

# Sanitary type Flow Meter



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# 1.0 GENERAL INFORMATION

This manual will assist you in installing, using and maintaining your turbine 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 turbine.
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 turbine removal, liquid may spill. Follow the liquid 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 the wrench flats.
9. For best results, calibrate the meter at least 1 time per year.

## Product Description

All components of LWS series sanitary turbine flow meters are machined and assembled to be compliant with Sanitary Standard.

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 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.

## 2.0 SPECIFICATIONS

### Performance

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

### Wetted Components

Housing:	Standard - 316 Stainless Steel Optional - 304 Stainless Steel
Bearings and Shaft:	Tungsten Carbide
Rotor:	Standard - 2Cr13 Stainless Steel (Optional CD4MCU Stainless Steel)
Retaining Rings:	316 Stainless Steel

Connections:	Sanitary Clamp Connections
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### 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:	Hausman Connector or three-core cable
Explosion Proof Type:	ISO M20×1.5 Female

### Explosion Proof Level:

Standard:	None
Optional:	ExdIIBT6

Protection Level:	IP65
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### 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
Field Display Type C:	+24V DC

#### Fluid Temperature and Pressure:

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

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

Table 1. Measurable Flow Range and Pressure Rating

Nominal Diameter		Standard Flow Range (SFR)	Extended Flow Range (EFR)	Standard Pressure Rating
(mm)	(in.)	(m <sup>3</sup> /h)	(m <sup>3</sup> /h)	(MPa)
4	0.15	0.04 to 0.25	0.04 to 0.4	1.0 Mpa
6	0.25	0.1 to 0.6	0.06 to 0.6	1.0 Mpa
10	0.4	0.2 to 1.2	0.15 to 1.5	1.0 Mpa
15	0.5	0.6 to 6	0.4 to 8	1.0 Mpa
20	0.75	0.8 to 8	0.45 to 9	1.0 Mpa
25	1	1 to 10	0.5 to 10	1.0 Mpa
32	1.25	1.5 to 15	0.8 to 15	1.0 Mpa
40	1.5	2 to 20	1 to 30	1.0 Mpa
50	2	4 to 40	2 to 40	1.0 Mpa
65	2.5	7 to 70	3.5 to 70	1.0 Mpa

## 4.0 MODEL AND SELECTION

### Model

#### 4.1 Turbine Flow Sensor/Transmitter

LWS-□N Type Sensor: 12 to 24V DC Power Supply; Pulse Output

LWS-□A Type Transmitter: 24V DC Power Supply; 2-wire 4 to 20 mA Output

Basic Type (Without Explosion Proof) and Explosion Proof Type are optional for LWS-□N and LWS-□A.



Basic Type (LWS-N)



Explosion Proof Type (LWS-A)

#### 4.2 Intelligent Integrated Turbine Flow Meter (Refer to photo on page 1)

- ◆ 4 digital instantaneous flow display
- ◆ 8 digital totalizer flow display (Resettable)
- ◆ With Explosion Proof (Level: ExdIIBT6)
- ◆ 3-Point Correction and Non-linearity Compensation on K-Factor

*Note: The K-Factor represents the number of output pulses transmitted per cubic meter (Optional: Liter and Gallons) of fluid passing through the turbine meter. Each turbine has a unique K-Factor. However, turbine meters are not functionally consistent throughout the full flow range of the meter. Therefore, correction and non-linearity compensation on K-Factor can enhance accuracy.*

LWS-□B Type: powered with 3.2V10AH lithium battery (Battery life > 4 years); no output

LWS-□C Type: 24V DC Power Supply; 2-wire 4 to 20 mA Output (Optional: RS485 or HART)

# Model Selection (See Table 2)

Table 2. Model Selection Guidance

Model Suffix Code								Description (SFR: Standard Flow Range)
LWS-	<input type="checkbox"/>	/ <input type="checkbox"/>	/ <input type="checkbox"/>	/ <input type="checkbox"/>	/ <input type="checkbox"/>	/ <input type="checkbox"/>	/ <input type="checkbox"/>	
Nominal Diameter (mm)	4							4mm; SFR: 0.04 to 0.25 m <sup>3</sup> /h
	6							6mm; SFR: 0.1 to 0.6 m <sup>3</sup> /h
	10							10mm; SFR: 0.2 to 1.2 m <sup>3</sup> /h
	15							15mm; SFR: 0.6 to 6 m <sup>3</sup> /h
	20							20mm; SFR: 0.8 to 8 m <sup>3</sup> /h
	25							25mm; SFR: 1 to 10 m <sup>3</sup> /h
	32							32mm; SFR: 1.5 to 15 m <sup>3</sup> /h
	40							40mm; SFR: 2 to 20 m <sup>3</sup> /h
	50							50mm; SFR: 4 to 40 m <sup>3</sup> /h
Type	N							Basic Type: +12V to +24V DC Power Supply; Pulse Output
	A							4 to 20 mA current output
	B							Battery Power Supply with filed Display
	C							Field Display and 4 to 20 mA current output
	C1							Field Display and RS485
	C2							Field Display and HART
Accuracy Rating		10						±1.0% of reading
		05						±0.5% of reading
Measurable Range				S				Standard: Refer to table 1
				E				Extended: Refer to table 1
Housing Material					S			304 Stainless Steel
					L			316 (L) Stainless Steel
Explosion Rating								Blank: without Explosion Proof
						E		Explosion Proof: ExdIIIBT6

## 5.0 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

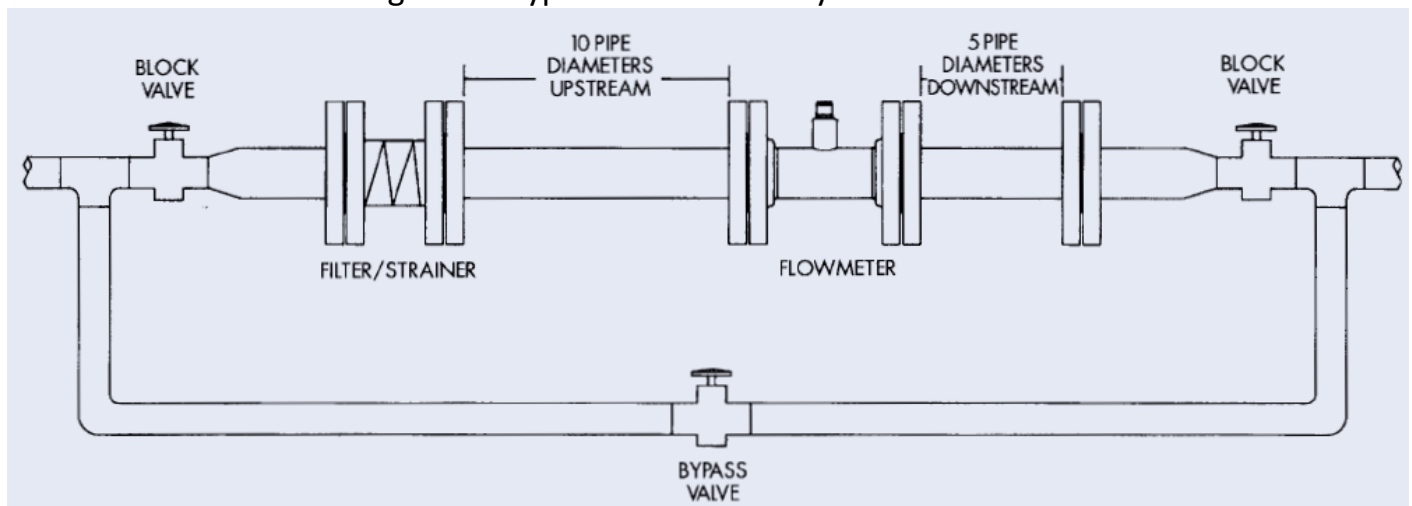
### Mounting Orientation

All our 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

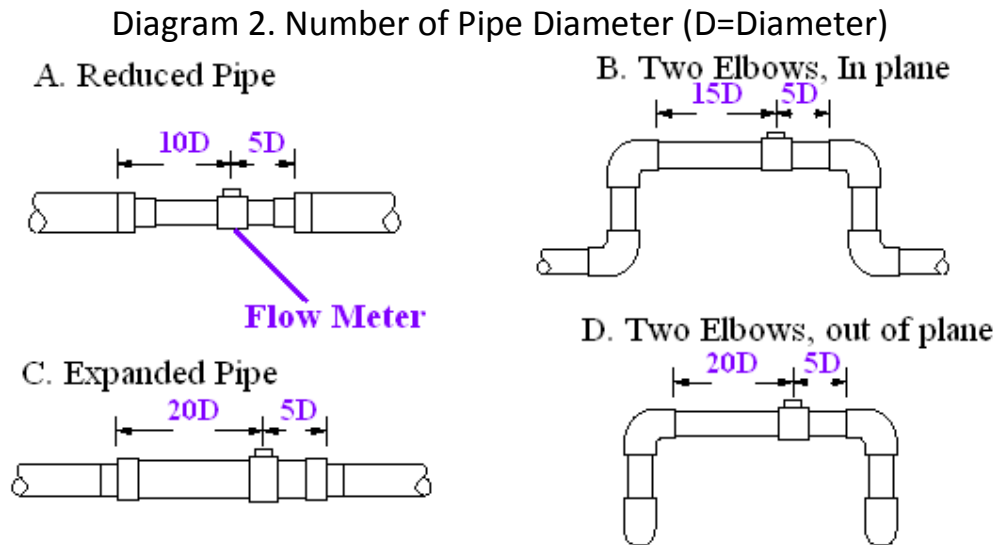


The recommended guidelines are given to enhance accuracy and maximize performance. Distance given here are minimum requirements; double them for desired straight pipe lengths.

- 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.



**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, 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.

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

In formula 1: ( $P_b$ : Back pressure;  $P_v$ : Vapor Pressure;  $P_{in}$ : Inlet Pressure;  $P_{out}$ : Outlet Pressure)

Create backpressure 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 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.

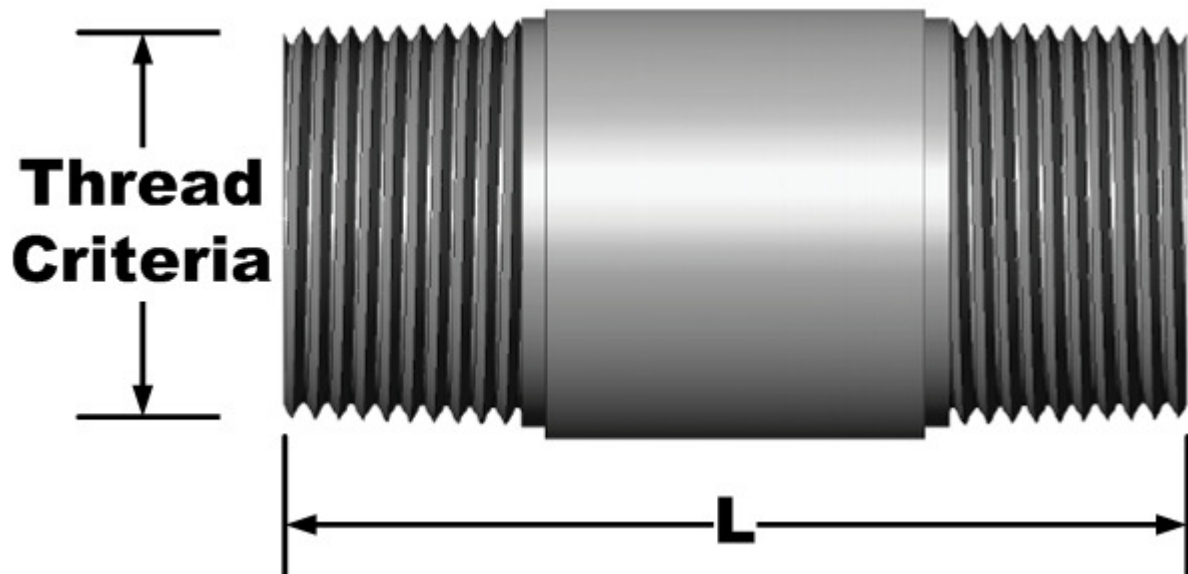
## 5.1 Connections

### 5.1.1 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*

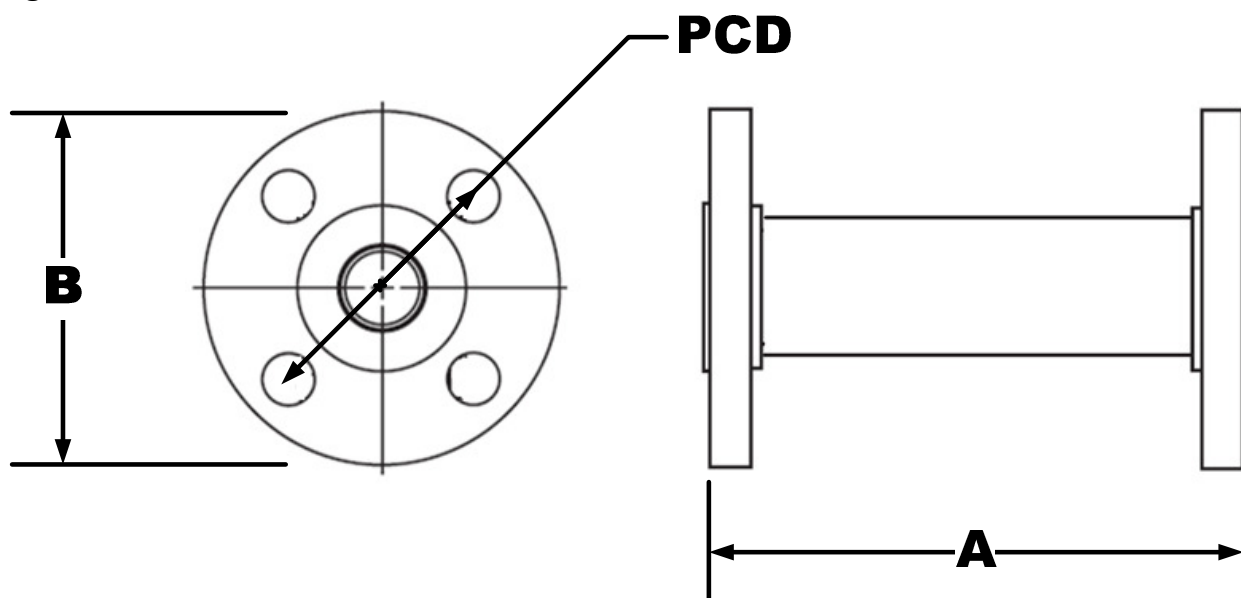
DN4...DN10: Straight Runs and filter are included in the length for DN4 to DN10.

DN15...DN50: Straight Runs are optional on request.



Diameter (mm)	L (mm)	Thread Criteria
4	279	G ½"
6	270	G ½"
10	390	G ½"
15	75	G 1"
20	80	G 1"
25	100	G 1-¼"
32	140	G 2"
40	140	G 2"
50	150	G 2-1/2"

### 5.1.2 Flange Connection



ANSI Flange Meter Dimensions							
Size Code		A (mm)	ANSI Flange Rating Class	Flange Diameter (B) (mm)	Bolt Hole Diameter (mm)	Bolt Circle Diameter (PCD) (mm)	Bolt Hole Quantity
(inch)	(mm)						
1/2"	15	75	150	89	16	60	4
			300	95	16	67	4
3/4"	20	80	150	99	16	70	4
			300	117	19	83	4
1"	25	100	150	108	16	79	4
			300	124	19	89	4
1-1/4"	32	140	150	115	16	89	4
			300	135	19	98	4
1-1/2"	40	140	150	127	16	99	4
			300	155	22	114	4
2"	50	150	150	152	19	121	4
			300	165	19	127	8
2-1/2"	65	170	150	180	19	140	4
			300	190	22	149	8
3"	80	200	150	191	19	152	4
			300	210	22	168	8
4"	100	220	150	229	19	191	8
			300	254	22	200	8
5"	125	250	150	255	22	216	8
			300	280	22	235	8
6"	150	300	150	279	22	241	8
			300	318	22	270	12
8"	200	360	150	343	22	298	8
			300	381	25	330	12

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

# 6.0 Electrical Wiring



Warning: Electrical Hazard

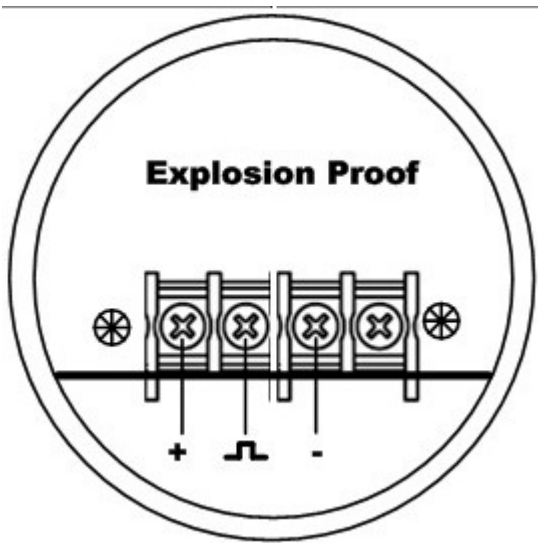
Disconnect power before beginning wiring.

## 6.1 LWS-N; Pulse Output, Basic Model.

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

## 6.2 LWS-N; Pulse Output, explosion proof model.

Terminal Configuration

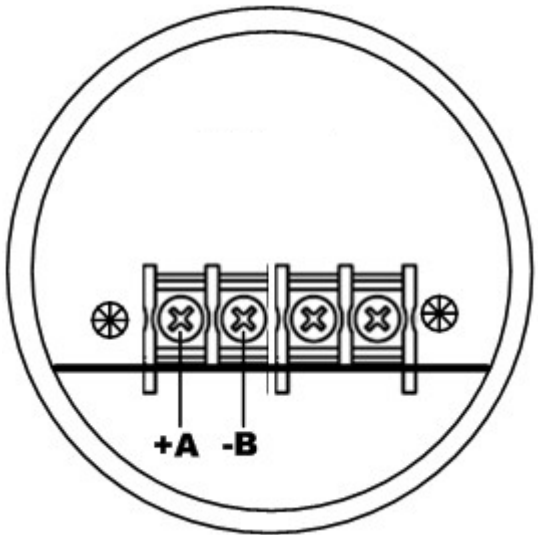


Terminal Wiring

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

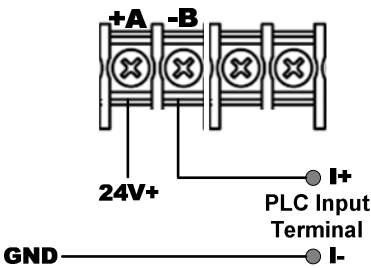
## 6.3 LWS-A; two-wire 4-20mA Output, No Local Display.

Terminal Configuration



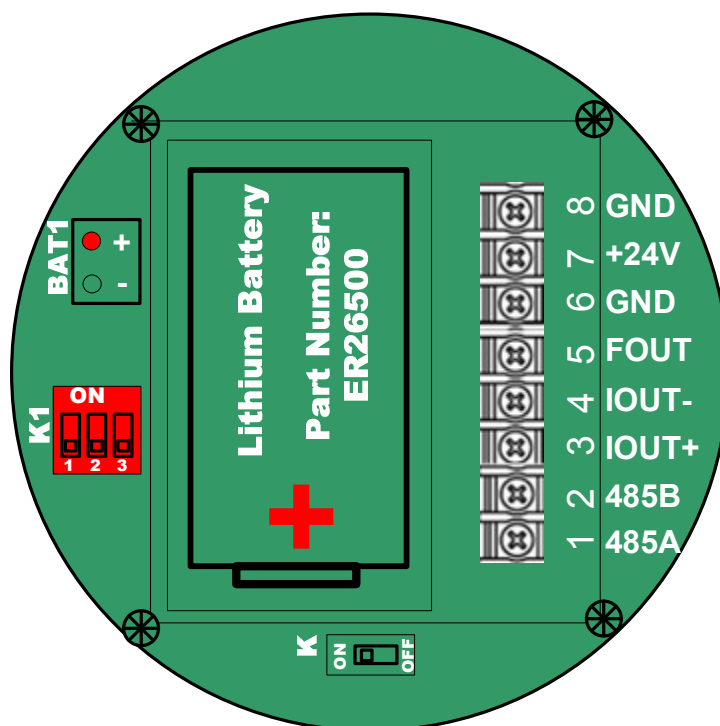
Terminal Wiring

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



*Note: Terminal configuration is same for LWS-B, LWS-C, LWS-C1 and LWS-C2, but some functions are ONLY available on specified model. The table lists the function of each model.*

## 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

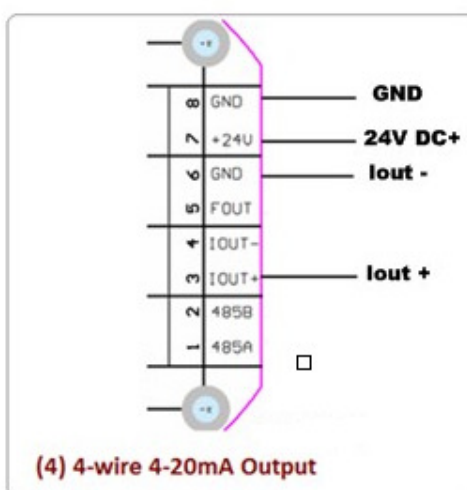
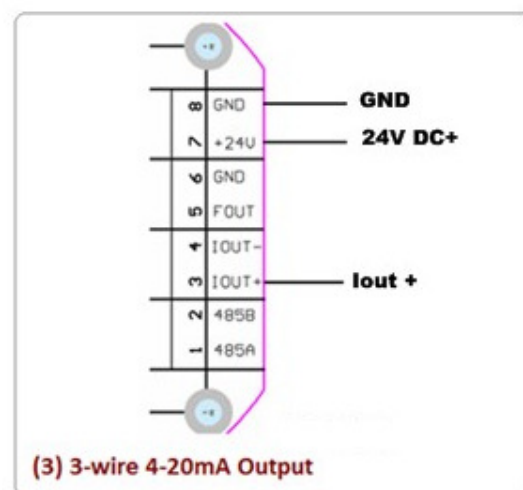
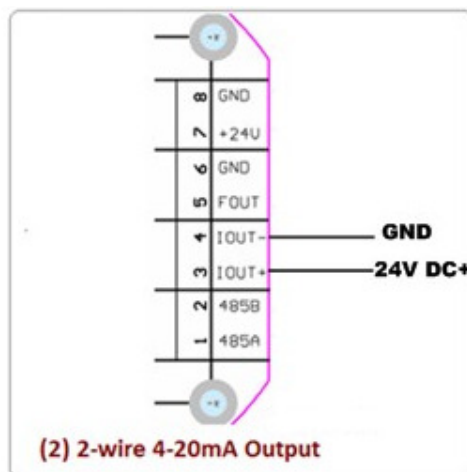
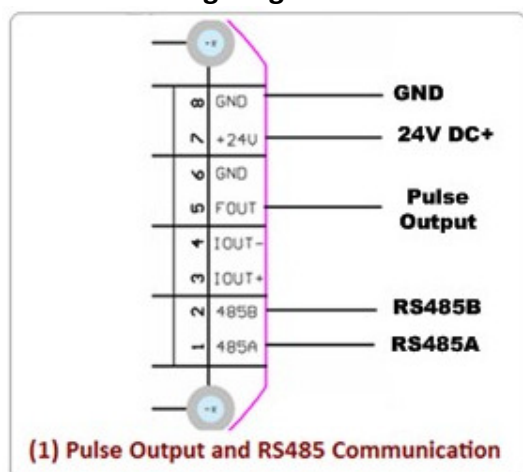
## Terminal Wiring

6.4.1 LWS-B: if the display is blank, put the plug of battery into the battery socket (BAT1).

6.4.2 LWS-C, LWS-C1 and LWS-C2

Model	Function (Optional)	Terminal Code	Terminal Symbols	Description
LWS-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-
LWS-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-
LWS-C2	HART Communication	3	IOUT+	24V DC+
		4	IOUT-	Current and HART Output

## Electrical Wiring Diagram



## 7.0 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.*

### 7.1 LWS-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.

### 7.2 LWS-A; No display; 4-20mA Output

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

#### 7.2.1 Zero Point Calibration

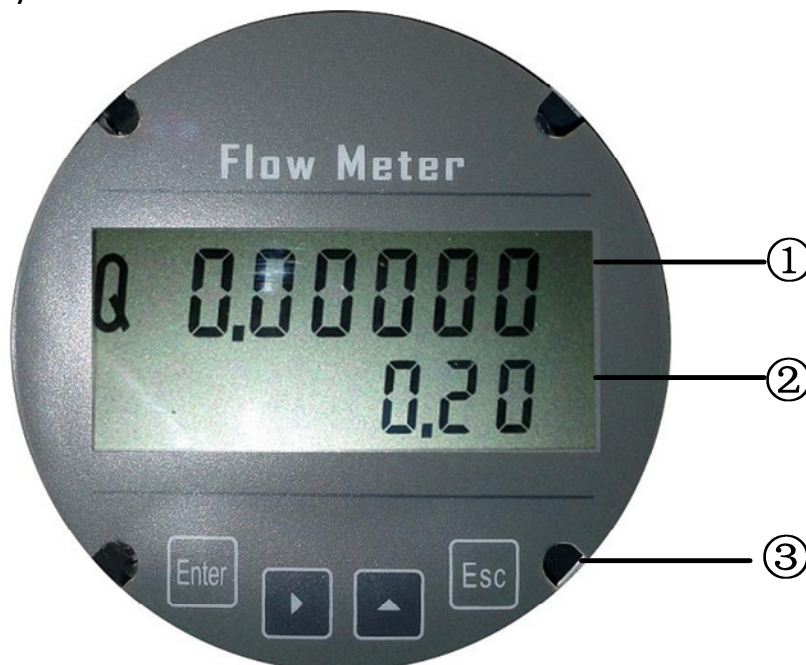
- (1) Shut off the valve where the flowmeter is installed, ensure there is no flow rate in pipe.
- (2) Put high accuracy amperometer into the circuit loop as series connection.
- (3) Adjust the potentiometer W502 to make sure the display on amperometer is 4mA.

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

### 7.3 LWS-B, LWS-C, LWS-C1 and LWS-C2; Local Display



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

#### 7.3.1 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
<b>Enter</b>	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
<b>Note:</b> 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				

### 7.3.2 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.

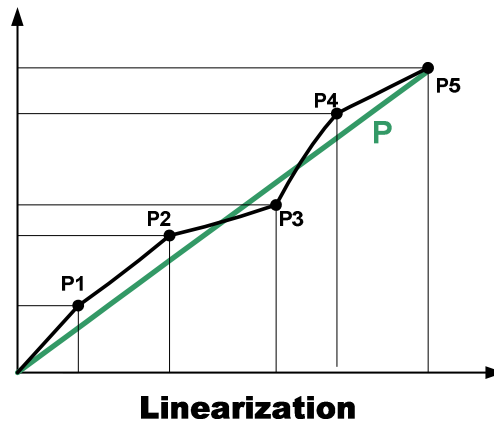
Table. Description of Password Grade

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)



### 7.3.3 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 Row: Frequency (P1) Second Row: K-Factor (P1)
P2	Linearization of the Flowcurve: point 2	First Row: Frequency (P2) Second Row: K-Factor (P2)
P3	Linearization of the Flowcurve: point 3	First Row: Frequency (P3) Second Row: K-Factor (P3)
P4	Linearization of the Flowcurve: point 4	First Row: 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)

## 8.0 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 installed backwards	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 displayed 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