



BLFT Turbine Flow Meter

Operation Manual



Version Number: E930000 Ver.E+001

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1. GENERAL INFORMATION

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



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

- 1. Use only fluids that are compatible with the housing material and wetted components of your Liquid turbine flow meter.
- 2. When handling hazardous liquids, always exercise appropriate safety precautions.
- 3. When measuring flammable liquids, observe precautions against fire or explosion.
- 4. When working in hazardous environments, always exercise appropriate safety precautions.
- 5. Handle the sensor carefully. Even small scratches or nicks can affect accuracy.
- 6. For best results, calibrate the meter at least once per year.
- 7. Do not purge the flow meter with compressed air.
- 8. During Liquid Turbine Flowmeter removal, liquid may spill. Follow the manufacturer's safety precautions for clean up of any minor spills

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 whereapplicable. Optional accessory modules can be used to transmit 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 the information on the 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, Chemicals (1) Filtered, without solids, sand, debris
	(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 remote mount version			
	N1: No display; pulse output only			
	N2: No display; Exd(not Europe) See EEx ia ATEX option			
Compact Version Converter	A: No display; 2 wire 4-20mA output only			
	E: Local display; 4~20mA/ pulse output; RS485 Modbus as an option.			
	Threaded: DN4-DN50			
Connection	Flange: DN4-DN200 (DIN, ANSI, JIS)			
Connection	Wafer: DN4-DN200			
	Tri-Clamp: DN4-DN100			
Measurement Ratio	Standard -10:1; Optional - 20:1			

Process Connections

Flange			
EN 1092-1	DN4200 in PN 640		
ASME	<u>1/2 "8 " in 150 lb RF</u>		
JIS	<u>1/2 "8 " in 1020K</u>		
Design of Gasket Surface	RF (Raised Face)		
Other Sizes or Pressure Ratings on Request			
Thread	DN4DN50 BSP or NPT, PN63		

Measurable Flow Range

Diameter	Standard Flow Range	Extended Flow Range	
(mm)	(m³/h)	(m³/h)	
4	0.04 to 0.25	0.04 to 0.4	
6	0.1 to 0.6	0.06 to 0.6	
10	0.2 to 1.2	0.15 to 1.5	
15	0.6 to 3.6	0.5 to 5	
20	0.8 to 8	0.45 to 9	
25	1 to 10	0.5 to 10	
32	1.5 to 15	0.8 to 15	
40	2 to 20	1 to 20	
50	4 to 40	2 to 40	
65	7 to 70	4 to 70	
80	10 to 100	5 to 100	
100	20 to 200	10 to 200	
125	25 to 250	13 to 250	
150	30 to 300	15 to 300	
200	80 to 800	40 to 800	

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

Reference Conditions	Flow conditions similar to EN 29104
	Medium: water/ Diesel/Alcohol
	Temperature: +10+50°C/ +50+86°F
	Straight lengths of pipe before & after: > 10 DN
	Test operating pressure: 1 bar/14.5 psig
Elow Motor Accuracy	Standard: ±1.0% of rate
TIOW MELET ACCULACY	Optional: ±0.5% of rate

Installation Conditions

	Take Notice that the flow sensor is always fully flooded			
Installation Flow	For detailed information see chapter "Cautions for Installation"			
Direction	Forward			
Direction	Arrow on flow sensor indicates flow direction			
Inlet Pipe Run	≥ 10 DN upstream straight lengths required			
Outlet Pipe Run	≥5 DN downstream straight lengths required			

Materials

Concertiousing	SS304	SS304			
Sensor Housing	Other materials	Other materials on request			
Elangoa	SS304	SS304			
Flanges	Other materials	Other materials on request			
Rotor					
	EN10088-3	1.4021	X20Cr13		
Standard: 20r12	ANSI	420			
Stanuaru. 20113	BS	420S37			
	JIS	SUS410J1			
Optional: CD4MCU	DN15DN80	DN15DN80			
Bearing and Shaft	Tungsten Carbic	Tungsten Carbide			
Converter Housing	Standard: Polyurethane coated die-cast aluminum				

3. CAUTIONS FOR INSTALLATION

3.1 Mounting Positions

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



Mounting Positions

□ Avoid Air Bubbles. If air bubbles enter a measurement pipe, flow rate accuracy and oper -ation may be affected and measurement errors may be caused.





- □ Avoid all pipe locations where the flow is pulsating, such as the outlet side of piston or diaphragm pumps
- Avoid locations near equipment producing electrical interferenc such as electric motors, transformers, variable frequency drives, etc.
- $\hfill\square$ Install the meter with enough room for future access for maintenance purposes



3.2 Required Lengths of Straight Pipe

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



Two 90 Degree Bends on One Level The recommended guidelines are given to enhance accuracy and maximize performance. Distance given here are minimum requirements; double them for ideal straight pipe lengths.

- □ Upstream: allow a minimum straight pipe length at least 10 times the internal diameter of the pipe. For example, with 50 mm pipe, there should be 500 mm of straight pipe immediately upstream. Desired downstream straight pipe length is 1000 mm.
- Downstream: allow a minimum straight pipe length at least 5 times the internal diameter of the pipe. For example, with 50mm pipe, there should be 250mm of straight pipe immediately upstream. Desired downstream straight pipe length is 500mm.

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≥1.25xPv + 2x (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.



- Debris 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 measured 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 G Male (BSPM) Thread, other threads are available on request. For example: BSP, NPT Male/ Female Thread; Consult us for more information

DN4...DN10: Straight pipe adaptors and filter are included for DN4 to DN10

, as standard; DN15...DN50: Straight pipe adaptors are optional on request



Diameter(mm)	L(mm)	Thread Criteria
4	225	G½″
6	225	G½″
10	345	G1⁄2″
15	75	G1″
20	80	G1″
25	100	G1-¼″
32	140	G 2″
40	140	G 2″
50	150	G 2-½″



DN15to DN50

DN4to DN10

Filter and Straight Pipe





3.4.2 Flange Connection

Flange	
EN 1092-1	DN4200 in PN 640
ASME	1/2"8"in 150 lb RF
JIS	1/2"8"in 1020k
Design of Gasket Surface	RF (Raised face)
	Other sizes or pressure ratings on request



ANS1150# Flange Dimensions							
Size	Code	L(mm)	ANSI Flange Rating Class	Flange Diameter (H)	Bolt Hole Diameter	Bolt Circle Diameter (PCD)	Bolt Hole Quantity
l (Inch)	(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 PN16 Flange Dimensions						
Size Code		L	DIN Flange Rating Class	Flange Diameter (H)	Bolt Hole Diameter	Bolt Circle Diameter (PCD)	Bolt Hole Quantity
(Inch)	(mm)	(mm)	MPa	(mm)	(mm)	(mm)	
1/2"	15	75	1.6	95	14	65	4
3/4"	20	80	1.6	105	14	75	4
1"	25	100	1.6	115	14	85	4
1-1/4"	32	140	1.6	140	14	100	4
1-1/2"	40	140	1.6	150	18	110	4
2"	50	150	1.6	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

Notice: Please contact manufacturer for JIS Flange Connection Dimensions.

3.4.3 Tri-Clamp Sanitary Connections (Max. Pressure: 10bar)

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



Diameter (mm)	D (mm)	A (mm)	B (mm)	d (mm)	L (mm)	
DN 4					4	
DN 6				6		
DN10				10	100	
DN15	50.5	46	40.5	15	100	
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

4.1 N1 Type (Pulse)

Cable Color	Terminal Symbols	Description
Red Wire	24V (+)	Power Supply: +24V
Blue Wire	Pulse	Pulse Signal Output
Black Wire	24V (-)	Power Supply: -24V

4.2 N2Type (Pulse)





4.3 AType (4-20mA)





4.4 E Type (Pulse/ 4-20mA/ModbusRS485)

					Output			
Power	Discular			Current				
supply	Display	Pulse	Scaled Pulse	2wires	3wires	3wires	DC105	ПУРТ
				4-20mA	4-20mA	0-20mA	K5400	
Battery	•							
DC24V	•	•	•	•	•		•	
BAT+ DC24V	•	•	•	•	•		•	
DC24V	•	•	•			•	•	
BAT+ DC24V	•	•	•			•	•	
DC24V	•			•				•
Symbol			Standard •				Option	0

(1)Terminal Description

Terminal No.	Terminal Symbol	Terminal Description	Note
1	СОМ	-24V	
2	DC24V+	-24V	
3	lout	Current output	
4	Fout	Pulse output	
5	Fout_C	Pulse or scaled pulse output	
6	AL	Low limit alarm	
7	AH	High limit alarm	
8	C_KEY	External button positive terminal	Use along with GND
9	485_A	RS485 terminal A	
10	485_B	RS485 terminal B	
11	GND	External button negative terminal	Use along with C_KEY

4.4.1 PCB Diagram



(2) Wiring





(3) Pulse Output Description

K2 is the switch for the PP and OC scaled pulse output, the terminal is Fout_C.

Code	Symbol	Description
K2	PP	Push-pull Output (1 ≤ 20mA)
	OC	Open collector (1≤ 20mA/ ≤24V)

The terminal of Fout is only used for calibration, and it will output the original frequency.

Code	Symbol	Description
K1	ON	Power by battery
	OFF	Power by DC 24V

4.4.2 Battery-supply Diagram



(1)Terminal Description

Terminal No.	Terminal Symbol	Terminal Description	Note	
1	DC24V+	24V+		
2	СОМ	24V-	Only for calibration	
3	FOUT	Pulse output		
4	C_KEY	External button positive terminal		
5	GND	External button Negative terminal	Use along with C_KEY	
6	IC		Reserved	
7	ICAL		Reserved	
8	ICAH		Reserved	
9	BAT		Reserved	
10	GND	External button negative terminal	Use along with C_KEY	

5. E Type Display and Buttons

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

5.1 Screen Display



Section 1	Functional region which consists of battery situation, communication, current, frequency, flow percentage (Temperature could be available on request)
Section 2	Units section which consists of 10 units: m³/h, L/h, L/min, US Gal/min, UK Gal/min. US Gal/h, UK Gal/h, kg/h, t/h, ft³/h
Section 3	Flow rate (7 digital figure at max)
Section 4	Alarm sign which consists of SET prompt and alarm prompt
Section 5	'Total flow (11 digital figure at mini) with two decimal places

5.2 Buttons with Function

Interface buttons (four keys)

	Button	s			
		Turn page/Save			
Interface Buttons	\Rightarrow	Move cursor			
	1	Menu value increase/Turn page			
		Exit			



for 5 seconds to turn off the back-light if the back-

and vice-versa.

Operation

Menu	A state of the	\rightarrow		5
Main Menu	Go to sub-menu	x	х	х
Sub-menu	Go to password menu	x	x	Back to main menu
Password Menu	a. False or No password will go to the next menu b. Correct password: The parameter is settable	Move Cursor	Set parameter	Back to main menu
Setup Menu	Set/Save	Move Cursor	a. Setup status: Menu Value Increase or Revise number; b. Non-Setup status: Turn to previous menu.	Cancel the setting and back to main menu

5.3Parameters Setting

5.3.1 Passwords

Туре	Password	Note	
User password	1234	To modify the P1-P14 parameters	
Engineer password	1010	To modify the P16-P26 parameters	
Total flow reset	5555	To reset the total flow	

Note: It will display "0000" before inputting password. If the password is incorrect, it will go to P1 menu automatically in non-programming mode.

5.3.2 Menu Instruction

Password	Code	Function	Parameter		Note	
			0- m³/h	5-USGal/h	Other parameters setting.	
			1- L/h	6-UKGal/h	the variables associated	
	P1	Unit	2- L/min	7- kg/h	automatically, according	
	• •	onic	3- US Gal/min	8-t/h	to the units of P1 to calculate, such as total	
			4- UK Gal/min 9- ft ³ /h flow, flow		flow, flow rate, scaled	
			10- US	S. bpd		
	P2	Damping Time	9-00	99S	To slow flow changes and prevent jump	
	P3 Maximum Flow Rate		Maximum Flov unit correspon	w settings, the ds to the flow.	Exceed the maximum flow, showing the minium flow	
F 1234 F	P4	Minimum Flow Rate	Minimum flow s corresponds	ettings, the unit to the flow.	When the flow rate is lower than minimum flow rate, the flow rate will show "0"	
	P5	Input frequency cap setting	The upper lir measuring	nit setting of frequency	When it exceeds the upper limit, it will display max value, accuracy is 0.1 Hz.	
	P6	Meidum Density	When the unit setting is mass unit, the density unit of medium requests to be set		The density unit is g/cm ³ .	
	P7	Frequency Output Mode	0- No frequency output			
			1- Corrected pulse output after linearization.		Select Parameter	
			2- Scaled p	ulse output		
	P8 Scaled-pulse Output		0.01:0.01 L/Pulse 0.1:0.1L/Pulse 1:1L/Pulse 10:10L/Pulse 100:100L/Pulse 1000:1000L/Pulse		Unit is in accordance with P1 menu	
	P9	Pulse Width	1 ~ 20	00 ms	The width setting of scaled pulse	
	P10	COMM.	0: RS485	1: Hart		

Password	Code	Function	Parameter			Note		
				Address	1-255			
		Communication		Baud Rate	1200, 2400, 4800, 9600, 19200			
	P11		RS485	Verification	N, O, E	No verify, Odd verify, Even verify		
				Data Length	7, 8			
				Stop Bits Length	1,2			
1234			HART	Address	Editable			
	D 40	Upper limit			YES/NO			
	P1Z	alarm setting	1%-100	0%: Setting the	e flow percentag	ge of the upper limit		
		Lower limit			YES/NO	0		
	P13	alarm setting	1 %-10	0%: Setting th	e flow percenta	age of the upper limit		
			0- Off m	ode				
	P14	Backlight	1- Automatic mode					
			2- On m	ode (available				
****	P15	Total Flow	Modifying total flow value					
1010	P-16 F-1	Linearization of the Flowcurve: poi nt 1	First Row: Frequency (P1) Second Row: K-Factor (P1)			Input Value, Factory ONLY		
	P-17 F-2	Linearization of the Flowcurve: point2	First Row: Frequency (P2) Second Row: K-Factor (P2)			Input Value, Factory ONLY		
	P-18 F-3	Linearization of the Flowcurve: point3	First Row: Frequency (P3) Second Row: K-Factor (P3)			Input Value, Factory ONLY		
	P-19 F-4	Linearization of the Flowcurve: point4	First Row: Frequency (P4) Second Row: K-Factor (P4)		Input Value, Factory ONLY			
	P-20 F—5	Linearization of the Flowcurve: point5	First Row: Frequency (P5) Second Row: K-Factor (P5)		Input Value, Factory ONLY			
	P-21 F-6	Linearization of the Flowcurve: point6	First Row: Frequency (P6) Second Row: K-Factor (P6)		Input Value, Factory ONLY			

Password	Code	Function	Parameter	Note
1010	P-22 F-7	Linearization of the Flowcurve: point 7	First Row: Frequency (P7) Second Row: K- Factor (P7)	InputValue, Factory ONLY
	P-23 F-8	Linearization of the Flowcurve: point 8	First Row: Frequency (P8) Second Row: K- Factor (P8)	Input Value, Factory ONLY
	P-24 F	K- Factor	1 st Row: Corrected Frequency 2sec Row: Factor(p26)	Input Value, Factory ONLY
	P-25	Reserved menu	Reserved Menu	
	P-26	K-Factor unit	0:P/L 1:P/m ³	

Note:To turn on/ off the back light by longer pressing 5 seconds.

5.3.3 ERR Analysis

Display	Description	Solutions		
ErrD	Data storage in error	A new PC board need to be replaced		
Err I	Low battery percentage	Change Batteries		
Er rE	Data stored in error and low battery	Change Batteries, if the error is still shown, the PC board may need replacing.		

6. Modbus Communication Protocol

6.1 EType Communication Protocol Description

The data format defaults to n, 8, 1 (1 start bit, 8 data bits, no parity, 1 stop bit), supports parity check, 2 stop bits, etc

The default baud rate is 9600, and five options are available: 1200, 2400, 4800, 9600, 19200 Meter address is decimal "01- 255", "0" address is used for broadcasting, this protocol does not support broadcasting.

This instrument uses the 0*03 instruction in the MODBUS protocol.

Command 03 (HEX)

Read single or multiple registers

The data in the protocol:

Float: the format is IEEE754, from high to low. Double: the format is IEEE754, from high to low. Unsigned int: 0-65535. Command 3 format is as follows.

6.2 MODBUS Request

Meter Address	1 BYTE	01-F7
Function Code	1 BYTE	03
Start Address	2 BYTE	0000-FFFF
Number of Reads	2 BYTE	N(01-7D)
CRC Low Bit	1 BYTE	
CRC High Bit	1 BYTE	

6.3 MODBUS Response

MODBUS Response	1 BYTE	01-F7
Function Code	1 BYTE	03
Byte Count	1 BYTE	N*2
Input Status	N*2 BYTE	
CRC Low Bit	1 BYTE	
CRC High Bit	1 BYTE	

6.4 Error Response

Meter Address	1 BYTE	01-FF
Function Code	1 BYTE	83
ERROCode	1 BYTE	01,02, 03 (See Note 1)
CRC Low Bit	1 BYTE	
CRC High Bit	1 BYTE	

Notel:

01: Register address error;

02: Register length error;

03: CRC error.

6.5 Data Definition

Characteristic	lt	em	Address (Hex)	Register Length(word)		Data Type	Description
Read Only	Tota	al flow	0000	4		Double float	
Read Only	Tota	al flow	0004	2		Float	
Read Only	Instant fl	taneous ow	0006	2		Float	
Read Only	Instant Flov	itaneous w Unit 0008		1		Unsigned int	0:m ³ /h 1 :L/h 2:L/min 3:US Gal/min 4:UK Gal/min 5:USGal/h 6:UK Gal/h 7:kg/h 8:t/h 9:ft ³ /h
Read Only	Ba Vol	ttery Itage	0009 2		2	Float	Unit: V
Read Command 01 0		01 03 0	0004 0004 05C8 CF		CRC low bit first, read cumulative flow and instantaneous flow at the same time		ad cumulative ous flow at the ne
0 4 Return Data		01 03 0 42 84 0 flow=66 00 00 0	01 03 08 42 84 00 00 (cumulative flow=66) 00 00 00 00		Floatir	ng point high bit bit first	first, CRC low

(instantaneous flow=0)

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