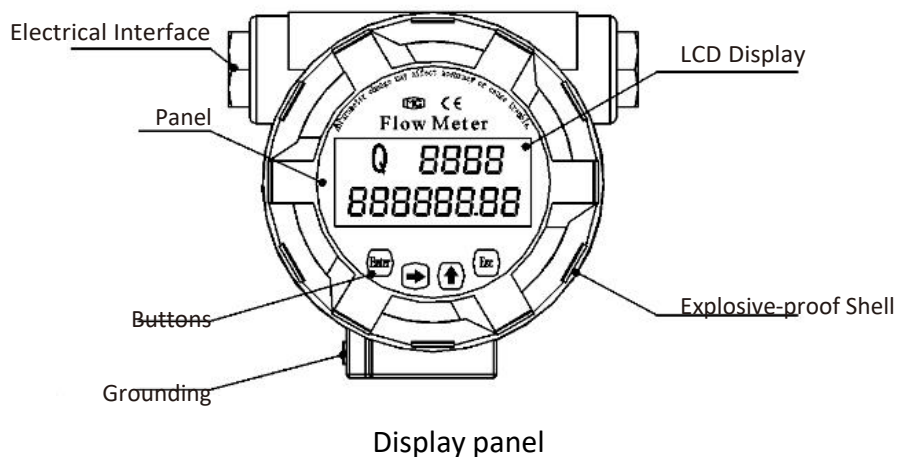
4.2.4 RS485 communication



4.2.5 Function table for

DIP Switch: K1			
Function	1	2	3
Original Pulse Output	ON	OFF	OFF
Scaled Pulse Output: 1 m ³ / Pulse	OFF	ON	OFF
Function Reserved	OFF	OFF	ON

7.0 Parameter set



7.1 There are four keys: "Enter", "→", "↑", "Esc".

KEYS	Description
Enter	Save the value and advance to next menu
→	For numerical values, move cursor position
↑	To change number unit, setting
Esc	Return to measuring model

7.2 Description of Password Grade

Password	Description
1234	Modify parameters
5555	Total rate reset

7.3 Description of menu

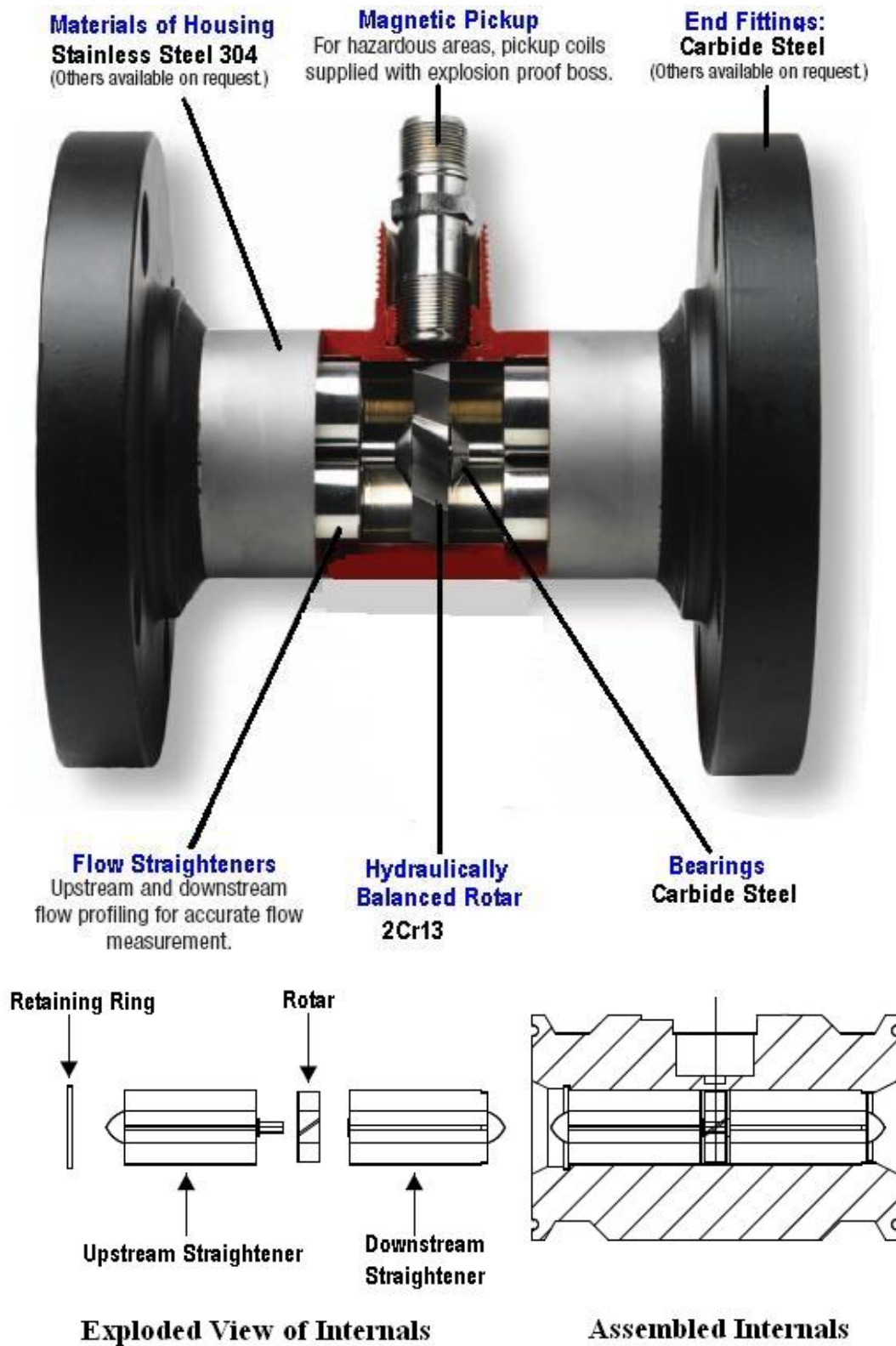
Menu	Parameter	Setting Method	Grade	Description		
F-1	Unit	Select parameter	User	Value	Flow Unit	Total Flow Unit
				0	M3/h	M3
				1	L/h	L
				2	L/min	L
				3	US Gal/min	US Gal
				4	UK Gal/min	UK Gal
				5	US Gal/h	US Gal
				6	UK Gal/min	UK Gal

				7	KG/h	Kg
				8	t/h	T
				9	Ft3/h	Ft3
F-2	Damp time	Input value	User	Unit: Second Value: 0~99s		
F-3	Max flow rate	Input value	User	Unit: The same to the F-1		
F-4	Min flow rate	Input value	User	When the flow rate lower than min flow rate, the flow rate will display 0; The unit is the same to the F-1		
F-5	Max frequency output	Input value	User	Accuracy: 0.1Hz		
F-6	Density	Input value	User	When need to display mass unit, it needs to input the density of liquid. The unit of density is g/cm3		
F-7	Pulse output	Select parameter	User	1: Original pulse output 2: Corrected pulse		
F-8	Scaled pulse	Select parameter	User	0.001: 0.01 unit volume / pulse 0.01: 0.01 unit volume / pulse 0.1: 0.1 unit volume / pulse 1: 1 unit volume / pulse		
F-9	Pulse width	Input value	User	The value is between 0005-2000 range, and it's multiple of 5 with ms unit;		
F-10	Communication	Select parameter	User	Address: 1-247 Baud rate: 1200, 2400, 4800, 9600, 19200		
F-11	Baud	Select parameter	User	N(No verify) O(Odd verify) E(Even verify) Data length: 7,8 Stop bits length: 1,2		
F-12	Total flow	Input value	User	It could be modified with right code		
P1	Linearization of the Flowcurve: point 1	Input value	Factory only	First Row: Corrected Frequency (F1) without decimal, F1 Second Row: Coefficient error with (K1) six decimals		
P2	Linearization of the Flowcurve: point 2	Input value	Factory only	First Row: Corrected Frequency (F2) without decimal, F1 Second Row: Coefficient error with (K2) six decimals		
P3	Linearization of the Flowcurve: point 3	Input value	Factory only	First Row: Corrected Frequency (F3) without decimal, F1 Second Row: Coefficient error with (K3) six decimals		
P4	Linearization of the Flowcurve: point 4	Input value	Factory only	First Row: Corrected Frequency (F4) without decimal, F1 Second Row: Coefficient error with (K4) six decimals		
P5	Linearization of the Flowcurve: point 5	Input value	Factory only	First Row: Corrected Frequency (F5) without decimal, F1 Second Row: Coefficient error with (K5) six decimals		
P6	Linearization of the Flowcurve: point 6	Input value	Factory only	First Row: Corrected Frequency (F6) without decimal, F1 Second Row: Coefficient error with (K6) six decimals		
P7	Linearization of the Flowcurve: point 7	Input value	Factory only	First Row: Corrected Frequency (F7) without decimal, F1 Second Row: Coefficient error with (K7) six decimals		
P8	Linearization of the Flowcurve: point 8	Input value	Factory only	First Row: Corrected Frequency (F8) without decimal, F1 Second Row: Coefficient error with (K8) six decimals		
P9	Coefficient	Input value	Factory only	First Row: Corrected Frequency with one decimal, F1 Second Row: Coefficient error with two decimals, unit : /L, K		

8.0 TROUBLESHOOTING

Symptom	Probable Cause	Solution
Measurement is not accurate	1. Turbine operated below minimum rate.	Increase flow rate. Refer to Section 3.0 Operation Conditions
	2. Turbine partially clogged with dried liquid	Remove turbine. Clean carefully. Make rotor spins freely.
	3. Installed too close to fittings.	Install correctly. Refer to Section 5.0 Cautions for Installation
LCD Display Abnormality	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

9.0 METER CONSTRUCTION



Limited Warranty Policy

Hereby provides a limited warranty against defects in materials and workmanship. This product includes a one-year warranty. The warranty period shall begin on the date of the original new equipment purchase. Warrantor's obligation hereunder shall be limited to repairing defective workmanship or replacing or repairing any defective parts.

In the event Purchaser believes the product is defective, the product must be returned to, transportation prepaid by Purchaser, within the appropriate warranty period relative to the product. If 's inspection determines the workmanship or materials are defective and the required maintenance has been performed and,has been properly installed and operated,the product will be either repaired or replaced, at 's sole determination,free of additional charge, and the goods will be returned,transportation paid by , using a transportation method selected by .

Prior to returning the product to , Purchaser must obtain a Returned Material Authorization(RMA) Number from 's Customer Service Department within 30 days after discovery of a purported breach of warranty, but not later than the warranty period;otherwise,such claims shall be deemed waived.

If 's inspection reveals the product to be free of defects in material and workmanship or such inspection reveals the goods were improperly used, improperly installed,and/or improperly selected for service intended,will notify the purchaser in writing and will deliver the goods back to Purchaser upon receipt of Purchaser's written instructions and agreement to pay the cost of transportation. If Purchaser does not respond within thirty (30) days after notice from , the goods will be disposed of in 's discretion.

does not warrant the product to meet the requirements of any safety code or other jurisdiction,and Purchaser assumes all risk and liability whatsoever resulting from the use thereof, whether used singly or in combination with other machines or apparatus.

This warranty shall not apply to any product or parts thereof,which have been repaired outside 's factory or altered in any way,or have been subject to misuse,negligence, or accident,or have not been operated in accordance with 's printed instructions or have been operated under conditions more severe than,or otherwise exceeding,those set in the specifications.

FOR NON- WARRANTY REPAIRS OR CALIBRATIONS,consult for current repair/calibration charges. Have the following information available BEFORE contacting :

- 1.P.O. number to cover the COST of the repair/calibration,
- 2.Model and serial number of the product, and
- 3.Repair instructions and/or specific problems relative to the product.