BELL
Flow Systems

BGFT Gas Turbine Flow Meter

Gas Turbine Flow Meter

Operation Manual

Version Number:2019.07

Table of Contents

Table of Contents

1. GENERAL INFORMATION

This manual will assist you in installing, using and maintaining the 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 gases that are compatible with the housing material and wetted components of your turbine.

2.When measuring flammable gases, observe precautions against fire or explosion.

3.When handling hazardous gases, always follow the manufacturer's safety precautions.

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

5.During turbine removal, gas may escapel. Follow the gas manufacturer's safety precautions

6.Do not blow compressed air through the turbine.

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

8.For best results, calibrate the meter each year.

1.1 Product Description

Gas 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 applicable. Optional accessory modules can be used to re-transmitthe 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. Refer to the nameplate for your customized product's specification.

2. Technical Data

2.1 Measuring system& Measuring accuracy

Application range	Gas: Natural Gas, LPG, Air
	(1) Dry gas without water
	(2) Gas without risk of wetted materials corrosion
Measured value	
Primary measured value	Flow Rate
Secondary measured value	Volume flow
Tertiary measured value	Temperature; Pressure
	(ONLY available for compensation model)
Reference conditions	Flow conditions similar to ISO 9951
	Medium: Gas
	Temperature: +10…+55°C
	Inlet section: ≥ 10 DN
	Operating pressure: 1 bar / 14.5 psig
Flow Meter Accuracy	Standard: 1.5%

Flow Meter Accuracy		
	Standard: 1.5%	Qmin to 0.2Qmax: 3%; 0.2Qmax to Qmax: 1.5%
	Optional: 1.0%	Qmin to 0.2Qmax: 2%; 0.2Qmax to Qmax: 1.0%

Converter	
Application range	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 display
	A Type: 4-20mA Output without local display
	E1 Type: Local Display; Lithium Battery Power; No Output
	E2Type: Local Display; 24V DC/ Battery Power; 2 wire 4-20mA Output;
	E3 Type: Local Display; 24V DC/ Battery Power; Pulse output
	E4 Type: Local Display; 24V DC/ Battery Power; 3 wire 0-20mA output
	E5 Type: Local Display; 24VDC/Battery Power; 3 wire 4-20mA output
	H Type: Local Display; 24VDC Power; Hart
	Compensation Type
	D1: Local Display; 24V DC Power; Dual Power: Battery;
	4-20mA(2-wire);T&P Compensation; RS485
	D2: Local Display: 24V DC Power; Dual Power: Battery;
	4-20mA(3-wire);T&P Compensation; Modbus RS485
Measurement Ratio	Standard: 10:1 Optional: 20:1

2.2 Operating conditions

Temperature	
Process temperature	−20…+80°C
Ambient temperature	Standard (with aluminum converter housing):
(all versions)	-10…+55°C
Storage temperature	-20…+70°
Pressure	
EN 1092-1	DN25…DN300: PN 16
	Other pressures on request
ASME B16.5	1"…12": 150 lb RF
	Other pressures on request
JIS	1"…12": 10 K
	Other pressures on request

2.3 Installation conditions

Installation	Take care that flow sensor is always safely installed
	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

2.4 Materials

Sensor housing	SS304
	Other materials on request
Flanges	SS304
	Other materials on request
Rotor	ABS Plastic (Acrylonitrile - Butadiene – Styrene)
	Aluminum Alloy
Bearings and Shaft	SS304
Converter Housing	Standard: polyurethane coated die-cast aluminum

2.5 Flange

Flange	
EN 1092-1	DN25…80 in PN 16…40
	DN100…150 in Pn16…25
	DN200…300 in Pn16
ASME	1"…3" in 150…300 lb RF
	4"…12" in 150 lb RF
JIS	1"…3" in 10…20K
	4"…12" in 10K
Design of gasket surface	RF
	Other sizes or pressure ratings on request
Thread	DN25…DN50 in Pn16

2.6 Measurable flow rate range:

Nominal Diameter		Standard Flow Range (SFR)		Extended Flow Range (EFR)		Standard Pressure Rating
(mm)	(in.)	Code	(m³/h)	Code	(m³/h)	(Mpa)
25	1"	S	2.5 to 25	W	4 to 40	
40	1.5"	S	5 to 50	W	6 to 60	
50	2"	S1	6 to 65	W1	5 to 70	
		S2	10 to 100	W2	8 to 100	
65	2.5"	S	15 to 200	W	10 to 200	
80	3"	S1	13 to 250	W	10 to 160	
		S2	20 to 400			
100	4"	S1	20 to 400	W	13 to 250	1.6"
		S2	32 to 650			
125	5"	S	25 to 700	W	20 to 800	
150	6"	S1	32 to 650	W	80 to 1600	
		S2	50 to 1000			
200	8"	S1	80 to 1600	W	50 to 1000	
		S2	130 to 2500			
250	10"	S1	130 to 2500	W	80 to 1600	
		S2	200 to 4000			
300	12"	S	200 to 4000	W	320 to 6500	
400	16"	S	400 to 8000	W	260 to 8000	

3. CAUTIONS FOR INSTALLATION

3.1 Mounting Positions

★　Avoid all pipe locations where the flow is pulsating, such as on the outlet side of piston or diaphragm pump.

★　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. Please Avoid !

3.2 Required Lengths of Straight Runs

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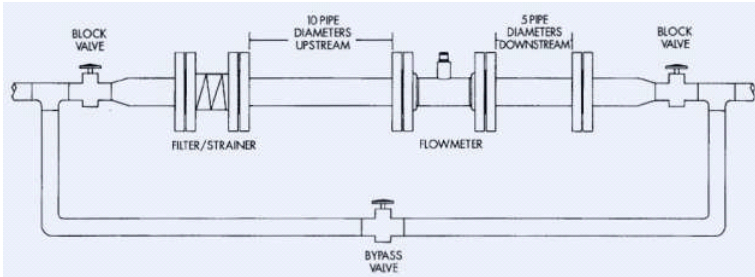

Diagram 1. Typical Flow Meter System Installation

The recommended guidelines are given to enhance accuracy and maximize performance. Distances 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 the 50mm pipe, there should be 500mm of straight pipe immediately upstream. Desired upstream straight pipe length is 1000mm for ideal installation.

★ 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 for ideal installation.

★ Foreign material in the gas being measured can clog/damage the meter 's rotor and adversely affect accuracy.If this problem is anticipated or experienced, install screens to filter impurities from incoming media... especially at first installation

★ To ensure accurate measurement,follow all installation guidelines ★ When the meter contains removable cover plates. Leave the cover plate installed unless the accessory modules specify removal. Don't remove the cover plates when the meter is powered, or an electrical shock and explosion hazard can be caused.

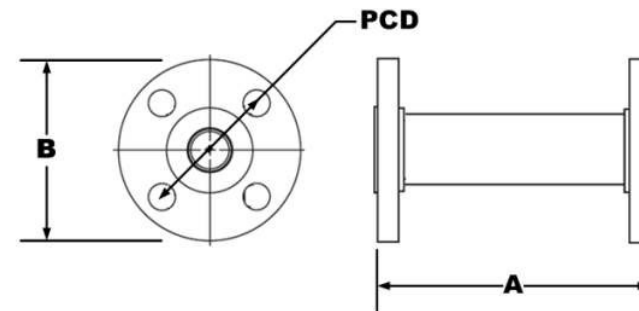## 3.3 Connections

3.3.1 Thread Connection

Note: Default Thread is Male G Thread (BSP), other thread are available on request.
For example: Female NPT Thread, Male NPT Thread; Consult us for more information.
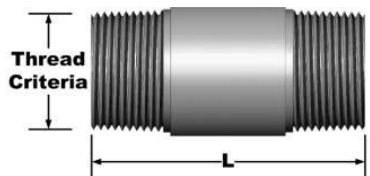
Diameter (mm)	L (mm)	Thread Criteria
25	170	G 2"
40	140	G 2"
50	150	G 2-1/2"

3.3.2 Flange Connection

ANSI Flange Meter Dimensions							
Size Code		A	ANSI Flange	Flange Diameter (B)	Bolt Hole	Bolt Circle	Bolt Hole Quantity
(inch)	(mm)	(mm)	Rating Class	(mm)	(mm)	(mm)	
1"	25	170	150	108	16	79	4
1-1/2"	40	200	150	127	16	99	4
2"	50	200	150	152	19	121	4
2-1/2"	65	240	150	180	19	140	4
3"	80	240	150	191	19	152	4
4"	100	300	150	229	19	191	8
5"	125	240	150	255	22	216	8
6"	150	450	150	279	22	241	8
8"	200	500	150	343	22	298	8
10"	250	500	150	460.4	25	362	12
12"	300	300	150	482.6	25.4	431.8	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"	25	170	1.6	115	14	85	4
1-1/2"	40	200	1.6	150	18	110	4
2-1/2"	65	240	1.6	185	18	145	4
3"	80	240	1.6	200	18	160	8
4"	100	300	1.6	220	18	180	8
5"	125	240	1.6	250	18	210	8
6"	150	450	1.6	285	22	240	8
8"	200	500	1.6	340	22	295	12
10"	250	500	1.6	405	26	355	12
12"	300	300	1.6	460	26	410	12

4.Electrical Wiring

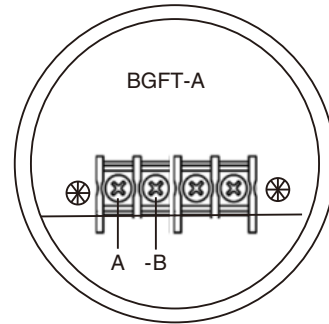**Warning: Electrical Hazard; Disconnect power before beginning wiring.**

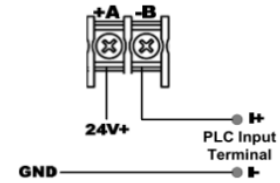### 4.1 BGFT-N: Pulse Output, Explosion Proof Model (NOT EUROP OR USA)

BGFT-N
Explosion Proof
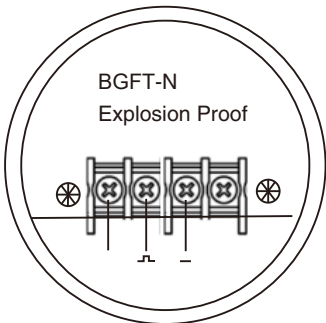
Terminal Configuration

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

4.2 BGFT-A:Two-wire 4-20mA Output, No Local Display

BGFT-A

Terminal Configuration

A -B

Terminal Wiring

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

4.3 BGFT-E series

Terminal board of E type

Lithium Battery

COM+PE
PE+GND

COM PE GND

PNP NPN   OC 24V

1 COM
2 +24V
3 Iout
4 Fout
5 Fout_C
6 AL
7 AH
8 C_KEY
9 485_A
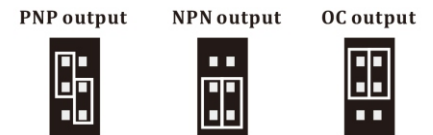10 485_B
11 GND

⊕ ⊖

Battery socket
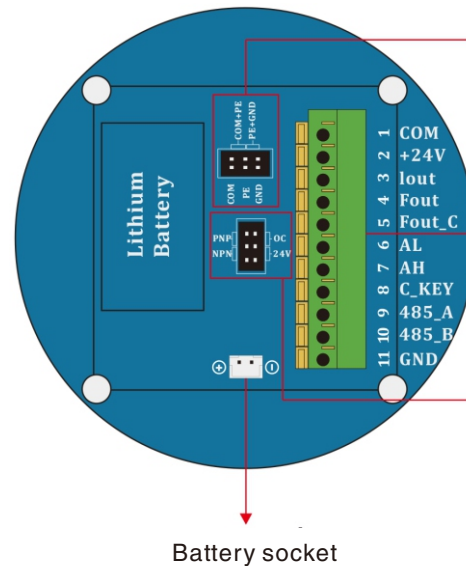
If the signal is interfered with on site, please try these JUMPER terminals as following diagram(a).If the situation is not improved, p l e a s e follow diagram (b)

a   b

Wire terminals

The PNP, NPN and OC output could be chosen by the following JUMPER terminals.

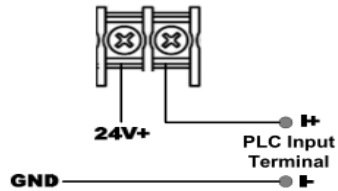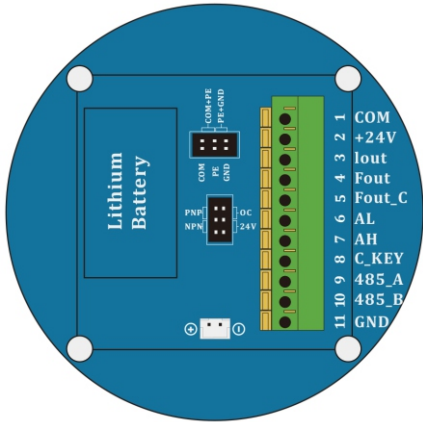PNP output   NPN output   OC output

4.4 Current output(E2,E4, E5,H)

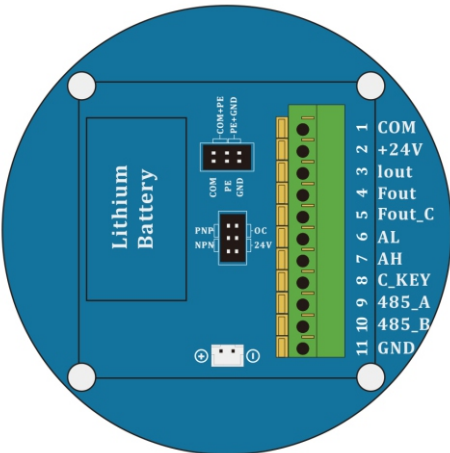*Notice: (BGFT-E1 IS POWERED BY BATTERY ONLY, NO OUTPUT)*

Terminal Configuration

Notice: 1. E4 is 0-20mA output and E5

is 4-20mA output

2.The RS485 does not work in a 2-

wire connection situation

a.2 wire Current output(E2,H)

Terminal Symbols	Description
2	Power Supply: "24V+"
3	Current Output

b.3 wire Current output(E4,E5)

Terminal Symbols	Description
1	GND
2	24V DC+
3	Current output

c. RS485 Communication

Terminal Symbols	Description
9	485_A
10	485_B

4.5 Frequency& Pulseoutput(E2,E3,E4,E5)

Terminal Configuration

Frequency & Pulse output(E2,E3,E4,E5,H,R)

Terminal Symbols	Description
1	GND
2	224V DC+
5	Frequency/Pulse output

Note:The parameters need to be set in the following format.

Output Type	Menu P7	Menu P8	Menu P9
Frequency	1	– – –	– – –
Scaled	2	Need to set	Need to set

4.6 D2S Type converter

4.6.1 D2S Converter Terminal

Sheet 4-1 Configuration of Temperature & Pressure Compensation

Power Supply	Display	Output Type								
		Pulse	Scaled Pulse	4-20mA		IC card	RS485	Alarm		
				Two wire 4-20mA	Three wire 4-20mA			AH	AL	
Battery +DC24V	●	●	●	●	●	●	●	●	●	

Note:

1.Pulse refers to the pulse signal which is to rotor rotational speed;

2.Scaled pulse refers to the pulse signal when the set cumulative amount of units (such as 0.1m3, 1m3 or 10m3, etc.) then a pulse is transmitted

3.Battery model is ER34615, lifetime can be ensured at least 2 years;

4. ● means standard configuration; O means optional configuration;

Terminal Configuration Diagram

Terminal board of D2S Converter
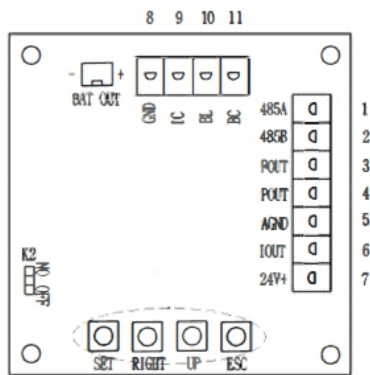
Code	Function
1234	Set by user
1010	Engineer only
6666	Special finstions
	Including total flow reset

Sheet 4-2 Terminal Wiring

No.	Terminal Symbols	Description	
1	485A	Communication RS485A	
2	485B	Communication RS485B	
3	FOUT	Pulse Output	Corresponding Menu V_03
4	POUT	Frequency Output	Calibration dedicated
5	AGND	24V DC-	
6	IOUT	Current Output	
7	24V+	24V DC+	
8	GND	IC+	
9	IC	IC-	
10	BL	Battery power under voltage alarm output	
11	BC	Error alarm output	

Pulse output jumper options

A. Switch of Pulse output type selection is located on the back of the mainboard of the D2S converter, corresponding FOUT output type can be selected from NPN, PNP or OC, detailed operation have been shown ast Sheet 5-3; pulse output type corresponds with the parameters of V-03 menu;

Sheet 4-3

NPN	PNP	OC
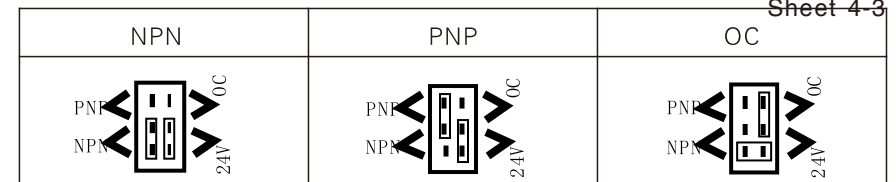
B. POUT is the frequency output for calibration, output correction frequency is fixed.

4.6.2 D2S Converter Electrical Wiring

1. wire 4-20mA Output
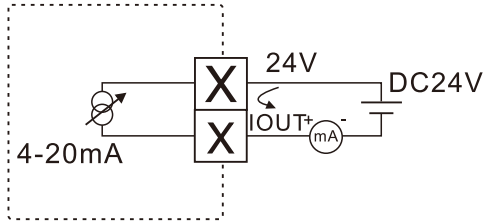
2 wire 4-20mA Output Wiring Diagram

2. 3 wire 4-20mA Output Wiring Diagram
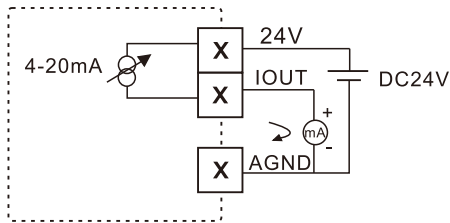
3. Pulse Output Wiring Diagram
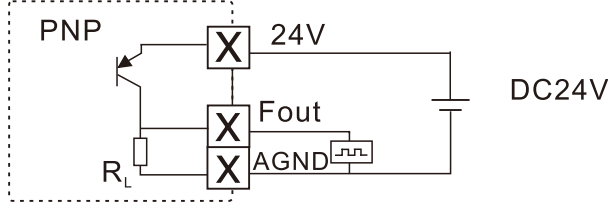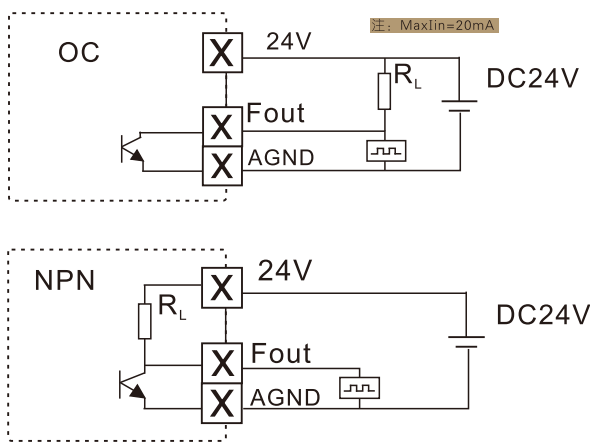
4. RS485 Wiring Diagram
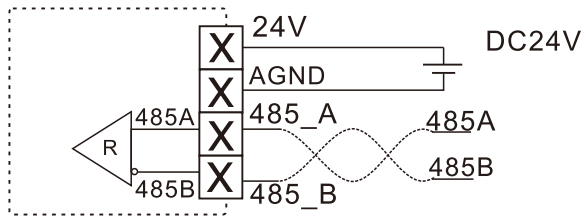
Note:

1.Low electrical level as default, high electrical level is also possible; high electrical level is 2.8V and the Low electrical level is 0.2V. The Pulse width can be set. The electrical wiring of BC and BL are same as IC card signal; more details, please check menu descriptions.

2.IC card signal outputs are workable under any kinds of power supply.

5. Alarm output
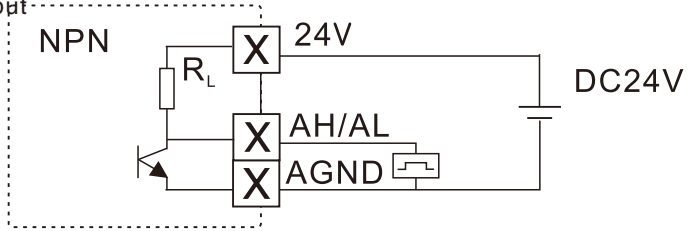
Alarm Output Wiring Diagram

5. Programming and Setup

All flowmeters are tested and calibrated prior to leaving the factory, and the unique K-factor is provided on on the calibration certificate. Keep the calibration certificate well to avoid loss of K-factor information.

5.1 BGFT-N: No display; Pulse Output

Customer should set the correct K-factor into his/her PLC or Flow totalizer in order to get the correct flow rate.

5.2 BGFT-A: No display; 4-20mA Output

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

5.2.1 Zero Point Calibration

(1) Shut off the valve where the flowmeter is installed, ensure there is no flow rate in pipe

(2) Put a high accuracy Amp meter into the circuit loop in series connection.

(3)Adjust the potentiometer W502 to make sure the display on Amp meter is 4mA.

5.2.2 Full Scale Calibration

It's ONLY available for factory; Return the flowmeter to factory for full scale calibration where it is applicable.

5.3 BGFT-E

5.3.1 Description

(1)Under any setting status, press "ESC" This will not save current settings and put the unit back to measuring mode.

(2) No password input or pressing "Enter" with an incorrect password will ONLY allow the user to view all parameters. The total menus in "Parameters Set" are 26, and users can access and modify these menus depending on the input password levels. See table below for more information on password levels.

Table. Description of Password Grade

Password	Login Privileges
No Password	Read Only
1234	Modify Parameter P1-P14
1010	Modify Parameter P16-P26
5555	SettingTotal rate reset
1111	Save all data as factory defaults
5678	Reload Factory Defaults
9999	Total Flow

5.3.2 Display And Key

RS485 Sign

HART Sign

External power Sign

Flow rate percentage

Battery situation

Flow rate

Total Flow

High/low limit alarm

Refer to page 28
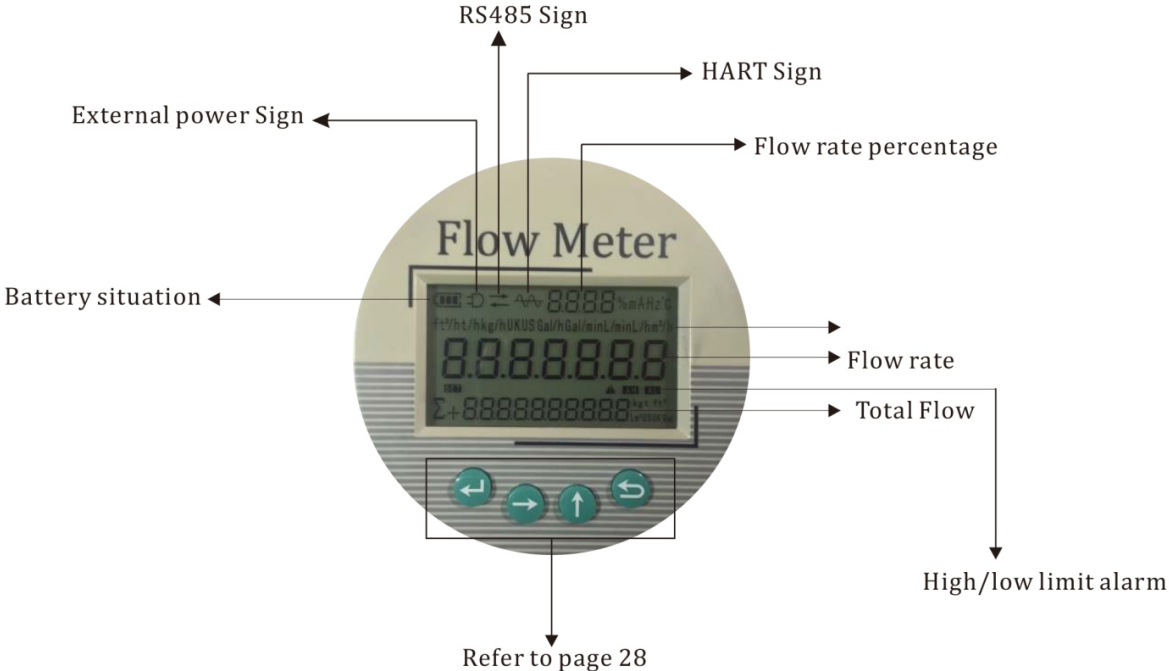
	Measuring Mode	Menu Mode	Sub-menu or Function Mode	Parameter and Data Mode
Enter	1.Display the frequency corresponding to flow rate. 2.Enter the parameter setting mode.	Select menu	Press 1 time,return to menu mode,data saved.	Save the value and advance to next menu
(right arrow)				For numerical values,move cursor one position to the right or left
(up arrow)			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

Note: Data is not saved when press "Esc" to return to measuring mode. If the value needs to be changed, press "Enter" to save the value first

Menu	Parameter name	Setting Method	Levels	Range		
P--1		Select Parameter	User	Value	Flow Rate Unit	Total Rate Unit
				0	m3/h	m
				1	L/h	L
				2	L/min	m
				3	US Gal/min	US Gal
				4	UK Gal/min	UK Gal
				5	US Gal/h	US Gal
				6	UK Gal/h	UK Gal
				7	Kg/h	Kg
				8	t/h	t
				9	ft3/h	f
P--2	Damping Time	Input Value	User	Unit: Second Value:0-9		
P--3	Maximum Flow Rate	Input Value	User	Unit: The same as Flow Rate		
P--4	Maximum Flow Rate	Input Value	User	Minimum flow rate(when the flow rate is lower than it, the flow rate will show 0); Unit: The same as Flow Rate		
P--5	Maximum Frequency output	Input Value	User	Accuracy: 0.1Hz		
P--6	Relative density	Input Value	User	Relative density: 1(water density at 4℃)		
P--7	Frequency / Comms Output Mode	Select Parameter	User	The value should be multiple of 10; The units is ms		
				0: RS485		
				1: Hart		

Menu	Parameter name		Setting Method	Level	Range
P--11	RS485	Address:	Input	User	Max is 255
		Baud Rate:	Select Parameter	User	1200, 2400, 4800, 9600, 19200
		Verification:	Select Parameter	User	N(No verify)
					O(Odd verify)
					E(Even Verify)
		Data Length	Select Parameter	User	7,8
		Stop bits length	Select Parameter	User	1, 2
	Hart	Device Address	Select Parameter	User	
P--12	High Limit Alarm		Select Parameter	User	Yes: On
					1%-100%: Percentage of upper limit flow rate
P--13	Low Limit Alarm		Select Parameter	User	1%-100%: Percentage of upper limit flow rate
P--14	Backlight		Select Parameter	User	0: Off Backlight
					1: Automatic mode
					2: ON mode
P--15	Total Rate		Input value	User	It could be modified with right code

Menu	Parameter name	Setting Method	Level	Range
P--16 F--1	Linearization of the Flowcurve: point 1	Input value	Factory ONLY	First Row: Frequency (P1) Second Row: K-Factor (P1)
P--17 F--2	Linearization of the Flowcurve: point 2	Input value	Factory ONLY	First Row: Frequency (P2) Second Row: K-Factor (P2)
P--18 F--3	Linearization of the Flowcurve: point 3	Input value	Factory ONLY	First Row: Frequency (P3) Second Row: K-Factor (P3)
P--19 F--4	Linearization of the Flowcurve: point 4	Input value	Factory ONLY	First Row: Frequency (P4) Second Row: K-Factor (P4)
P--20 F--5	Linearization of the Flowcurve: point 5	Input value	Factory ONLY	First Row: Frequency (P5) Second Row: K-Factor (P5)
P--21 F--6	Linearization of the Flowcurve: point 6	Input value	Factory ONLY	First Row: Frequency (P6) Second Row: K-Factor (P6)
P--22 F--7	Linearization of the Flowcurve: point 7	Input value	Factory ONLY	First Row: Frequency (P7) Second Row: K-Factor (P7)
P--23 F--8	Linearization of the Flowcurve: point 8	Input value	Factory ONLY	First Row: Frequency (P8) Second Row: K-Factor (P8)
P--24 F--9	Average K-Factor	Input value	Factory ONLY	First Row: Frequency (P) Second Row: K-Factor (P)

## 6. BGFT-D with Temperature and Pressure Compensation

Keys for D type (See table below for function and representation in text)

Menu	Measuring Mode	Sub-menu or Function Mode	Parameter and Data Mode
SET	1.Display the frequency corresponding to flow rate Enter the parameter setting mode	Press 1 time, return to menu mode, data saved	Save the value and advance to next menu
RIGHT			For numerical values, move cursor one position to the right or left
UP			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
Note: Data is not saved when pressing "Esc" to return to measuring mode. If the value needs to be changed, press "Set" to save value first			

Warning: Electrical Hazard Disconnect power before opening /connecting wires.

BGFT-D4 Display(4-20mA)

6.1 Measure Menu
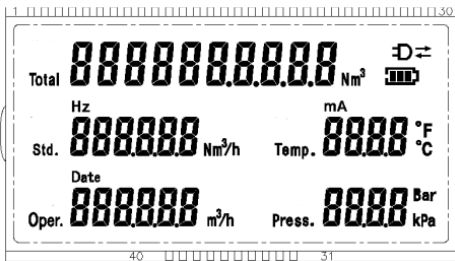
Total: Four decimal places can be shown at most,

　　　a) m3 : Operation condition total flow;

　　　b) Nm3 : Standard condition total flow;

2.Standard condition flow rate: Three decimal places can be displayed at most. The max-value is 999999 Nm3/ h

3.Operation condition flow rate: Three decimal places can be displayed most, The max-value is 999999 Nm / h

4.Temperature: Two decimal places can be displayed at most, and the range can be set in the menu with ℉ and ℃ both available

5. Pressure: Two decimal places can be displayed at most, and the range can be set on the menu with Bar and kPa both available.

6.Battery capacity " " : It will display full when the voltage over 3.4V, when 3.2V<voltage <3.4V, two remaining bars will be left. When 3V<voltage <3.2V, one remaining bars will be left. When voltage<3V, no bar will left.

7.External power " ": will be displayed when external power is provided.

8.Communication " ": will be displayed when it communicates over RS485

6.2 Menu
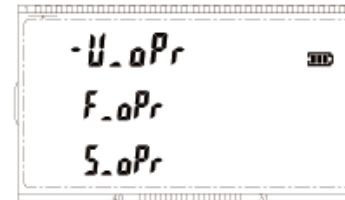
Menu level	Password explain
U _ oPr	User menu
F _ oPr	Engineer menu
S _ oPr	Special function menu

Press "right" or "up" to enter menu, then press "set' to enter password.

6.3 Menu explanation

Press U_oP, then press "SET ", you will get the following user menu interface

U _ oPr user menu		
Code	Parameter	Explanation
U_01	Damping time	01-99s , the bigger value means the slower flow change
	Upper flow limit	20mA and 1000Hz frequency output will match this value. When the flow is 1.5 times the upper flow limit, then it will display as 1.5 times value.
	Working flow cutoff	Below this flow rate, it will display 0
U_02	Address	001 -255 decimal When set to 0, the default country 1; when over 255, the default is 255
	Baud rate	0:1200； 1:2400； 2:4800； 3:9600； 4:19200
	Uart setup	n:no parity; 0:odd parity; Eeven parity. 7 :7 data bits ；8 ：8data bits 1 :1 stop bits ；2 :2 stop bits
U_03	Scaled pulse	0.001-9999.999 Nm3, user settable
	Pulse width	Left on second line : unit : ms, range ； 1-9999ms
	Output mode	Right on second line 0:Scaled pulse output 1:0-1000 working flow rate 2:verification frequency output 3:original frequency output Ap plicable Terminal: FOUT
	Pulse Output electrical level	0：NPN corresponds to low level, PNP corresponds to high level, OC corresponds to normally closed 1：NPN corresponds to a high level, PNP corresponds to a low level, and OC corresponds to normally open corresponding terminal FOUT and a pulse output jumper.

Code	Parameter	Explanation
U_04	Alarm limit value 1	Unit is same with main menu unit
	signal source	Left on the second line ： 0 ： standard flow rate 1 ： working flow rate 2 ： temperature 3 ： pressure
	Alarm mode 1	Right on the second line：0：below set value 1 beyond set value
	Alarm electrical level 1	0: Default low level, output high level when alarming. 1: Default high level, output low level when alarming. Corresponding terminal AH
U_05	Alarm limit value 2	Same as above , termimal : AL
	signal source 2	
	Alarm mode 2	
	Alarm electrical level 2	
U_06	Language	0: Chinese 1 ： English
	Black light	0: no black light
		1: The battery is automatically on for 20 seconds, the two wire is not bright, the three wire is always bright
		2 ： Batter power and 3 wire always bright, 2 wire is dark
U_07	Time setting	Year,month, date, hour ,minutes
U_08		4.digit passwords can be set manually, the second line is encryption prompt,, when user forgets the password, please contact manufacturer

F_oPr. Engineer menu		
	Parameter	Explanation
	Meter type	0：turbine meter 1： gas roots meter
	Output signal	0: porcelain resistance sensor 1: coil sensor
	correction factor	First line: correction factor second line: frequency
	K- factor	Unit : P/m3
F_11	Temperature compensation	0：no compensation 1：set 2：automatic
	Set temp	Set value range : -40-150℃
	Temperature shift	Only for automatic mode
F_12	Pressure compensation	0: no compensation 1：set 2：automatic
	Set pressure	Unit : kpa
	Pressure shift	Only for automatic mode
F_13	Pressure upper limit	Unit : kPa
	sensor mode	0: absolute pressure sensor 1: gauge pressure sensor
	Local air presure	Not work for ansolute pressure sensor,unit:KPa
F_14	Pressure correction	0：no correction 1：correction
	5 points correction	First line is standard pressure Value, second line is correction value
F_15	Standard temp	Unit :℃
	Standard pressure	Unit : kPao

F_16	Compression factor setup	setup the compensation value of the compression factor
	Compression factor compensation method	0: No 1: Setup 2.Mole component, using format NX-9 calculation Physical property value, using SGERG-88 calculation
F_17	Relativity Density	Mole component algorithm, using NX-19 calculate, range as below: Relativity Density=0.55-0.75 CO2 mole content＜0.15 N2 mole content＜0.15 Physical property value, using SGERG-88 calculation, range as below: Relativity Density=0.55-0.75 CO2 mole content＜0.15 N2 mole content＜0.1 Upper limit heating value=27.95-41.93
	Co2 mole fraction	
	H2 mole fraction (second line in left)	
	Upper limit heating value(second line in right)	
	N2 mole fraction	
F_18	Working condition relative humidity	Gas humidity compensation
	Standard condition relative humidity	
F_19	GPRS Communication interval	Interval by day
	Hours	Second line in left for interval hours
	Minute	Second line in right for interval minute
	Second	Interval by second
	Password modify	The four-digital password is arbitrarily modified, and the second line is a password encryption prompt. When the user forgets the password, they can contact the manufacturer for decryption

S_0Pr Special function menu setup		
	Parameter	Description
S_01	Total flow clear	S_02 & S_03 will be clear all after input confirmation clear password
S_02	Total flow under working condition setup	Input total flow password and setup, save it
S_03	Total flow under standard condition setup	Input total flow password and setup, save it
S_04	Restore factory/storage factory selection	0: F-r confirmation to restore factory setup, input password and save it; 1: F-s confirmation to save factory original data, input password and save it
S_05	Special function setup	Single digit: to read D4 protocol while setup value as "1"; ten's: to support 2 wires GPRS open while set value as "1"
S_06	Password modify	The four-digital password is arbitrarily modified, and the second line is a password encryption prompt. When the user forgets the password, they can contact the manufacturer for decryption

Reminder:

Press and hold the ESC key for 5 seconds to switch the auto and off status of the backlight setting.

7. **Special Notice:**

1.When the battery level is below 1 Bar, it indicates that the battery level is low and the battery should be replaced in time. The battery info is collected every 4 minutes.

2.It is key for the meter to work properly to set the parameters correctly. Please reconfirm the parameters are correct before putting the meter into service

3.If on the menu screen or the auxiliary menu screen and there is no operation for a long time, it will automatically exit to the main screen after 5 minutes.

4.Pressing the "ESC" button for 5 seconds will switch the automatic and off state of the backlight.

5.BL is the low voltage alarm of the battery. When the voltage is lower than 2.0V, it will alarm. The default is low level and it will alarm on high level.

6.BC is the closing valve signal. When the temperature, pressure or flow fail, it will output high level. After the temperature, pressure or flow display normally, it will not alarm if it is set as compensation of setting.

8. Seven Troubleshooting

Table7-1 Trouble Shooting

Failure	Failure analysis	Test method and solution
There is flow through the meter, but the instantaneous flow rate of the meter is zero	The inner parameters of the meterhave been modified	Please check if the meter parameters are correct according to the verification certificate. If the parameters are wrong, please input the correct parameters
There is no flow through the meter, but the meter displays instantaneous flow rate	The valve in the pipeline does not close completely	Check the valve
	The vibration of the pipeline is violent	Suggest adding vibration reduction measures
	The meter is not grounded well	Please check the grounding
	There is strong electromagnetic interference on the site. The meter is too close to the high-power equipment, such as frequency converter, electrical machinery, solenoid valves, etc.	By judging whether the instantaneous flow value is affected by the electromagnetic field ($Q=3600f/k, f=50Hz, k=$meter factor.), can determine whether the meter is affected by power frequency interference. If there is evidence of this then changing the installation location is suggested

Failure	Failure analysis	Test method and solution
The meter measures normally, but the measured value is not accurate	The meter temperature and pressure are inputs are wrong (Temperature and Pressure Compensation Type)	Check if the temperature and pressure displayed by the meter are consistent with the medium in the pipeline. If not, the temperature and pressure sensor is damaged and needs to be returned to the factory for repair.
	There are problems with meters inner parameters	Please check if the meter parameters are correct according to the verification certificate. If the parameters are wrong, please input the correct parameters
	The meters internal parts are broken	Need to contact supplier or return it to factory for inspection
The meter measures normally, on-site LCD display is normal, but the meter current output is wrong	Meter wiring is wrong	If there is no current output, check if the meter wiring is wrong
	Meter output range parameter is wrong	If there is current output, but the value is wrong, check if the transmission upper limit value in the meter parameters is the same as the range upper limit marked on the nameplate. If not, change the parameter to the upper limit of the range marked on the nameplate.

8. Appendix RS485 communication protocol illustration

1.Illustration

This meter uses MODBUS_RTU format.

Default data format is n,8,1(1 start bit, 8 data bits, no parity bit and 1 stop bit), supporting parity check, 2 stop bits, etc.

The default baud rate is 9600, 5 options: 1200, 2400, 4800, 9600, 19200.

The meter address is decimal "01-255", "0" address is used for broadcast and this protocol does not support broadcast.

This meter uses the 0x03 instruction in MODBUS protocol:

Command 03 (HEX)	Read single or multiple registers

The data type in the protocol:

Single-precision floating-point number float, the format is IEEE 754, the data is from high to low.

Double-precision floating-point number double, the format is IEEE 754, the data is from high to low.

Unsigned integer unsigned int is 0-65535.

The format of command 0x03 is shown in the following table:

MODBUS request

Meter address	1 BYTE	01-FF
Function code	1 BYTE	03
Start address	2 BYTE	0000-FFFF
Reading quantity	2 BYTE	N(1-7D)
CRC low bit	1 BYTE	
CRC high bit	1 BYTE	

MODBUS response

Meter address	1 BYTE	01-FF
Function code	1 BYTE	03
Byte count	1 BYTE	N*2
Input state	N*2 BYTE	
CRC low bit	1 BYTE	
CRC high bit	1 BYTE	

Error response

Meter address	1 BYTE	01-FF
Function code	1 BYTE	83
Error code	1 BYTE	01,02,03(see Note 1)
CRC low bit	1 BYTE	
CRC high bit	1 BYTE	

Note1: 01. Register address error

02. Register length error

03. CRC error

	Parameter	Address (Hex)	Register length(bit)	Data type	Illustration
	Cumulative flow rate under working conditions	0000-0001	2	float	Unit m³
	Instantaneous flow rate under working conditions	0002-0003	2	float	Unit m³

	Parameter	Address (Hex)	Register length(bit)	Data type	Illustration
Customer Reading Parameters Area	Cumulative flow rate 1 under standard condition	0004-0005	2	float	Cumulative flow rate under standard condition is divided into two parts. See the Note 1 after the table for details. Unit N m³
	Cumulative flow rate 2 under standard condition	0006-0007	2	float	
	Instantaneous flow rate under standard condition	0008-0009	2	float	Unit N m³/h
	Medium pressure	000A-000B	2	float	Unit kPa
	Medium temperature	000C-000D	2	float	Unit ℃
	Battery voltage	000E-000F	2	float	Unit V
Customer Auxiliary Reading Parameters Area	Current time	010C-0111	6	unsigned int	Example: "9:39:20, June 27th, 2017" is "0X07E1 0X0006 0X001B 0X0009 0X0027 0X0014"
	Compressibility factor	0112-0113	2	float	

Note:

1."Cumulative flow rate under standard condition" is represented by two four-byte floating-point numbers. The relationship between them is:

Cumulative flow rate under standard condition= "Cumulative flow rate 1 under standard condition" *1000000 + "Cumulative flow rate 2 under standard condition".

Examples of communication: (The meter address is 01)

Read command	01 03 0006 0004 A408	CRC little endian, read Cumulative flow rate 2 under standard condition and Cumulative flow rate under standard condition
Return data	01 03 08 42 84 00 00 (Cumulative flow rate 2 under standard condition=66) 00 00 00 00 (flow rate under standard condition=0) D4 36	Floating point number big endian, CRC little endian