

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.

- 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.
- 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	1/2 "8 " in 150 lb RF			
JIS	<u>1/2 "8 " in 1020K</u>			
Design of Gasket Surface	RF (Raised Face)			
Other Sizes or Pressure Ratings on Request				

DN4...DN50 BSP or NPT, PN63

Measurable Flow Range

Thread

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.

Measuring Conditions

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

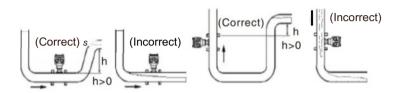
Materials

Canacallavaina	SS304	SS304				
Sensor Housing	Other materials	Other materials on request				
Flanges	SS304					
rianges	Other materials	on request				
Rotor						
Standard: 2Cr13	EN10088-3	1.4021	X20Cr13			
	ANSI	420				
	BS	420S37				
	JIS	SUS410J1				
Optional: CD4MCU	DN15DN80	DN15DN80				
Bearing and Shaft	Tungsten Carbic	Tungsten Carbide				
Converter Housing	Standard: Polyu	Standard: Polyurethane coated die-cast aluminum				

3. CAUTIONS FOR INSTALLATION

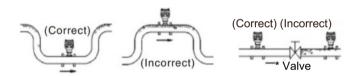
3.1 Mounting Positions

□ 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.



Avoiding Air Bubbles

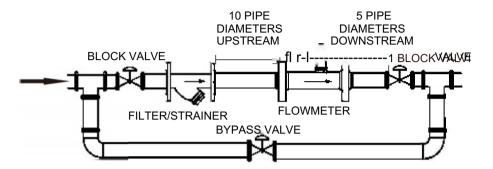
- Avoid all pipe locations where the flow is pulsating, such as the outlet side of piston or diaphragm pumps
- Avoid locations near equipment producing electrical interferenc such as electric motors, transformers, variable frequency drives, etc.
- Install the meter with enough room for future access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

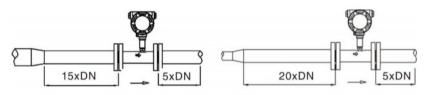


Warning: Precaution for direct sunshine and rain when the meter is installed outside.

3.2 Required Lengths of Straight Pipe

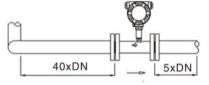
Flow profile altering device such as elbows, valves and reducers can affect accuracy. See diagram below for typical flow meter system installation.



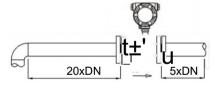


Concentric Contraction Fully Open Valve

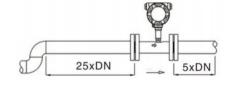
Concentric Expansion Valve



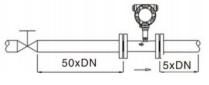
Two 90 Degree Ben ds on Different Levels



One 90 Degree Bend



Two 90 Degree Bends on One Level



Half Open Valve

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

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: Pb21.25xPv + 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.



Special Notice

- □ 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.

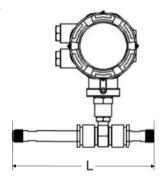
3.4 Connections

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



DN4to DN10

DN15to DN50



Diameter(mm) Thread Criteria L(mm) 4 225 G1/2" 225 G1/2" 10 G1/2" 345 15 75 G1" 20 80 G1" 25 100 G1-1/4" 32 140 G 2" 40 140 G 2" 50 G 2-1/2 150

Filter and Straight Pipe

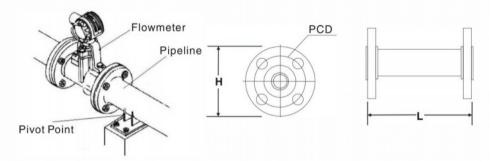






3.4.2 Flange Connection

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



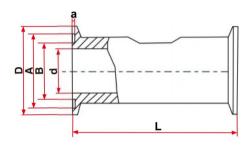
ANS1150# Flange Dimensions									
Size Code		Size Code		L(mm)	ANSI Flange Rating Class	Flange Diameter (H)	Bolt Hole Diameter	Bolt Circle Diameter (PCD)	Bolt Hole Quantity
(Inch)	(mm)			(mm)	(mm)	(mm)			
1/2"	15	75	150#	89	16	60	4		
3/4"	20	80	150#	99	16	70	4		
1"	25	100	150#	108	16	79	4		
1-1/4"	32	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



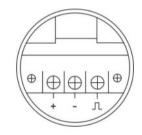
Diameter (mm)	D (mm)	A (mm)	B (mm)	d (mm)	L (mm)
DN 4			4		
DN 6				6	
DN10				10	100
DN15	50.5	46	40.5	15	100
DN20				20	
DN25				25	
DN32				32	120
DN40	64	59	54	40	140
DN50	77	73.5	68.5	50	150
DN65	91	86	80.5	65	170
DN80	106	94	94	80	200
DN100	119	106	106	100	220

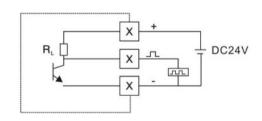
4. ELECTRICAL WIRING

4.1 N1 Type (Pulse)

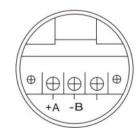
Cable Color	Terminal Symbols	Description
Red Wire	24V (+)	Power Supply: +24V
Blue Wire	Pulse	Pulse Signal Output
Black Wire	24V (-)	Power Supply: -24V

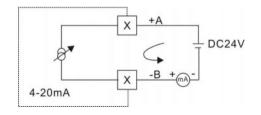
4.2 N2Type (Pulse)





4.3 AType (4-20mA)

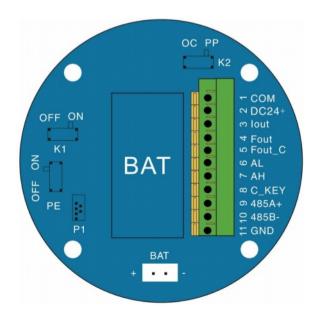




4.4 E Type (Pulse/ 4-20mA/ModbusRS485)

					Output			
Power	Display		Scaled Pulse	Current				
supply	Display	Pulse		2wires	3wires	3wires	DC 40E	HART
				4-20mA	4-20mA	0-20mA	RS485	HAKI
Battery	•							
DC24V	•	•	•	•	•		•	
BAT+ DC24V	•	•	•	•	•		•	
DC24V	•	•	•			•	•	
BAT+ DC24V	•	•	•			•	•	
DC24V	•			•				•
Symbol		Standard •					Option	0

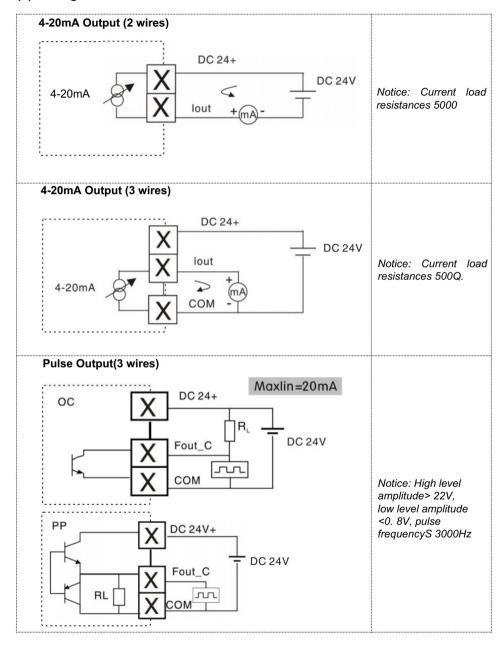
4.4.1 PCB Diagram

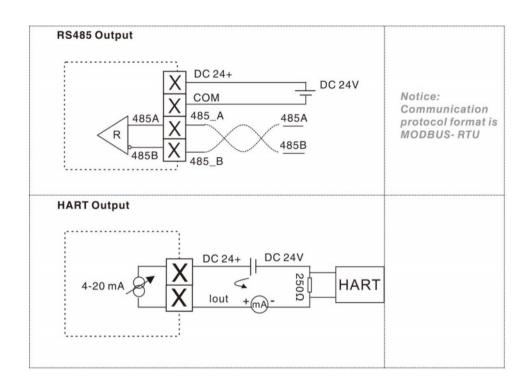


(1)Terminal Description

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

(2) Wiring





(3) Pulse Output Description

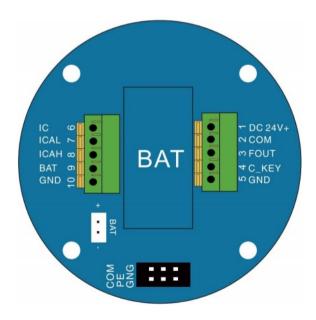
K2 is the switch for the PP and OC scaled pulse output, the terminal is Fout_C.

Code	Symbol	Description
K2	PP	Push-pull Output (1 ≤ 20mA)
	ОС	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



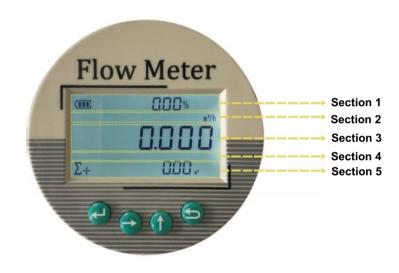
(1)Terminal Description

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, t/h, tf³/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)

	Buttons			
Interface Buttons		Turn page/Save		
	→	Move cursor		
	1	Menu value increase/Turn page		
		Exit		

Notice: To hold for 5 seconds to turn off the back-light if the back-light is on

and vice-versa.

Operation

Menu	@	•	•	9
Main Menu	Go to sub-menu	x	X	х
Sub-menu	Go to password menu	Х	Х	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	
		Unit	0- m ³ /h	5-USGal/h	Other parameters setting,	
			1- L/h	6-UKGal/h	the variables associated	
	P1		2- L/min	7- kg/h	with units will be related automatically, according	
		Offic	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 rate, scaled	
			10- US. bpd		pulse and so on.	
	P2	Damping Time	9-00	99S	To slow flow changes and prevent jump	
	P3	Maximum Flow Rate	Maximum Flounit correspon	w settings, the ds to the flow.	Exceed the maximum flow, showing the minium flow	
	P4	Minimum Flow Rate	Minimum flow s corresponds		When the flow rate is lower than minimum flow rate, the flow rate will show "0"	
	P5	Input frequency cap setting	The upper limit setting of measuring frequency		When it exceeds the upper limit, it will display max value, accuracy is 0.1 Hz.	
1234	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 .			
			0- No frequ	ency output		
	P7	Frequency Output Mode	1- Corrected pulse output after linearization.		Select Parameter	
			2- Scaled pulse output			
	P8 Scaled-pulse 0.1:0.1L/Pulse 0.1:0.1L/Pulse 1:1L/Pulse 1:1L/Pulse 1:1L/Pulse 1:10:10L/Pulse 1:10:100L/Pulse 1:10:100L/Pulse 1:10:100L/Pulse 1:10:100L/Pulse 1:10:100L/Pulse 1:10:100L/Pulse 1:10:100L/Pulse 1:10:100L/Pulse		Unit is in accordance with P1 menu			
	P9	Pulse Width	1 ~ 2000 ms		The width setting of scaled pulse	
	P10	сомм.	0: RS485	1: Hart		

Password	Code	Function	Parameter			Note	
				Address	1-255		
		Communication Parameter		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.10	Upper limit			YES/NO		
	P12	alarm setting	1%-100	0%: Setting the	e flow percenta	ge of the upper limit	
		Lower limit			YES/NO		
	P13	alarm setting	1 %-100%: Setting the flow percentage of the upper limit				
	P14	Backlight	0- Off mode				
			1- Automatic mode				
			2- On mode (available for 3 wires)				
****	P15	Total Flow	Modifying total flow value				
1010	P-16 F-1	Linearization of the Flowcurve: poi nt 1				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
	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
1010	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/m³	

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	Item	Address (Hex)	Register Length(word)	Data Type	Description
Read Only	Total flow	0000	4	Double float	
Read Only	Total flow	0004	2	Float	
Read Only	Instantaneous flow	0006	2	Float	
Read Only	Instantaneous Flow Unit	0008	1	Unsigned int	0:m³/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:ft³/h
Read Only	Battery Voltage	0009	2	Float	Unit: V

Read Command	01 03 0004 0004 05C8	CRC low bit first, read cumulative flow and instantaneous flow at the same time
Return Data	01 03 08 42 84 00 00 (cumulative flow=66) 00 00 00 00 (instantaneous flow=0) D4 36	Floating point high bit first, CRC low bit first