

# Darhor DH500 Series Liquid Turbine Flow Meter



Subject to change without notice.

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# 1. General Information

This manual will assist you in installing, using and maintaining DH 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.

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

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
<b>Measured Value</b>	
Primary measured value	Flow Rate
Secondary measured value	Volume flow

### Design

<b>Features</b>	
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

### Measuring accuracy

Reference conditions	Flow conditions similar to EN 29104
	Medium: Water
	Electrical conductivity: $\geq 300 \mu\text{S}/\text{cm}$
	Temperature: $+10\dots+30^\circ\text{C}$ / $+50\dots+86^\circ\text{F}$
	Inlet section: $\geq 10 \text{ DN}$
	Operating pressure: 1 bar / 14.5 psig
Flow Meter Accuracy	Standard: 1.0% of rate
	<b>Optional:</b> 0.5% of rate

## Operating conditions

<b>Temperature</b>	
Process temperature	T1 Level: -20...+80°C
	T2 Level: -20...+120°C
	T3 Level: -20...+150°C
Ambient temperature (all versions)	<b>Standard</b> (with aluminum converter housing):
	-10...+55°C
Storage temperature	-20...+70°
<b>Pressure</b>	
EN 1092-1	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

<b>Sensor housing</b>	SS304
	Other materials on request
<b>Flanges</b>	SS304
	Other materials on request
<b>Rotor</b>	
Standard: 2Cr13	EN10088-3      1.4021      X20Cr13
	AISI              420
	BS                420S37
	JIS                SUS410J1
Optional: CD4MCu	DN15...DN80
<b>Bearings and Shaft</b>	Tungsten Carbide
<b>Converter Housing</b>	Standard: polyurethane coated die-cast aluminum

## Process connections

<b>Flange</b>	
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
<b>Thread</b>	DN4...DN50 in PN63

## 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		Standard Flow Range	Extended Flow Range
(mm)	(in.)	(m3/h)	(m3/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
200	8	80 to 800	40 to 800

### 3. Model and Selection

Model Selection (See Table 1)

Table 1: Model Selection Guidance for Liquid Turbine Flowmeter

Model Suffix Code								Description		
<b>DH500</b>										
<b>Diameter</b>								Three Digitals; for example: 010: 10 mm;      015: 15 mm; 080: 80 mm;      100: 100 mm		
<b>Converter</b>		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		
		H						Local display; 24V DC Power; 4-wire 4-20mA Output & HART Communication		
<b>Accuracy</b>		10						1.0% of Rate		
		05						0.5% of Rate		
<b>Flow Range</b>		S						Standard Range: refer to flow range table		
		W						Wide Range: refer to flow range table		
<b>Body Material</b>		S						SS304		
		L						SS316		
<b>Explosion Rating</b>		N						Safety Field without Explosion		
		E						ExdIIBT6		
<b>Pressuring Rating</b>		N						Per Standard		
		H(x)						Customized Pressure Rating		
<b>Connection</b>							-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
									-TH	Thread; DN4...DN50
<b>Fluid Temperature</b>								-T1	-20...+80°C	
									-T2	-20...+120°C
										-T3

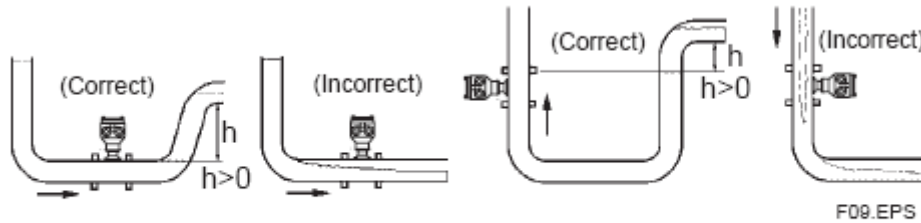
Model Code: DH500 050C10SSNN A1 T1

Explanation - Diameter: 50mm; Converter: 24V DC Power Supply, 4-20mA Output, Local Display  
Accuracy: 1.0%; Flow range: 4-40 m3/h; Body Material: SS304; No Explosion;  
Connection: ANSI 150# Flange; Fluid Temperature: -20...+80°C

# 4. Cautions for Installation

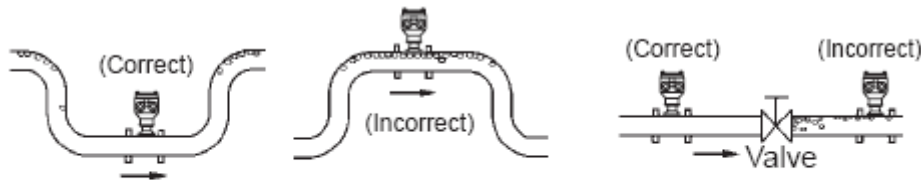
## 4.1 Mounting Positions

- 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.

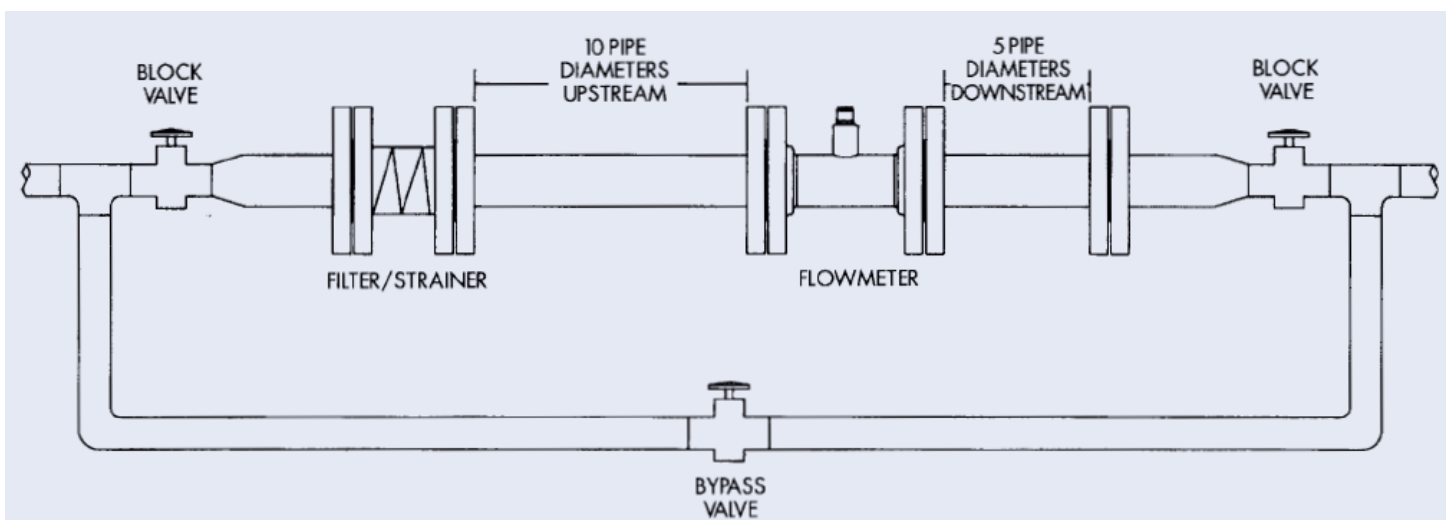
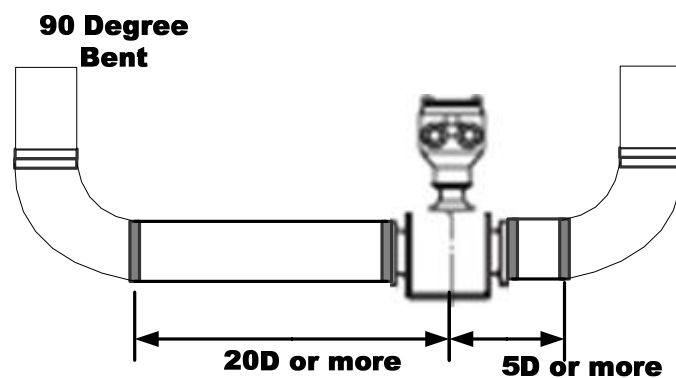
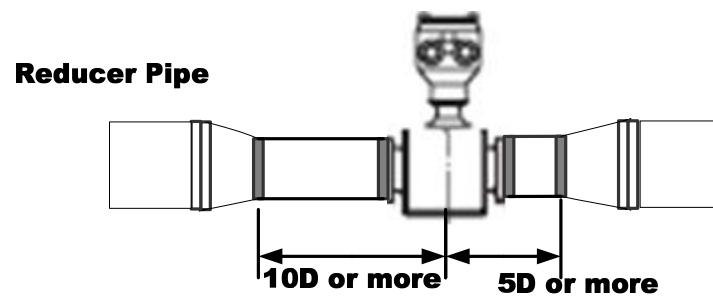
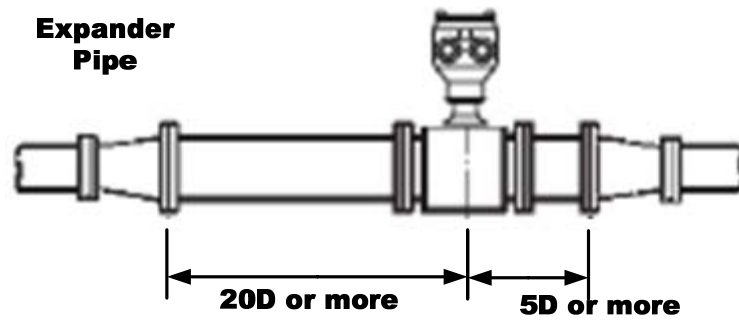


Diagram 1. Typical Flow Meter System Installation

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

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 SURE 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<sub>b</sub>: Back pressure; P<sub>v</sub>: Vapor Pressure; P<sub>in</sub>: Inlet Pressure; P<sub>out</sub>: 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.

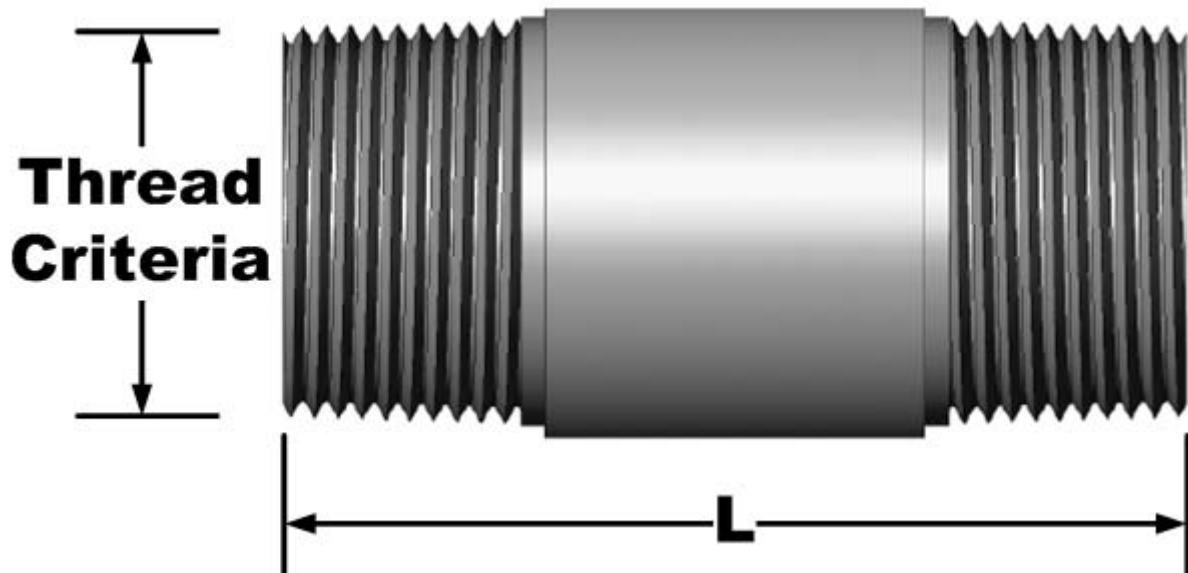
## 4.4 Connections

### 4.4.1 Thread Connection

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

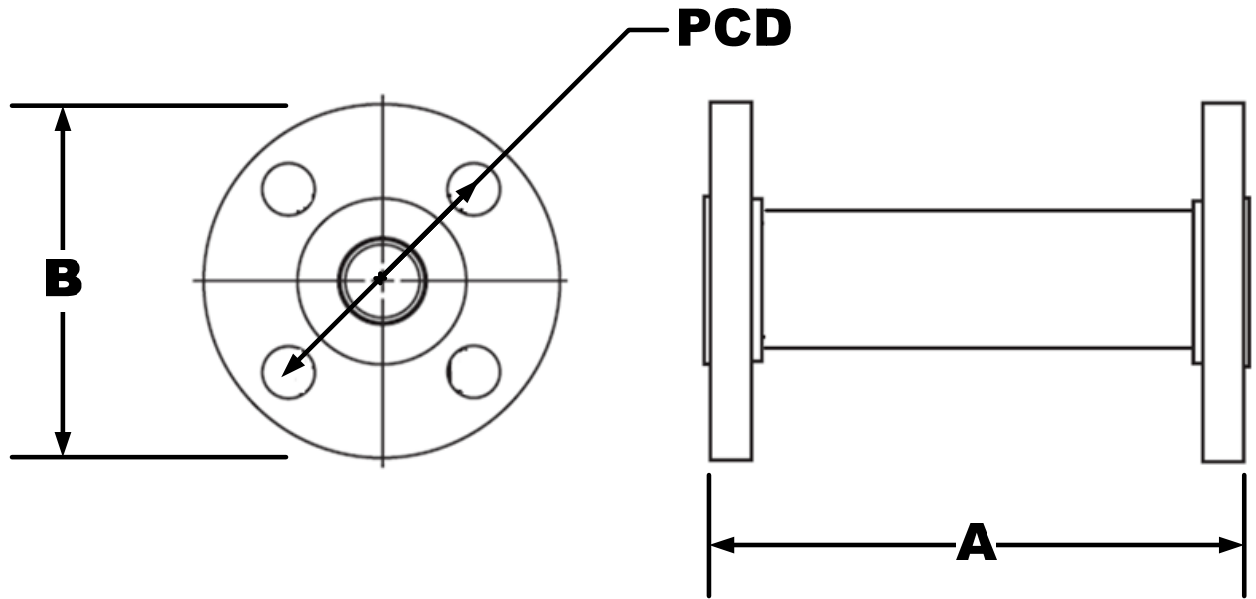
DN4...DN10: Straight Runs and filter are included in the length for DN4 to DN10.

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



Diameter (mm)	L (mm)	Thread Criteria
4	270	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"

#### 4.4.2 Flange Connection



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)					
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

## 5. Electrical Wiring



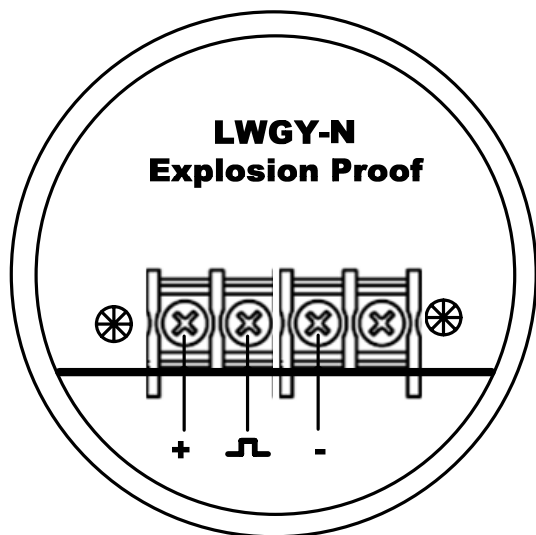
Warning: Electrical Hazard  
Disconnect power before beginning wiring.

### 5.1 DH500 -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

### 5.2 DH500 -N; Pulse Output, explosion proof model.

Terminal Configuration

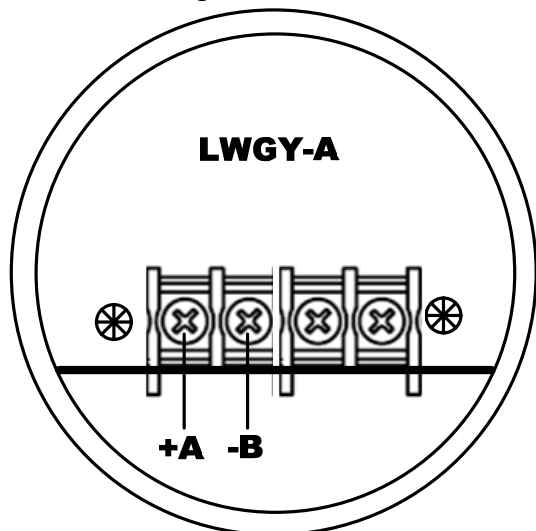


Terminal Wiring

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

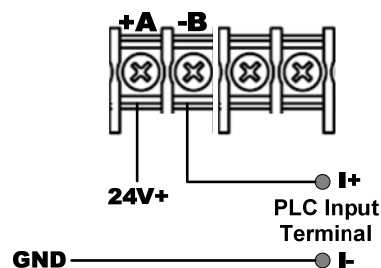
### 5.3 DH500-A; two-wire 4-20mA Output, No Local Display.

Terminal Configuration



Terminal Wiring

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

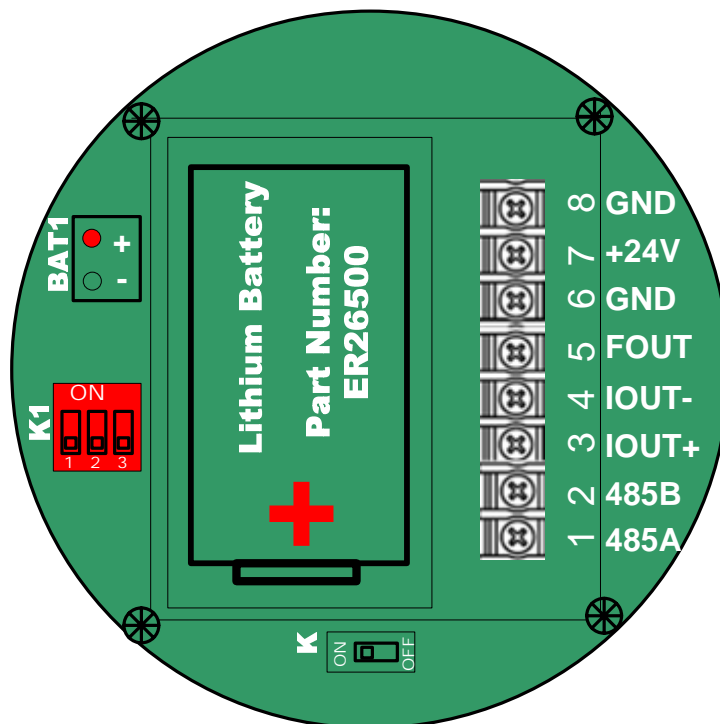


## 5.4 DH500-B,C,C1 Local Display

Note: Terminal configuration is same for DH500-B,C,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
DH500-B	Lithium Battery	Not Available	Not Available	Not Available	Not Available	
DH500-C	24V DC	Lithium Battery	4-20mA	Pulse	Not Available	Output is only available when 24V Power supply is on.
DH500-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

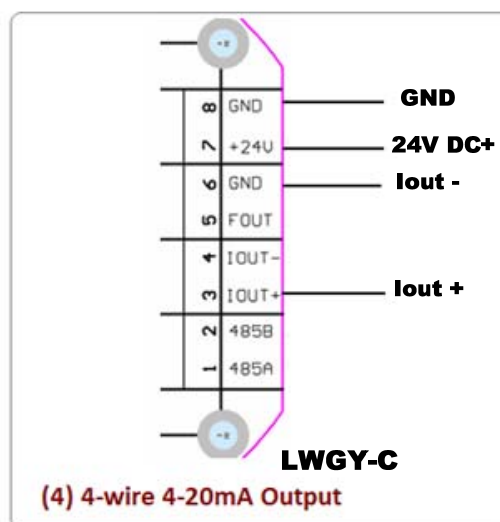
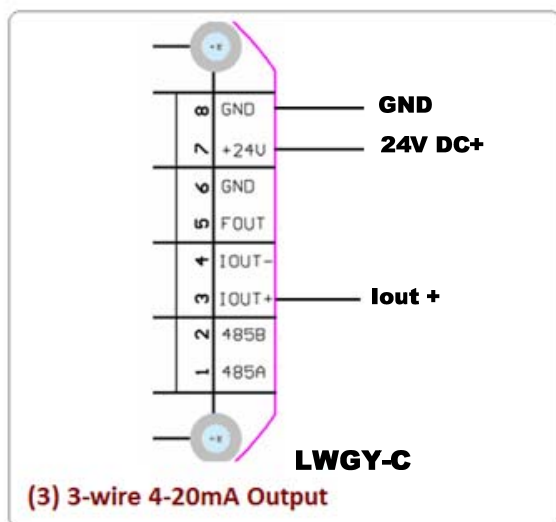
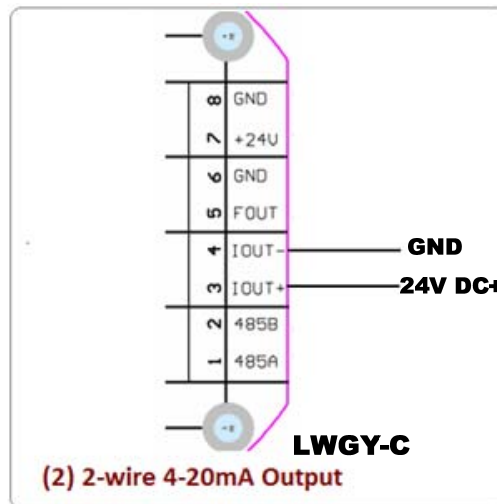
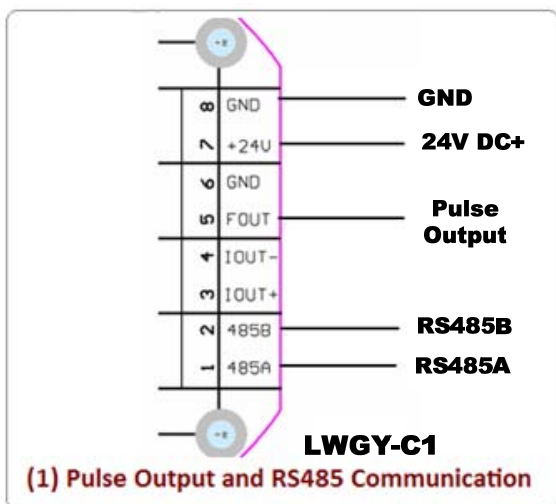
### Terminal Wiring

5.4.1DH500-B: if the display is blank, put the plug of battery into the battery socket (BAT1).

5.4.2DH500-C and DH500-C1

Model	Function (Optional)	Terminal Code	Terminal Symbols	Description
DH500-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-	
DH500-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





5.5 DH500-H

Function List for converter with local display					
Model	Power Supply	Output	Optional Dual Output	Communication	Note
DH500-H	24V DC	4-20mA (4-wire)	Not Available	HART	

Electrical Wiring Diagram

