# Ultrasonic Flow Sensor Instructions Manual

# Model: MP LoRaWAN Series
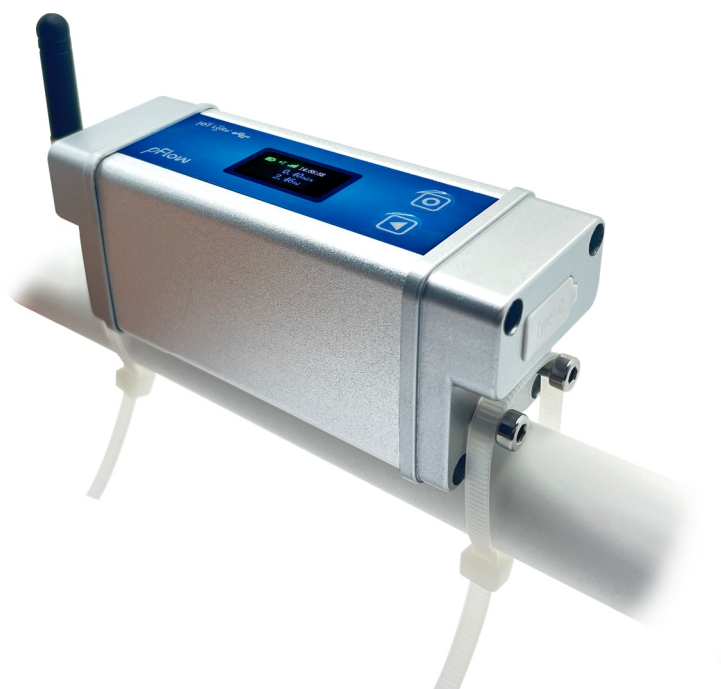


# pFlow

| Update Record | Revision | 3.0.0 |
|---|---|---|
| | Date | 11. 2023 |

# Content

# 1 Overview

MP LoRaWAN Series flow sensor is made with LoRa wireless communication technology and supports LoRaWAN communication protocol. It has low power consumption, long transmission distance and strong penetration ability. This equipment uses the measurement principle of the transit time method and combines Gentos' ultrasonic flow algorithm technology to measure the fluid flow in the pipeline.

The product is designed with an integrated clamp-on structure. Users only needs to clamp the flow sensor on the pipe section tested, and then use nylon cable tie to lock it automatically and the installation is completed quickly, which breaks through the cumbersome installation and use of the flow sensor in one fell swoop and reduces the trouble of on-site installation and various constraints.

# 2 Product Features

l   Easy installation, no pipe damaging

l   No adjustment, clip on to measure

l   LCD color display

l   LoRaWAN communication protocol
    is available

l   Long transmission distance, Strong
    penetrating ability

l   Strong anti-interference ability

l   No wiring

l   IP Rating: IP54

# 3 Application Industries

Municipal garden irrigation, building water management, residential water management, collective dormitory water management, monitoring and control of water production equipment, aquaculture, farm irrigation, automatic car washing etc.
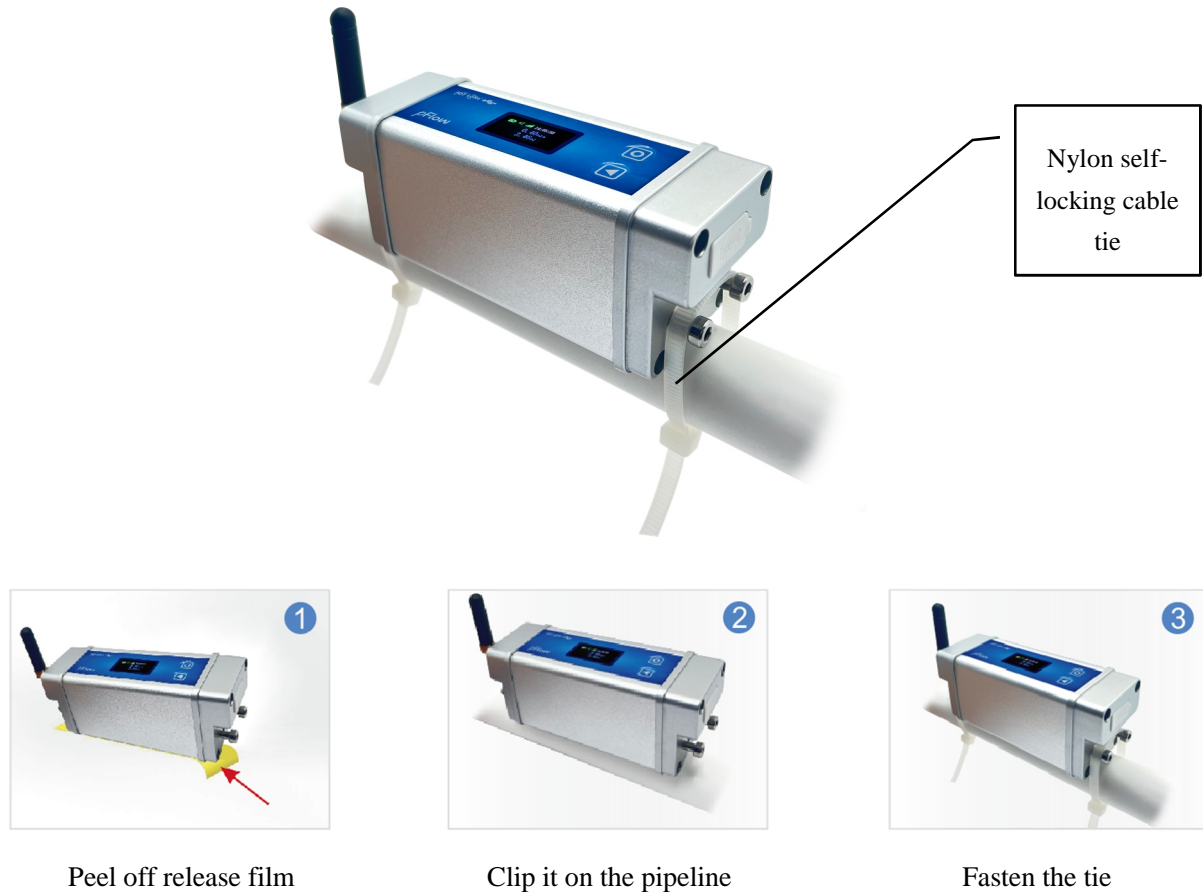
# 4 Dimension

## 4.1 Transmitter Dimension



Dimension Diagram
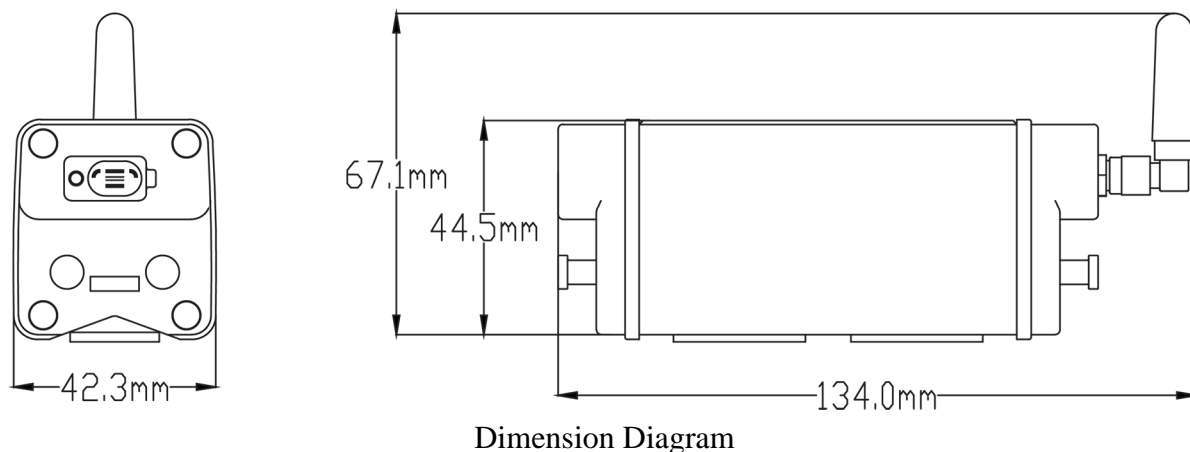
# 5 Installation and Wiring

## 5.1 Installation Diagram

Use nylon self-locking cable ties to fix both ends of the meter.



Nylon self-locking cable tie



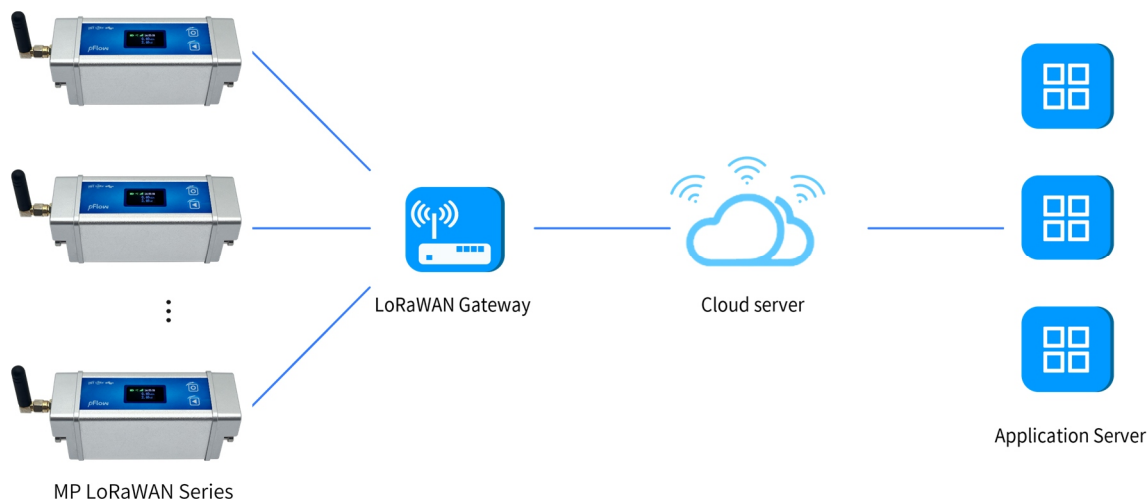| Peel off release film | Clip it on the pipeline | Fasten the tie |

## 5.2 Installation Instructions

1. Carefully read "Section 9. Measurement Site Selection". After the designated location is selected, the area of the pipe installation point must be cleaned, and the dense part of the pipe material must be selected for installation.
2. Gentos' special coupling pads are attached to the central part of the 2 sensors. During installation, peel off the release film. The sensor will squeeze the coupling pads to ensure that the sensor and the pipe wall are tightly fitted without air bubbles.

## 5.3 Meter Wiring

1. The instrument is equipped with a built-in battery and can be powered, charged, and used for serial communication through the Type-C port.
2. Users access the MP LoRaWAN Series flow sensor through a cloud server.

LoRaWAN Gateway            Cloud server            Application Server

MP LoRaWAN Series

# 6 Display and Settings



## 6.1 Display Area Description

| | | |
|---|---|---|
| Upper part of the display area | 🔋 | Displaying the battery level, with 4 bars indicating a full charge. |
| | *T | Displaying network communication status:<br><br>Displaying *X: Indicates a damaged or absent communication module.<br><br>Displaying *F: If the status is not switched within fifteen seconds, it indicates a network entry failure (either the entry permission is not added to the gateway or there is a network anomaly).<br><br>Displaying *T: Indicates normal network communication. |
| | *R | Displaying measurement status:<br><br>*R: Indicates normal measurement. |

| | | |
|---|---|---|
| | | *I: Indicates no signal. |
| | | *G: Indicates searching for a signal. |
| | 16:07:16 | Display the current time, hours-minutes-seconds. |
| Lower middle of display area | / | For details, see Section 9.1, "Displaying Screens 1 - 4". |

## 6.2  Key Description

1. ◎ Turn off/on：In the built-in battery power supply state, press and hold for 3s to turn on, and then press and hold for 3s to turn off. On/Off key does not work when powered via Type-C.

2. ◀ Function Key：Shortly press this key and alternately display flow, velocity, time and serial number. Press and hold this key for 3s to enter the setting menu interface, and then shortly press this key to light up the icons in sequence. When you need to modify the value in some sub menus, press ◀ to increase the value, press and hold ◀ to shift.

# 7  Technical Index

| Performance Index | |
|---|---|
| Measurable range of velocity | 0.03~5.0 m/s |
| Pipe Size | DN20、DN25、DN32 |
| Medium | Water |
| Pipe Material | Carbon steel, Stainless Steel, Copper, PVC (According to the user's model selection, the model has been determined at the time of delivery.) |
| Function Index | |
| Input | Type-C (Power Supply, Charge, Serial Communication) |
| Output | Type-C (Serial Communication) |
| LoRa Communication | Maximum Transmit Power: 22dBm |
| | Temperature：-40~85℃ |
| | LoRaWAN communication protocol is available |
| | EU868 Frequency: 863000000~865400000, unit: HZ |

| LoRa Frequency selection | 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 | Built-in two 3.7V (760mAH) batteries, fully charged for 6~9 hours<br>Externally Connected with 5V/2A power adapter for power or charge |
| Keyboard | 2 touch keys |
| Display Screen | 0.96'' LCD display screen, resolution 80*160 |
| Temperature | Transmitter installation ambient temperature: Class A, 5~55℃<br>The temperature of the medium measured by the sensor: 0℃~60℃ |
| Humidity | Relative humidity 0~99%, no condensation |
| IP Rating | IP54 |
| Installation Method | Nylon self-locking cable ties for quick clamping |
| Physical Properties | |
| Transmitter | All-in-one |
| Sensor | Clamp-on |
| Cable | Type-C cable，length 1m |

# 8  Comparison Table

### MP LoRaWAN Series Comparison Table

| Model | Pipe Material | Communication |
|---|---|---|
| MP805 | Carbon steel | LoRaWAN |
| MP806 | Stainless steel | LoRaWAN |
| MP807 | PVC | LoRaWAN |
| MP808 | Copper | LoRaWAN |
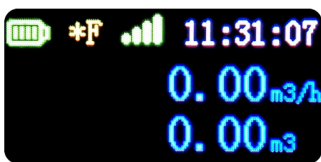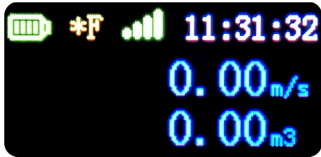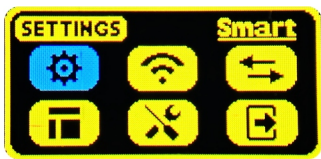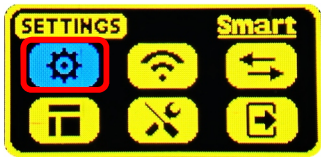
# 9 Menu Details
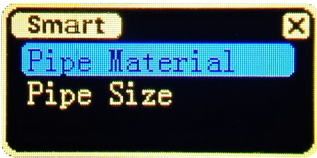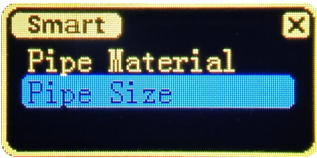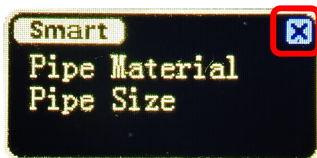
## 9.1 Operation Instructions

For example: DN25 pipe size selected

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*Press* 🔘 *and hold for 3s. Turn on and enter into measurement main interface.There are four main interfaces, which can be switched by pressing the* ◀ *key.*
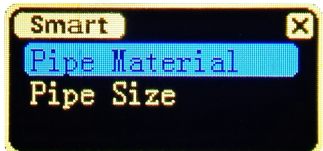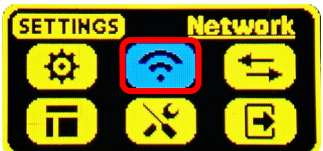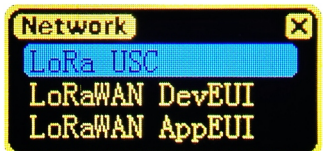
*At the main interface, hold* ◀ *key for 3s, enter the menu selection interface, there are 6 icon options in total.*

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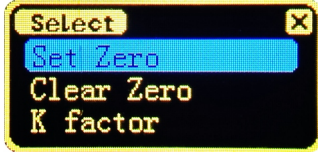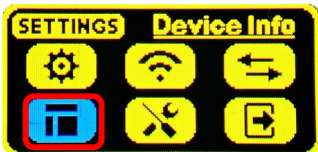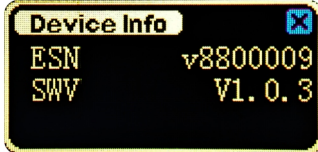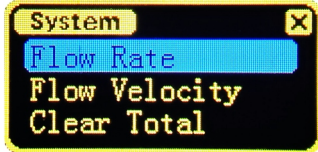
| Display Process Steps | Key Operation Instructions |
|---|---|
|  | Interface 1: Display instantaneous flow and cumulative flow; When the cumulative flow accumulates to 99999m3, 99999000L or 26416976Gal, it will be automatically cleared. |
|  | Interface 2: Display instantaneous flow velocity and cumulative flow; When the cumulative flow accumulates to 99999m3, 99999000L or 26416976Gal, it will be automatically cleared. |
|  | Interface 3: Date and time; Display the current date and time. |
|  | Interface 4: Serial number and version number; Display the factory serial number and software version number of the instrument. |
|  | Hold ◀ key for 2s, enter the menu selection interface, there are 6 icon options in total. |
|  | Press ◀ and light up each secondary menu option icon in turn.<br><br>For example 1: light up ⚙ , and choose Smart. |

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| | |
|---|---|
| **Smart** ☒ <br> Pipe Material <br> Pipe Size | In secondary menu option icon lit up, press and hold ◀, enter into corresponding secondary menu. <br><br> For example 2: enter into Smart menu option, including Pipe Material and Pipe Size sub option. |
| **Smart** ☒ <br> Pipe Material <br> Pipe Size <br><br> DN25 | Press ◀, choose the items in the secondary menu in turn. After finishing the choice of icon, press and hold ◀, enter into corresponding sub menu, and then press ◀ to choose, after selecting, press and hold ◀ to confirm. <br><br> For example 3: press ◀ to light up Pipe Size sub option, then press and hold ◀, enter the pipe diameter setting interface, and then press ◀ to choose DN20, DN25, DN32, finally, press and hold ◀ to confirm for DN25. |
| **Smart** ☒ <br> Pipe Material <br> Pipe Size | When need exit, light up X icon in the upper right corner, press and hold ◀ to exit to the main interface. |

## 9.2 Menu Details

> *When modifying the secondary menu item, press* ◀ *key to increase the value, press and hold* ◀ *to shift.*

| First-level menu selection interface | Secondary menu options | Description |
|---|---|---|
|  | <br><br>1.  Pipe Material<br>2.  Pipe Size | 1.  Pipe Materials are available to Copper, PVC, SS and Carbon Steel. (According to the user's selection requirements, it has been selected at the factory, and the specific information is subject to the instrument display)<br>2.  Pipe Sizes are available to DN20, DN25, DN32. |
|  | <br><br>1.  LoRa USC<br>2.  LoRaWAN DevEUI<br>3.  LoRaWAN AppEUI<br>4.  LoRaWAN AppKEY<br>5.  LoRaWAN Reset<br>6.  Up Link Time<br>7.  Reconnect Time<br>8.  LoRa Switch | 1.  LoRa USC: Display the starting frequency of the Lora uplink channel and set the starting frequency.<br>2.  LoRaWAN DevEUI: 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.<br>3.  LoRaWAN AppEUI:/<br>4.  LoRaWAN AppKEY: The application key is: 2b:7e:15:16:28:ae:d2:a6:ab:f7:15:88:09:cf:4f:3c<br>5.  LoRaWAN Reset: /<br>6.  Up Link Time：LoRaWAN Data upload time (Unit: sec), 5≤Up Link Time≤86400<br>7.  Reconnect Time: For prevent gateway disconnection, lorawan device reconnection time, default value is 7(unit: day), 5≤Up Link Time≤86400<br>8.  LoRa Switch: To prevent Lora's frequency, key, uplink time interval and other information from being modified by others, set the Lora password. After setting the 6-digit password, Lora's frequency, key, uplink time interval, etc. cannot be accessed and set. The device does not have a password when it leaves the factory. Lora information can be viewed and modified. It will automatically lock after entering and setting the password. It will |

| | | |
|---|---|---|
| | | automatically unlock after entering the correct password again. |
| SETTINGS Select | Select ☒ / Set Zero / Clear Zero / K factor<br><br>1. Set Zero<br>2. Clear Zero<br>3. K factor | 1. Set Zero: Set static zero, select "YES" and wait for the process to complete.<br>2. Clear Zero: clear the zero and restore it.<br>3. K factor: instrument coefficient, used to correct measurement results. |
| SETTINGS Device Info | Device Info ☒ / ESN v8800009 / SWV V1.0.3<br><br>1. ESN<br>2. SWV | 1. ESN: Display the serial number<br>2. SWV: Display software version number |
| SETTINGS System | System ☒ / Flow Rate / Flow Velocity / Clear Total<br><br>1. Flow Rate<br>2. Flow Velocity<br>3. Clear Total<br>4. Date<br>5. Time<br>6. Reset<br>7. Turn Screen<br>8. Power Off | 1. Flow Rate: Optional flow units are m3, L, Gal. Optional time units are h and m.<br>2. Flow Velocity：m/s，f/s<br>3. Clear Total: Clear Total Cumulative<br>4. Date: Set Date<br>5. Time: Set Time<br>6. Reset: Restore factory settings<br>7. Turn Screen: Press"∧"or"∨" to flip the display interface by 180°<br>8. Power Off: Shut down. |
| SETTINGS Exit | 🔋 *F ᴵᴵᴵ 11:31:07 / 0.00 m3/h / 0.00 m3 | Exit<br><br>Return to the main measurement interface. |
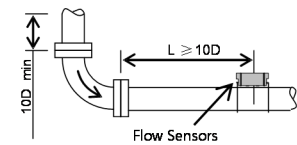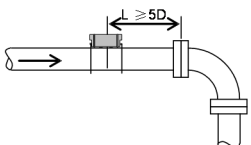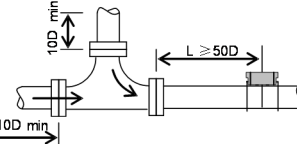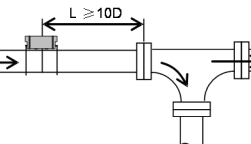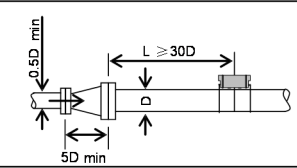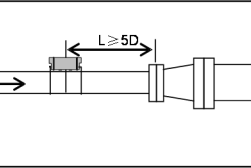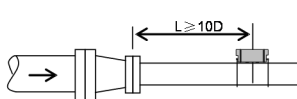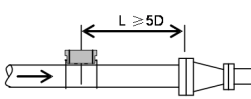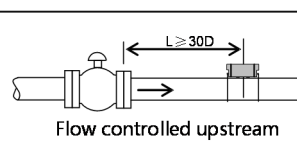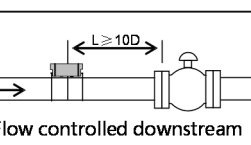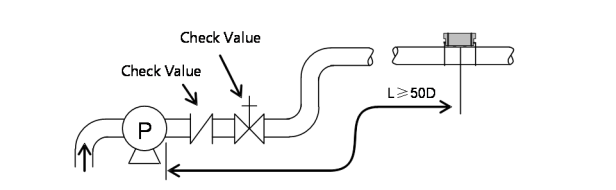
# 10   Measurement Site Selection

This product is the easiest and quickest in flow meter installation of all small pipe diameter. Just choose a suitable measurement point, clamp the sensor surface of the product on the pipe, and fasten the two ends with cable ties for measurement.

When selecting the measurement point, it is required to select the pipe section with uniform distribution of the fluid and flow field to ensure the measurement accuracy. When installing, the following principles should be followed:

l   Choose the pipe section filled with fluid, such as a vertical section of pipe section (the fluid preferably flows upwards) or horizontal pipe section filled with fluid.

l   The measurement point should choose a uniform straight pipe section that is within 10 diameters (10D) upstream and 5 diameters (5D) downstream. There are no valves, elbows, variable diameters and other devices that interfere with the flow field within this range. The length of the straight pipe section is recommended to adopt the values shown in the table below.

l   To ensure that the temperature at the measuring point is within the operating range.

l   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 with uniform and dense pipe material, which is easy to transmit ultrasonic waves.

l   During installation, there should be no air bubbles or particles between the sensor and the pipe wall. For horizontal pipes, the sensor should be installed at the 3 o'clock and 9 o'clock positions, avoiding the part where the top of the pipe may have air bubbles.

| Name | Straight length of Upstream piping | Straight length of Downstream piping |
|---|---|---|
| 90° bend | 10D min, L ≥ 10D, Flow Sensors | L ≥ 5D |
| Tee | 10D min, L ≥ 50D, 10D min | L ≥ 10D |
| Diffuser | 0.5D min, L ≥ 30D, D, 5D min | L ≥ 5D |
| Reducer | L ≥ 10D | L ≥ 5D |
| Value | L ≥ 30D, Flow controlled upstream | L ≥ 10D, Flow controlled downstream |
| Pump | Check Value, Check Value, P, L ≥ 50D | |

# 11　Communication Protocol

The flow meter adopts the response communication method, the upper computer to send "command" way, ask the lower position flow meter to response. The asynchronous communication baud rate (main workstation, computer system, ultrasonic flow meter) is generally 9600bps. Single byte data format (10 bits): 1 start bit, 1 stop bit and 8 data bits. Check bit: NONE。

## 11.1 FUJI Protocol

The basic commands are represented by data strings and the end of the command is indicated by a carriage return line break .They are characterized by arbitrary data length. The commands commonly used are shown in the following table:

Communication command

| Command | Command Meaning | Data Format |
|---|---|---|
| DQD(cr)(lf)Note0 | Return instantaneous flow per day | ±d.ddddddE±dd(cr)Note 1 |
| DQH(cr)(lf) | Return instantaneous flow per hour | ±d.ddddddE±dd(cr) |
| DQM(cr) (lf) | Return instantaneous flow per minute | ±d.ddddddE±dd(cr) |
| DQS(cr) (lf) | Return instantaneous flow per second | ±d.ddddddE±dd(cr) |
| DV(cr) (lf) | Return instantaneous flow rate | ±d.ddddddE±dd(cr) |
| DI+(cr) (lf) | Return positive accumulation amount | ±dddddddE±d(cr)Note 2 |
| DI-(cr) (lf) | Return negative accumulation amount | ±dddddddE±d(cr) |
| DIN(cr) (lf) | Return net accumulated amount | ±dddddddE±d(cr) |
| DID(cr) (lf) | Return instrument identification code (address code) | ddddd(cr)5 Bit 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 network command prefix | Note 4 |
| P | Prefix with checksum return command | |
| & | Command "plus" function symbol | |

Note:

1. (cr)indicates carriage return，Its ASCII value is 0DH.(lf) indicates a line feed and its ASCII value is 0AH.

2. d is a number ranging from 0 to 9, 0 value is indicated as+0.000000E+00.

   d is a number ranging from 0 to 9, the integer part in front of "E" has no decimal point.

3. dddddddd eight digits indicate the electronic serial number of the machine, t indicates the machine code.

4. If there are multiple traffic tables in the data network at the same time, the basic command cannot be used alone, and must be prefixed with W before it can be used, otherwise it will cause multiple traffic tables to response at the same time, which may result in system confusion.

## （1）P prefix

Character P can be added before each basic command to indicate that the returned data has CRC verification .The check sum is obtained by binary addition.

For example: If the return data of the command DI+ (CR)(The corresponding binary data are 44H, 49H, 2BH, 0DH)is+1234567E+0m3 (CR)(The corresponding binary data are 2BH，31H，32H，33H，34H，35H，36H，37H，45H，2BH，30H，6DH，33H，20H，0DH，0AH) the return data of the command PDI+ (CR) is +1234567E+0m3 !F7 (CR). "!" indicates that it is a sum character in front of it, and the checksum of two bytes is in the back

(2BH+31H+32H+33H+34H+35H+ 36H+37H+45H+2BH+30H+6DH+33H+20H=(2)F7H).

Note that "!" can be preceded by no data, and a space character may be present.

## （2）W prefix

The usage of W prefix: W + string address code(Must be 5-digit number) + basic command, digital string value range 0~65535 except 13 (0DH enter), 10(0AH line feed) 42(2AH*), 38(26H&). If access to the instantaneous flow rate of the flow meter No. 12345, issue the command W012345DV (CR), 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 (prefixed with P) to form a composite command and transmit it to the flow meter, which responds at the same time. For example, to send back simultaneously 1. instantaneous flow rate; 2. instantaneous flow rate; 3. positive cumulative quantity; 4. negative cumulative quantity; and 5. net cumulative quantity with verification from the flow meter No. 4321, 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）

## 11.2 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 totalizer－highest byte | 32 bits int | 4 | The totalizer of the instrument is sent in integers after 100 times amplificator (unit is m3) |
| $0005 | Positive totalizer－high byte | | | |
| $0006 | Positive totalizer－low byte | | | |
| $0007 | Positive totalizer－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.