# Ultrasonic Flowmeter Instructions Manual

## Model: GFR


pFlow

| | | |
|---|---|---|
| Update Record | Version | 3.0.1 |
| | Date | 06 . 2024 |

# Content



Updated Information:

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# 1 Overview

The GFR uses LoRa communication, the LoRaWAN communication protocol is available. The advantage of the communication protocol is that it can transmit information at very low frequencies at low complexity and cost. It is an ultra-remote, low-power, high-availability, and low-cost communication technology that can be used in different regions.

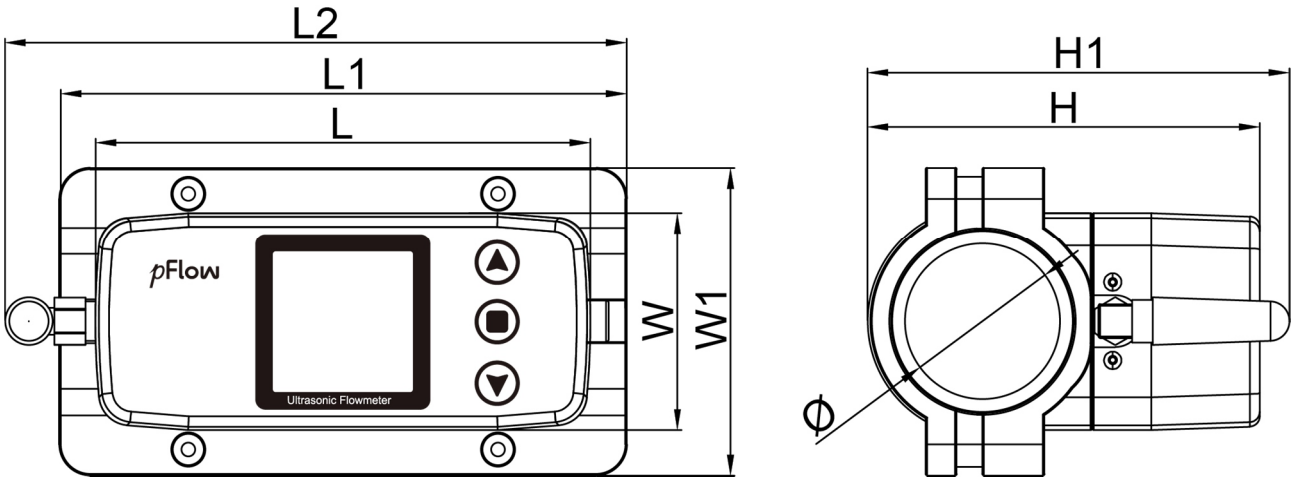
GFR adopts the ultrasonic transit-time measurement principle, combined with the patented flow algorithm technology, it realizes accurate measurement of the fluid flow in the pipe. The product is all-in-one and clip-on structure design, which is simple and convenient to install. Only four steps are needed all along. The installation process requires no contact with fluid media and no need to shut down the flow.

# 2 Product Features

- Easy installation, no pipe damaging
- No adjustment, clip on to measure
- LCD color display
- 360° rotation adjustable display screen
- No wiring
- Long transmission distance
- Low power dissipation
- Strong anti-interference ability
- LoRaWAN communication protocol is available

# 3 Technical Parameter

## 3.1 Dimension




GFR Transmitter Dimension

| Pipe Size Comparison Table | | | | | | | | | Unit: mm |
|---|---|---|---|---|---|---|---|---|---|
| Model | Nominal Inner Diameter of Pipe | W | W1 | L | L1 | L2 | H | H1 | ϕ |
| GFR | DN15 | 42 | 42 | 96 | 110 | 120.5 | 63 | 68.8 | 22.5 |
| | DN20 | 42 | 59.5 | 96 | 110 | 120.5 | 69.5 | 75.3 | 29 |
| | DN25 | 42 | 59.5 | 96 | 110 | 120.5 | 76 | 81.8 | 35.5 |
| | DN32 | 42 | 64.5 | 96 | 110 | 120.5 | 83 | 88.8 | 42.5 |
| | DN40 | 42 | 76.5 | 96 | 110 | 120.5 | 95 | 100.8 | 54.5 |
| | DN50 | 42 | 85.5 | 96 | 110 | 120.5 | 104 | 109.8 | 63.5 |

## 3.2 Product Categories

| Model | Specifications | Description | | |
|---|---|---|---|---|
| | | Output | Application Industry | Pipe Size |
| GFR | EM -DNxx | LoRaWAN | Equipment Matching | DN15~DN50 |
| | HC -DNxx | LoRaWAN | Healthcare | DN15~DN50 |
| | AQC -DNxx | LoRaWAN | Aquaculture | DN15~DN50 |
| | AGC -DNxx | LoRaWAN | Agriculture | DN15~DN50 |

Noted:

Products have been configured with application industry options at the factory, please refer to the table above.

## 3.3 Technical Index

| | |
|---|---|
| Performance Index | |
| Flow velocity | 0.03m/s ~5.0m/s |
| Accuracy | ±2.0%, (0.3m/s ~5m/s) |
| Repeatability | 0.4% |
| Pipe Size | DN15、DN20、DN25、DN32、DN40、DN50 |
| Medium | Water |
| Pipe Material | Stainless Steel, PVC, Copper, PPR |
| Functional Index | |
| Communication interface | RS485, FUJI or MODBUS Protocol |
| LoRa Communication | Maximum Transmit Power: 22dBm |
| | Temperature: -40℃~85℃ |
| | LoRaWAN communication protocol is available |
| LoRa Frequency selection | EU868 Frequency: 863000000~865400000, unit Hz |
| | US915 Frequency: 902300000~914900000, unit Hz |
| | CN779 Frequency: 780100000~786500000, unit Hz |
| | EU433 Frequency: 433775000~434665000, unit Hz |
| | AU915 Frequency: 915200000~927800000, unit Hz |
| | CN470 Frequency: 470300000~489300000, unit Hz |
| | AS923(HK) Frequency: 920000000~925000000, unit Hz |
| Power supply | 10～36VDC/500mA |

| | |
|---|---|
| Keyboard | 3 touch keys |
| Display screen | 1.54"LCD color display, resolution 240*240 |
| Temperature | Transmitter: 14℉ to 122℉ ( -10℃ ~ 50℃ )<br>Transducer: 32℉ to 140℉ ( 0℃ ~ 60℃ ) |
| Humidity | Relative humidity 0~99%, No condensation |
| IP | IP54 |
| Physical Characteristics | |
| Transmitter | All-in-one |
| Transducer | Clamp on |
| Cable | Φ5 Six-core cable, standard length: 2m |

- The accuracy is obtained by Gentos flow calibration facilities. Errors may occur due to the type of pipeline, fluid type, temperature, etc. used by the customer.

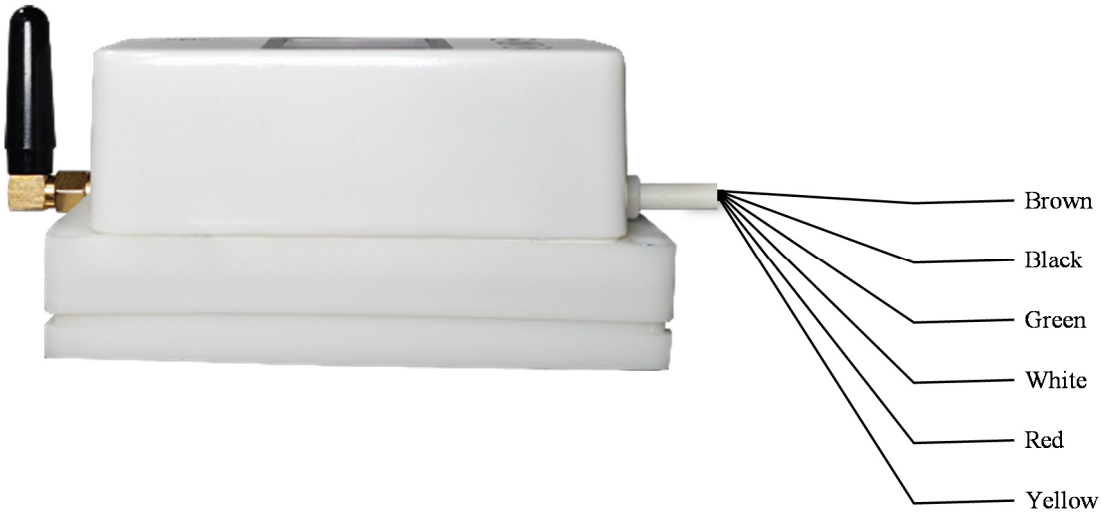
# 4 Installation and Wiring

## 4.1 Installation Description

1. Carefully read "Section 7. Measurement Site Selection". After the designated location is selected, the area outside the pipe to be installed must be cleaned, and the dense part of the pipe is more appropriate for installation.
2. The special coupling sticker is pasted on the center of the sensors, which will be squeezed during installation to ensure that the sensors and the pipe wall are closely fitted without bubbles. It comes with coupling compound and replaceable coupling pads. The coupling compound can be applied to the coupling pads.
3. The direction of the arrow on the nameplate of the instrument must be consistent with the direction of the fluid in the pipeline.

## 4.2 Meter Wiring

Refer to the diagram below for meter wiring



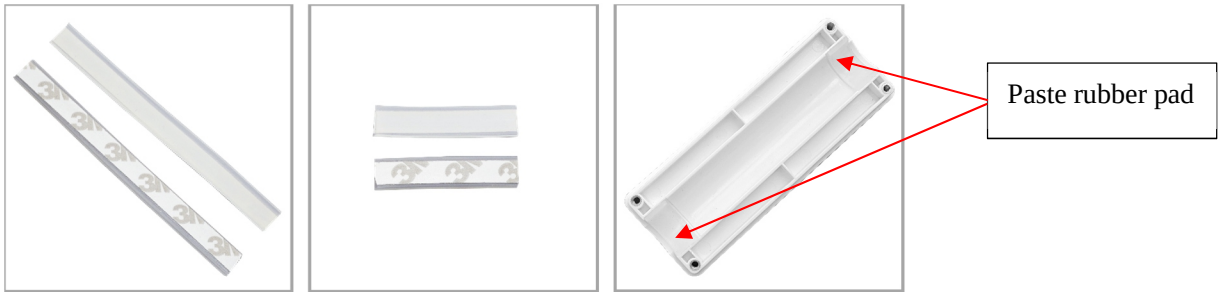

| Function | Identifier | Color |
|---|---|---|
| Power Supply （10~36VDC） | + | Brown |
| | - | Black |
| RS485 | A | Green |
| | B | White |
| None | + | Red |
| | - | Yellow |

## 4.3 Fast installation steps of GFR ultrasonic flowmeter

This flowmeter adopts integrated design. It is easy to install and set parameters in a few steps. It can be directly clamped on the pipe section. After connected to the power supply, the flowmeter can realize flow measurement.

| | |
|---|---|
| Step 1 Cleaning pipes<br>Perform pipe surface treatment to remove impurities such as paint, rust, dirt, etc. that are easily removed from the surface. |  |
| Step 2 Installation of Pipe Clamp<br>Snap the upper and lower pipe clamps to the selected location on the pipe. If looseness is found, adhesive pads may be applied to the inside of the lower clamps to enhance the tightening effect. |  |
| Step 3 Tighten the screws.<br>Tighten the 4 screws connecting the upper and lower hose clamps securely to ensure stability and no looseness. |  |
| Step 4 Power on and start measurement<br>Set the actual pipe outer diameter, wall thickness and pipe parameters through the "Pipe Parameter Setting" menu item to make the measurement more accurate. |  |

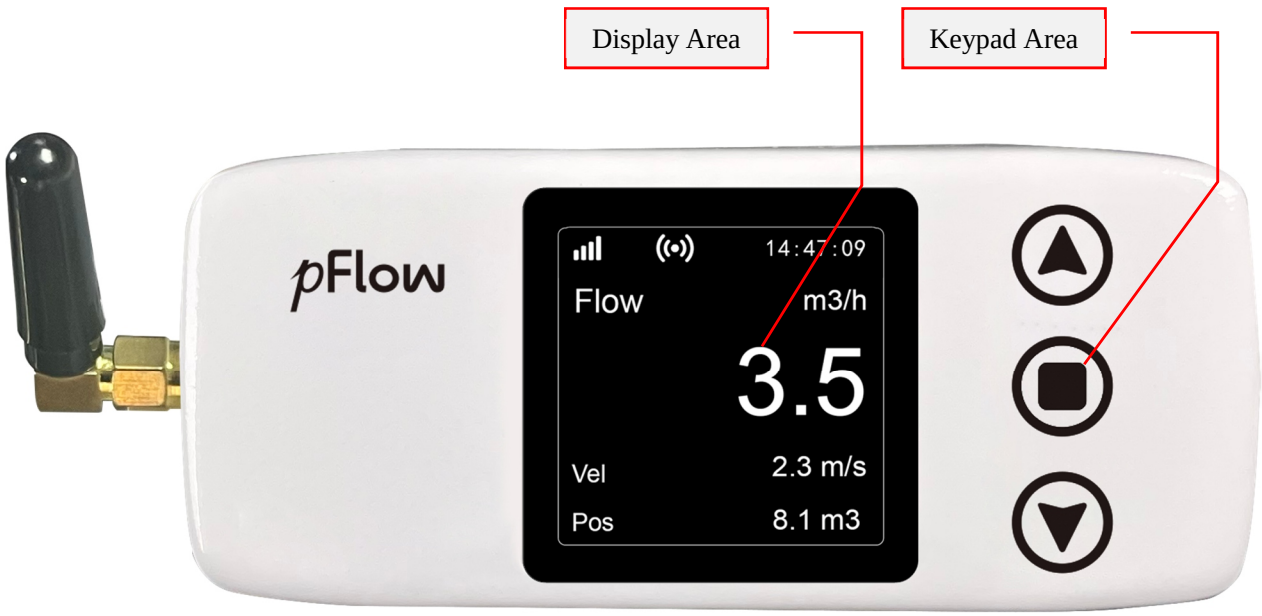
- If the pipe clamp is still loose after locking, paste the black rubber pad (2mm thick ) attached to the accessory bag on both sides of the inner wall of the pipe clamp.



# 5 Display and Settings

## 5.1 Display description

| Display area | Display element | Description |
|---|---|---|
| Upper part of the display area |  | Indicates measurement status:<br>  : indicates normal measurement.<br>··· : indicates searching signal. |
| |  | Indicates network status:<br>  : indicates network anomaly.<br>  : indicates failure to switch state within 15 seconds results in connection failure.<br>  : indicates network communication is normal. |
| | 18:19:35 | It displays the current time. |
| Middle part of the display area | Flow rate | Indicates momentary flow rate. |
| Lower part of the display area | Flow velocity | Indicates momentary flow velocity. |
| | Total flows | Indicates total flows.<br>Automatically clears when the total flow value reaches 99999999.9. |



## 5.2 Key Description

The clamp on flowmeter comes with three keys, and the operation instructions are shown in the following table:

| Key | Main menu | Main menu interface | Sub-menu interface | Setting interface | |
|---|---|---|---|---|---|
| | | | | Option Setting | Digital Setting |
| ▲ | / | Press up to select Main menu item | Press up to select Sub-menu item | Press up to select Sub-menu item | Press to increase the number |
| ■ | Hold to enter the Main menu | 1.Press to enter secondary menu<br>2.Press and hold to return to the display | 1.Short press to enter Setting<br>2.Press and hold to return to Main menu | 1. Press to enter Option Setting<br>2. In the sub-menu items, press to save the settings and return to the previous level<br>3. Press and hold to save the settings and return to the previous level | 1. Press to enter Digital Setting<br>2. Press on the digital interface to move the cursor position<br>3. Press and hold to confirm and return to the previous level |
| ▼ | / | Press down to select Main menu item | Press down to select Sub-menu item | Press down to select Sub-menu item | Press to reduce the number |

# 6 Menu window description

## 6.1 Menu interface

| Main menu interface | Sub-menu interface | Setting interface | Description |
|---|---|---|---|
| 1.Pipe Setup | 1.Pipe Material | 1.Stainless Steel 2.PVC. 3.Copper 4.PPR. | Select the pipe material.<br>In the setting interface, there will be a check mark on the right side of the selected item. The same goes for the following. |
| | 2.Outside Diameter | Different pipe diameter specifications correspond to different pipe outer diameter ranges. | Enter the outer diameter of the pipe and set the pipe diameter parameters of the purchased product. The pipe outer diameter range has been set at the factory.<br>For more details, please refer to Appendix 1—Pipe Diameter Comparison Table.<br>For example: if you select DN32 steel pipe, the effective input range of the pipe outer diameter is (36~42.5) mm. |
| | 3.Wall Thickness | 0.5mm~1/3 pipe outer diameter | The minimum value is 0.5mm, and the maximum value cannot exceed 1/3 of the outer diameter of the pipe. (Different pipe diameter specifications correspond to different pipe wall thickness ranges.)<br>Please enter the actual pipe wall thickness parameters. Inaccurate parameter input will affect the measurement accuracy. |

| Main menu interface | Sub-menu interface | Setting interface | Description |
|---|---|---|---|
| 2.Output Setup | 1.LoRa | 1.Uplink Start Channel | The difference between each setting of the starting frequency must be a multiple of 200KHz, so there are only four digits of setting. The data will not save if the starting frequency is not a multiple of 200KHz. The upper limit of the starting frequency that can be set is related to the number of channels. |
| | | 2.DevEUI | LoRa EUI, like IEEE EUI 64, is a globally unique ID, it's a uniquely identified terminal device. This is equivalent to the MAC address of the device. |
| | | 3.AppEUI | / |
| | | 4.AppKEY | The application key for LoRa is 2b:7e:15:16:28:ae:d2:a6 :ab:f7:15:88:09:cf:4f:3c |
| | | 5.Reset | Select"Yes", compulsory resetting. |
| | | 6.Uplink Time | LoRaWAN data up link time. (unit:sec) 5≤Up Link Time≤86400 |
| | | 7.Reconnect Time | LoRaWAN device reconnect time default value is 7 (in days)1≤Reconnect Time≤999 |
| | 2.RS485 Setup | 1.Baud Rate | There are 8 baud rates to choose. 4800,9600,19200,38400,50400,57600,76800,115200 |
| | | 2.Network ID | Network ID address code is taken from 1~247 |
| 3.Unit Setup | 1. System unit | 1.Metric unit , 2.imperial unit | Select metric and imperial units |
| | 2. Flow unit | 1.m3/h, 2.m3/m, 3.L/h, 4.L/m, 5.Gal/h, 6.Gal/m | Select the flow unit and time unit of instantaneous flow |
| | 3. Total unit | 1.m3, 2.L, 3.Gal | Select cumulative flow unit |
| 4.System Setup | 1. Clear Totalizer | 1. No, 2. Yes | Clear the accumulation, select "Yes" to clear the accumulation. |
| | 2. Damping Factor | 1~99s | Enter the damping coefficient, which acts as a smoothing factor for the displayed data. Usually a value between 3 and 10 is entered in the application. |
| | 3. Low Flow Cut Off | ≤0.25m/s | Cut out for low flow rates. This allows the system to display a "0" value at low flow rates to avoid ineffective accumulation. The factory default cutout value is 0.03m/s. |
| | 4. Date- Time | 1.Date, 2.Time | Set current time, year-month-day, hour:minute:second |

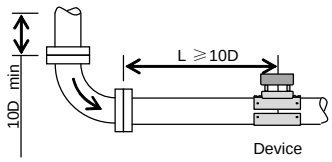
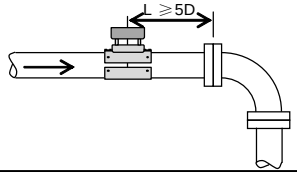
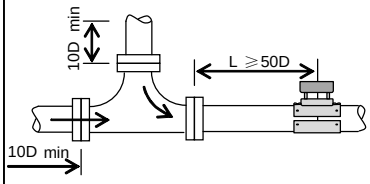
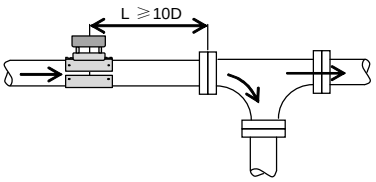
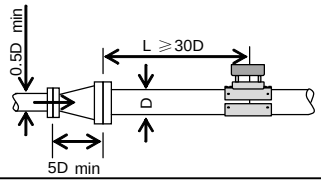
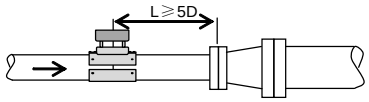
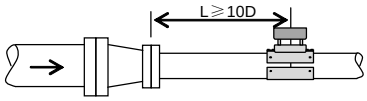
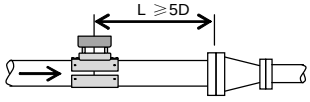
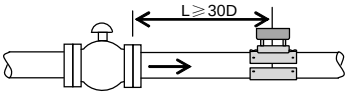
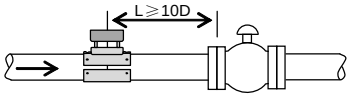
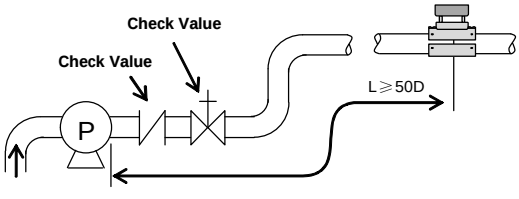
| Main menu interface | Sub-menu interface | Setting interface | Description |
|---|---|---|---|
| | 5. Language | 1.English, 2.Chinese | Select English or Chinese |
| | 6. Screen Orientation | 1. 0°, 2. 90°, 3. 180°, 4. 270° | Rotate the screen to set the direction of the screen display, and the key functions will automatically adapt with the screen direction change |
| | 7. System Lock | xxxxxx | Enter the new password, prompted to close the system lock or open the system lock, choose to open the system lock, the system is locked, prohibit any modification of the parameters of the operation, can only view the main interface parameters, thus protecting the normal operation of the instrument. The only way to “unlock“ is to enter the original password correctly. The password is a 6-digit number. “000000“ is invalid password. |
| | 8. Buzzer Switch | 1.On, 2.Off | Setting the Buzzer Switch |
| | 9. Factory Data Reset | 1. No 2. Yes | Clear all setup parameters and restore them to the original factory defaults.<br>Select "Yes", this operation will erase all user data (except cumulative amount) and change them to the factory defaults, so please be careful with this operation. |
| 5.Calibration Setup | 1. Set Zero | 1. No 2. Yes | When the fluid is static, the value of the instrument is called the "zero point". When the meter's "zero point" is not zero, at any moment the zero point will be superimposed on the true value of the flow rate, so that the measurement of the meter deviation. It must be removed. Select "Yes" and wait for the process to complete. |
| | 2. Clear Zero | 1. No 2. Yes | The set zero point is restored. Select "Yes" to clear the user-set "zero point". |
| | 3. K Factor | 0.5~1.5 | Known as the meter K-factor, it is used to correct flow measurements. (Factory Calibrated) |
| 6.Device information | 1. Serial Number | vxxxxxxx | Flowmeter Factory Number |
| | 2. Firmware Number | V1.x.x | Software Version |

# 7 Choose Measurement Point

The flowmeter is simple and convenient to install. As long as a suitable measuring point is selected, Clamp the product sensor surface on the pipe section directly and fix the pipe clamp, and then the power is turned on, the flow measurement can be realized.

When selecting measuring points, it is required to select pipe sections with uniform fluid flow field distribution to ensure measurement accuracy. The following principles shall be followed during installation:

- Select a pipe segment that is filled with fluid, such as the vertical part of the pipe line (the fluid is better to flow upward) or the horizontal pipe segment that is filled with fluid.
- The measuring point should be on a uniform straight pipe section with 10 times the diameter (10D) from the upstream and 5 times the diameter (5D) from the downstream. There are no valves, elbows, reducers and other devices interfering with the flow field within this range. The length of the straight pipe section is recommended to use the values shown in the following table.
- Ensure that the temperature at the measuring point is within the working range.
- Fully consider the scaling condition on the inner wall of the pipe, try to select the pipe section without scaling for measurement, and select the pipe section of uniform and dense pipes so as to make ultrasonic transmission easier.

| Name | Straight length of Upstream piping | Straight length of Downstream piping |
|---|---|---|
| **90°**bend |  |  |
| **Tee** |  |  |
| **Diffuser** |  |  |
| **Reducer** |  |  |
| **Value** |  **Flow controlled upstream** |  **Flow controlled downstream** |
| **Pump** |  | |

# 8 Communication Protocol

The flowmeter adopts response communication mode, and the upper computer sends "command" to request the lower flowmeter to respond. The baud rate of asynchronous communication (main workstation, computer system, ultrasonic flowmeter) is generally 9600bps. Single byte data format (10 bits): 1 start bit, 1 stop bit and 8 data bits. Check bit: NONE.

## 8.1 FUJI Protocol

The FUJI protocol of the instrument adopts the response communication mode, and the upper computer sends a "command" to require the instrument to respond. The baud rate of asynchronous communication (main workstation, computer system, secondary workstation, ultrasonic flowmeter) is generally 9600bps. Single byte data format (10 bits): 1 start bit, 1 stop bit and 8 data bits. Check bit: NONE.

The basic command is represented by a data string, and the command ends with a carriage return newline character. The feature is that the data length is random. Common commands are shown in the following table: Communication Command

| Command | Command Meanings | Data Format |
|---|---|---|
| DQD(cr)(lf) | Return daily instantaneous flow | ±d.dddddd E ± dd(cr)Note 1 |
| DQH(cr)(lf) | Return hourly instantaneous flow | ±d.dddddd E±dd(cr) |
| DQM(cr) (lf) | Return instantaneous flow per minute | ±d.dddddd E±dd(cr) |
| DQS(cr) (lf) | Return instantaneous flow per second | ±d.dddddd E±dd(cr) |
| DV(cr) (lf) | Return instantaneous flow velocity | ±d.dddddd E±dd(cr) |
| DI+(cr) (lf) | Return positive accumulative flow | ±ddddddd E±d(cr)Note2 |
| DID(cr) (lf) | Return instrument identification code (address code) | ddddd(cr)5 bits in length |
| DL(cr) (lf) | Return signal strength | UP:dd.d, DN:dd.d, Q=dd(cr) |
| ESN(cr) (lf) | Return electronic serial number | ddddddd(cr)(lf) Note 3 |
| W | Digital string address networking command prefix | Note 4 |
| P | Prefix of back haul command with verification | |
| & | Function sign of Command "Add" | |

Note:

1. (cr) means carriage return, and its ASCII code value is 0DH. (lf) means line feed, and its ASCII code value is 0AH.
2. “d” is a number ranging from 0 to 9, and the 0 value is +0.000000E+00.

   “d” is a number ranging from 0 to 9, and there is no decimal point in the integer part before "E".
3. ddddddddd eight digits represent the electronic serial number of the machine, and “t” represents the machine code。
4. If there are more than one flow meters in the data network at the same time, the basic command cannot be used alone. It must be prefixed with W before used. Otherwise, multiple flow meters will respond at the same time, which causes system disorder.

**（1）P prefix**

The character P can be added in front of each basic command, indicating that the returned data has CRC check. The checksum is obtained by binary addition.

For example, the data returned by the command DI+(CR) (corresponding binary data is 44H, 49H, 2BH, 0DH) is+1234567E+0m3 (CR) (corresponding binary data is 2BH, 31H, 32H, 33H, 34H, 35H, 36H, 37H, 45H, 2BH, 30H, 6DH, 33H, 20H, 0DH, 0AH), and the data returned by the command PDI+(CR) is+1234567E+0m3! F7（CR）, “！” Indicates that the character before it is the sum character, and the checksum of the next two bytes (2BH+31H+32H+33H+34H+35H+36H+37H+45H+2BH+30H+6DH+33H+20H=(2) F7H).

Pay attention to "!". There may be no data before, or there may be a space symbol.

**（2）W prefix**

The use of W prefix is W+number string address code (must be 5 digits)+basic command. The number string value range is 0~65535, excluding 13 (0DH carriage return), 10 (0AH line feed), 42 (2AH *), 38 (26H&). If user access the instantaneous flow velocity of No. 12345 flowmeter, user can issue the command W012345DV (CR), and the corresponding binary codes are 57H, 31H, 32H, 33H, 34H, 35H, 44H, 56H, 0DH.

**（3）& Functional Symbols**

& The function symbol can add up to five basic commands (with prefix P) to form a composite command and send it to the flowmeter, which will respond at the same time. For example, 1. Instantaneous flow of No. 4321 flowmeter is required to be sent back at the same time; 2. Instantaneous flow velocity; 3. Positive cumulative flow; 4. Negative cumulative flow; 5. Net cumulative flow with verification, send the command as follows:

W04321PDQD&PDV&PDI+&PDI-&PDIN（CR）

The data returned at the same time may be as follows:

+0.000000E+00m3/d! AC（CR）

+0.000000E+00m/s! 88（CR）

+1234567E+0m3! F7（CR）

+0.000000E+0m3! DA（CR）

+0.000000E+0 m3! DA（CR）

## 8.2 MODBUS Communication Protocol

The MODBUS protocol of this instrument adopts RTU transmission mode, and its check code is obtained by CRC-16-IBM (polynomial is X16+X15+X2+1, shielded word is 0xA001) cyclic redundancy algorithm.

MODBUS RTU mode uses hexadecimal to transmit data.

### 8.2.1 MODBUS protocol function code and format

This instrument protocol supports the following two function codes of MODBUS protocol:

| Function Code | Function Data Represented |
|---|---|
| 0x03 | Read register |
| 0x06 | Write single register |

### 8.2.2 Use of MODBUS protocol function code 0x03

Format of read register information frame sent by the host:

| Slave address | Function code | Register first address | Number of registers | Check code |
|---|---|---|---|---|
| 1 bytes | 1 bytes | 2 bytes | 2 bytes | 2 bytes |
| 0x01~0xF7 | 0x03 | 0x0000~0xFFFF | 0x0000~0x7D | CRC check code |

Slave returned data frame format:

| Slave address | Read operation function code | Number of bytes of data | Data | Check code |
|---|---|---|---|---|
| 1 bytes | 1 bytes | 1 bytes | N*x2 bytes | 2 bytes |
| 0x01~0xF7 | 0x03 | 2xN* | N*x2data | CRC check code |

N*＝Number of registers for data.

The value range of instrument address (address of flowmeter) is 1~247 (hexadecimal: 0x01~0xF7), and the address can be viewed in Menu 46. If the decimal number displayed in Menu 46 is 11, the address of this instrument in MODBUS protocol is 0x0B.

The CRC check code of this instrument is obtained by using CRC-16-IBM (polynomial is X16+X15+X2+1, shielded word is 0xA001) cyclic redundancy algorithm. The low byte of the check code comes first and the high byte comes last.

Example 1. In RTU mode, read the instantaneous flow (m3/h) of the meter with address 1 (0x01) in hours, that is, read the data of registers 40,005 and 40,006. The read command is as follows:

0x01 0x03 0x00 0x04 0x00 0x02 0x85 0xCA

Instrument Address Function Code First Address of Register Number of Registers CRC Check Code

The data returned by the instrument is (assuming the current flow=1.234567 m3/h):

0x01 0x03 0x04 0x06 0x51 0x3F 0x9E 0x3B 0x32

Instrument Address Function Code Data Byte Number Data (1.2345678) CRC Check Code

The four bytes of 3F 9E 06 51 are the IEEE 754 format single accuracy floating-point format of 1.2345678.

Please note the order of data storage in the above example. When using C language to interpret values, users can use pointers to directly put the required data into the corresponding variable address. The general order of

storage is that low byte comes first. For example, in the 1.2,345,678m/s example above, the storage order of data 3F 9E 06 51 is 06 51 3F 9E.

Example 2. In RTU mode, read the positive cumulative flow (m3) in m3 of the instrument with address 1 (0x01), that is, read the data of three registers with register addresses 0008, 0009 and 000A. The read command is as follows:

0x01 0x03 0x00 0x08 0x00 0x03 0x84 0x09

Instrument Address Function Code Register First Address Register Number CRC Check Code

The data returned by the instrument is (assuming the current positive cumulative flow=2.46m3):

0x01 0x03 0x06 0x00 0xF6 0x00 0x00 0xFF 0xFE 0x29 0x10

Instrument Address Function Code Data Byte Number Data (246 * 10-2) CRC Check Code

The four bytes of 00 00 00 F6 are the hexadecimal of 246, that is, directly convert the hexadecimal data into decimal:

Two bytes of FF FE are 10 to the power of -2. The following table:

| MODBUS Data | Corresponding Index Unit | |
|---|---|---|
| FFFD | x0.001(1E-3) | $10^{-3}$ |
| FFFE | x0.01 | $10^{-2}$ |
| FFFF | x0.1 | $10^{-1}$ |
| 0000 | x1 | $10^{0}$ |
| 0001 | x10 | $10^{1}$ |
| 0002 | x100 | $10^{2}$ |
| 0003 | x1000 | $10^{3}$ |
| 0004 | x10000(1E+4) | $10^{4}$ |
| Including positive, negative, net accumulation and energy accumulation | | |

Example 3. In RTU mode, change the address of the instrument with address 1 (0x01) to 2 (0x02), that is, write the data in the 44100 register of the flowmeter to 0x02. The write command is as follows:

0x01 0x06 0x10 0x03 0x00 0x02 0xFC 0xCB

Instrument Address Function Code Register Address Register Data CRC Check Code

The data returned by the instrument is:

0x01 0x06 0x10 0x03 0x00 0x02 0xFC 0xCB

Instrument Address Function Code Register Address Register Data CRC Check Code

### 8.2.3 Error Handling

This instrument returns only one error code 0x02, indicating that the first address of the data is wrong.

For example, in RTU mode, only 40002 register data of the instrument with address 1 (0x01) is read. The instrument thinks that the integrity of the data is damaged, and the command sent is:

0x01 0x03 0x00 0x01 0x00 0x01 0xD5 0xCA

Instrument Address Function Code Register First Address Register Number CRC Check Code

The error code returned by the instrument is:

0x01 0x83 0x02 0xC0 0xF1

Instrument Address Error Code Error Extension Code CRC Check Code

### 8.2.4 MODBUS register address list

The MODBUS register of this instrument includes read-only register and single write register.

Read only register address list (read with 0x03 function code)

| Register Address | Register | Data Description | Data Type | Register Number | Description |
|---|---|---|---|---|---|
| $0000 | 40001 | Instantaneous flow/sec - low byte | 32 bits real | 2 | |
| $0001 | 40002 | Instantaneous flow/sec - high byte | | | |
| $0002 | 40003 | Instantaneous flow/minute - low byte | 32 bits real | 2 | |
| $0003 | 40004 | Instantaneous flow/minute - high byte | | | |
| $0004 | 40005 | Instantaneous flow/hour - low byte | 32 bits real | 2 | |
| $0005 | 40006 | Instantaneous flow/hour - high byte | | | |
| $0006 | 40007 | Flow velocity - low byte | 32 bits real | 2 | |
| $0007 | 40008 | Flow velocity - high byte | | | |
| $0008 | 40009 | Positive accumulative flow - low byte | 32 bits int. | 2 | |
| $0009 | 40010 | Positive accumulative flow - high byte | | | |
| $000A | 40011 | Positive accumulative flow－index | 16 bits int. | 1 | |
| $0016 | 40023 | Upstream signal strength - low byte | 32 bits real | 2 | 0～99.9 |
| $0017 | 40024 | Upstream signal strength - high byte | | | |
| $0018 | 40025 | Downstream signal strength - low byte | 32 bits real | 2 | 0～99.9 |
| $0019 | 40026 | Downstream signal strength - high byte | | | |
| $001A | 40027 | Signal quality | 16 bits int. | 1 | 0～99 |
| $001B | 40028 | 4~20mA output current value - low byte | 32 bits real | 2 | Unit: mA |

| | | | | | |
|---|---|---|---|---|---|
| $001C | 40029 | 4~20mA output current value - high byte | | | |
| $001D | 40030 | Error code - characters 1,2 | String | 3 | R=0x52<br>G=0x47<br>I=0x49 |
| $001E | 40031 | Error code - characters 3,4 | Reserved | | |
| $001F | 40032 | Error code - characters 5,6 | Reserved | | |
| $003B | 40060 | Flow velocity unit - characters 1,2 | String | 2 | |
| $003C | 40061 | Flow velocity unit - characters 3,4 | | | |
| $003D | 40062 | Instantaneous flow unit - characters 1,2 | String | 2 | |
| $003E | 40063 | Data Description | | | |
| $003F | 40064 | Instantaneous flow/sec - low byte | String | 1 | |

Note:

a) The units of cumulative flow are as follows

0. "m3" —Cubic meter
1. "l" —Litre
2. "gal" —Gallon

b) When changing the instrument address or communication baud rate, the instrument will work according to the new address or communication baud rate immediately after returning the response with the original address or communication baud rate.

c) 16 bits int - short integer, 32 bits int - long integer, 32 bits real - floating point, String - string.

## 8.3 Lora Protocol Frame Format

The Lora protocol frame of this instrument is to split the data into hexadecimals and send it in a large-end data format. The following table format is identified by the low address from which the data is sent (Assuming that the starting address of the continuous data address is 0000, continuous storage of data in sequential order).

For example: Lora's frames are composed of instantaneous flow, positive accumulation, instantaneous velocity, signal quality, and timestamp in turn. At the same time, we assume that the actual data is: 3.78m3/h, 1.42m3, 3.62m/s, 99, 2353401716, the sent data format is (100 times greater):

0x83 0x01 0x00 0x00 0x8e 0x00 0x00 0x00 0x46 0x01 0x63 0x74 0x0f 0x46 0x8c

Instantaneous Flow Positive Cumulative Instantaneous Velocity Signal Quality Timestamp

The data before sending is:

Instantaneous Flow：0x00 0x00 0x01 0x83(Decimal is:378)

Positive Cumulative:0x00 0x00 0x00 0x8e (Decimal is:142)

Instantaneous Velocity:0x01 0x46 (Decimal is:362)

Signal Quality:0x63(Decimal is:99)

Timestamp: 0x8c 0x46 0x0f 0x74(Decimal is:2353401716)

| Start Address | Data Description | Data Type | Number of bytes | Explanation |
|---|---|---|---|---|
| $0000 | Instantaneous flow/hour－highest byte | 32 bits int | 4 | The flow of the instrument is sent in integers after 100 times amplificator |
| $0001 | Instantaneous flow/hour－high byte | | | |
| $0002 | Instantaneous flow/hour－low byte | | | |
| $0003 | Instantaneous flow/hour－lowest byte | | | |
| $0004 | Positive cumulative－highest byte | 32 bits int | 4 | The cumulative of the instrument is sent in integers after 100 times amplificator (unit is m3) |
| $0005 | Positive cumulative－high byte | | | |
| $0006 | Positive cumulative－low byte | | | |
| $0007 | Positive cumulative－lowest byte | | | |
| $0008 | Instantaneous velocity－high byte | 16 bits int. | 2 | The Instantaneous velocity of the instrument is sent in integers after 100 times amplificator |
| $0009 | Instantaneous velocity－low byte | | | |
| $000A | Signal quality | 8 bits int. | 1 | 0～99 |
| $000B | Timestamp－highest byte | 32 bits int | 4 | |
| $000C | Timestamp－high byte | | | |
| $000D | Timestamp－low byte | | | |
| $000E | Timestamp－lowest byte | | | |

Note: 16 bits int - represents short integer, 32 bits int - represents long integer, 32 bits real - represents floating point number, String - represents character string.

# 9 Appendix 1—Pipe Diameter Comparison Table

| Model | Pipe Material | Nominal Inner Diameter of Pipe | Applicable Range of Pipe Outer Diameter (mm) | | Adapter pipe outer diameter (mm) | Measurable Flow Range [0.03~5m/s] (m3/h) |
|---|---|---|---|---|---|---|
| | | | Level A | Level B | | |
| GFR | Stainless Steel<br>PVC<br>PPR<br>Copper | DN15 | 18.5~22.5 | | ϕ 18.5~ ϕ 22.5 | 0.02~3.5 |
| | | DN20 | 24~29 | 22.5~27.5 | ϕ 22.5~ ϕ 29 | 0.04~6 |
| | | DN25 | 30.5~35.5 | 29~34 | ϕ 29~ ϕ 35 | 0.05~9 |
| | | DN32 | 37.5~42.5 | 36~41 | ϕ 36~ ϕ 42.5 | 0.09~15 |
| | | DN40 | 49.5~54.5 | 48~53 | ϕ 48~ ϕ 54.5 | 0.13~23 |
| | | DN50 | 58.5~63.5 | 57~62 | ϕ 57~ ϕ 63.5 | 0.20~35 |
| Note: B Level needs to be achieved by pasting attached rubber pads on both sides of the inner wall of the pipe clamp | | | | | | |