Turbine Flowmeter
TRFM 1.0

User Manual

CONTENT

I. General

1.1 Introduction

TRFM 1.0 turbine flow meter consists of turbine flow sensor and display instrument and it is made by us using foreign state-of-the-art technologies, which is an ideal gauge for measuring of liquid flow.

The flow meter is characterized by simple structure, high precision and easy installation and repair. The product may be used in a wide range of industries, including oil industry, chemical industry, metallurgy, water supply, paper-making, environment protection and food industry.

It is applicable for use in closed pipes to measure flow of liquid which will not erode stainless steel (1Cr18Ni9Ti), 2Cr13, Al2O3 and hard alloy and is free of impurities such as fiber and granules. If this product is used in association with display instruments with special functions, it can be used for purpose of automatic definite quantity control and alarming in case of excessive amount.

1.2 Product Features

1. The sensor is of hard alloy bearing thrust type, which may guarantee the   precision and improve the wear resistance performance as well.

2．Simple and firm structure, easy for installation and dismantling.

3．Wide range of measuring with very low lower flow velocity limit.

4．Small loss of pressure,fine repeat ability and high precision.

5．High resistance to electromagnetic interference and vibration.

1.3 Working Principle

When liquid flows through the casing of sensor, the impulse of fluid will provide the blade with a rotation moment as there is an angle between the blade of impeller and the flow direction. The blade will rotate as the friction moment and the fluid resistance are overcome and it will reach a stable speed when the moments are at balance. Under certain conditions, the rotation speed of blade will be in direct proportion to the flow velocity. Due to the magnetic conductivity of blade, when located in the magnetic field generated by signal detector (made of permanent magnet steel and coils), the rotating blade will cut the magnetic lines and periodically change the flux through the coil, thereby inducing electrical impulse signals at both ends of the coil. The induced signals, after amplified and rectified by amplifier, will form a continuous rectangular impulse wave with certain amplitude which may be remotely transmitted to display instrument indicating the instant flow and the cumulative flow of fluid. Within a certain range of flow, the impulse frequency f is in direct proportion to the instant flow of fluid flowing through the sensor, which is shown in the equation below:

$$Q = 3600 \times \frac{f}{k}$$

Wherein:

f- Impulse frequency [Hz];

k- Instrument factor of sensor [1/m3], which is given by checklist. If [1/L] is used as

the unit, the equation will be: $Q = 3.6 \times \frac{f}{k}$

Q- Instant flow of liquid (in operation) [m3/h];

3600- Conversion factor.

Instrument factor of each sensor will be filled out in verification certificate by the manufacturer. The instant flow and cumulative flow will be displayed when the value of k is loaded into associated display instrument.

1.4 Major Technical Performance

1. Nominal drift diameter: （4～200）mm, refer to Table 1 for the basic parameters;

2. Medium temperature: （-20～80）°C; Split type (－20～120) °C;

3. Ambient temperature: （-20～70）°C;

4. Precision: ±0.5%, ±1％;

5. Detector signal transmission wiring system: three-wire voltage impulse (three-core shield wire);

6. Power supply:

   1) TB3WE Three Wire

   External Power:12~24VDC/30mA(-20%~+15%),if no output can be as low as 6V

   Battery:Lithium battery 3.6V(2/13Ah)/0.4mA

   2)TB2WE Two Wire

   12~24VDC/4-20mA(-20%~+15%)

7. Transmission distance: the distance between the sensor and the display instrument may be as far as 1000m;

8. Local display power supply: 3.6V (Lithium battery, may be used continuously for more than 3 years);

9. Display mode: local LCD displays instant flow and cumulative flow;

10. Output Signal

a)TB3WE Three Wire

1)Pulse Output:High level voltage amplitude≥5V, low level<0.5V

2)Three sire 4-20mA linearity correction current output(need ground wire)(load resistance≤800Ω at 24V)

3)RS485 communication:flowmeter with RS485 interface, communication distance≤ 1200mm.

b)TB2WE Two Wire

1) Two wire 4~20mA linearity correction current output(need ground wire)(load resistance≤600Ω at 24V)

2) Origin Pulse output:High level≥5V(power supply voltage-1V),Low level<0.5V

Table 1

	TRFM1.0□	□□□	□	□	□	Description
Type	TRFM1.0-A					Flow sensor pulse output three-wire system, +12V power supply;
	TRFM1.0-B					Local display, powered by 3.6V battery;
	TRFM1.0-C					Local display with 4～20mA or pulse output, powered by 24V;
	TRFM1.0-D					Flow transmitter 4～20mA output, powered by 24V;
Nominal drift diameter	4				Normal flow range m3/h	0.04～0.25	Extended flow range m3/h	0.04～0.4
	6					0.1～0.6		0.06～0.6
	10					0.2～1.2		0.15～1.5
	15					0.6～6		0.4～8
	20					0.8～8		0.45～9
	25					1～10		0.5～10
	32					1.5～15		0.75～15
	40					2～20		1～20
	50					4～40		2～40
	65					7～70		3.5～70
	80					10～100		5～100
	100					20～200		10～200
	125					25～250		12.5～250
	150					30～300		15～300
	200					80～800		40～800
Explosion protection						Not marked, without explosion protection
		B				Explosion protection type
Precision class			A			Precision: Class 0.5
			B			Precision: Class 1.0
Turbine type				A		Normal flow range
				B		Extended flow range

Note:

Sensors with pipe diameter of DN4～DN40 are of thread connections with maximum operating pressure of 6.3Mpa.

Sensors with pipe diameter of DN50～DN200 are of flange connections with maximum operating pressure of 2.5Mpa.

Sensors with pipe diameter of DN4～DN10 are provided with front and rear straight pipe sections and filters.

Please specify when placing an order if flange connections are required for pipe diameter of DN15～DN40.

Please specify when placing an order for high pressure type and special requirements.

Drawing 3　Insertion Vortex Flowmeter Outline Size and Installation Diagram

1.5 Overall Dimension

The installation types of sensors vary according to specifications, which may be connected either by thread or flange. The installation types are shown in Fig. 1, Fig. 2, Fig.3, Fig. 4 and Fig. 5. The installation dimensions are shown in Table 2.

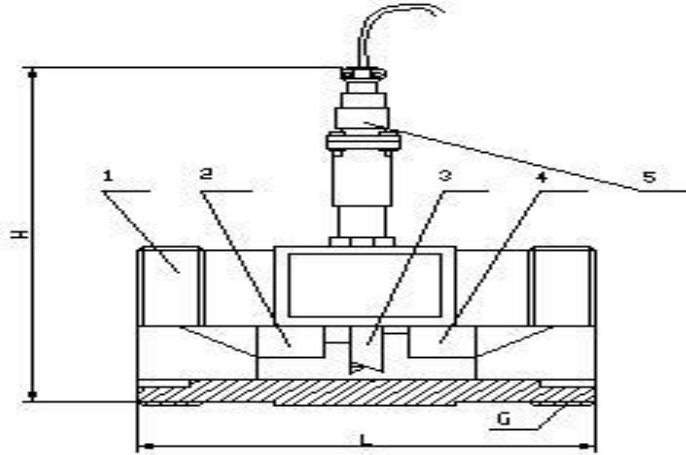Fig. 1 Structure of DN4～DN10 sensor and installation dimension diagram
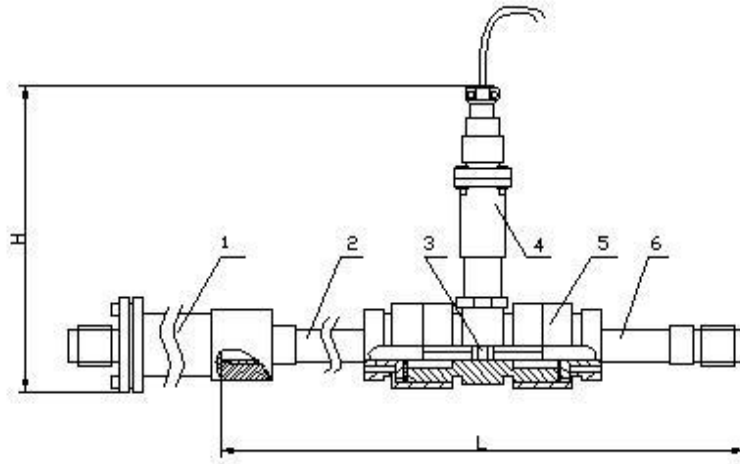
Filter 2. Front straight pipe section 3. Impeller 4. Preamplifier 5. Casing 6. Rear straight pipe section
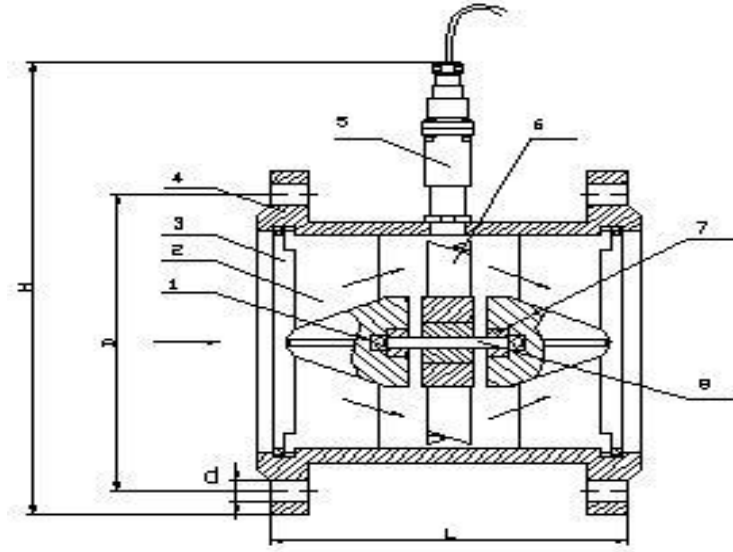
Fig. 2 Filter structure diagram
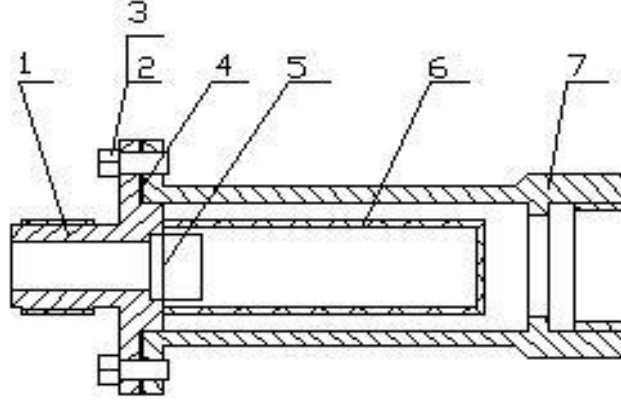
Clamp ring 2. Bolts 4×14 3. Washer 4. Sealing washer 5. Steel wire 1Cr18Ni9Ti-0.8×2.5　6. Filter screen 7. Base

Fig. 3 Structure of DN15～DN40 sensor and installation dimension diagram

Casing 2．Front guide part 3．Impeller 4．Rear guide part 5．Preamplifier

Fig. 4　Structure of TRFM1.0—50～200 sensor and installation dimension diagram

Ball bearing   2．Front guide part   3．Expansion ring   4．Casing   5．Preamplifier
6．Impeller   7．Bearing   8．Shaft

Fig. 5 Wiring diagram for connection between sensor and display instrument
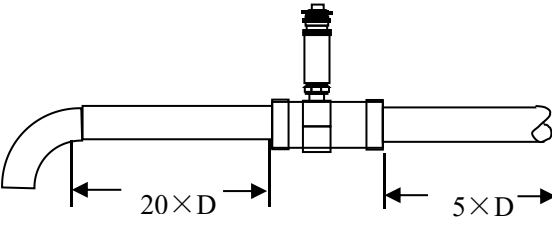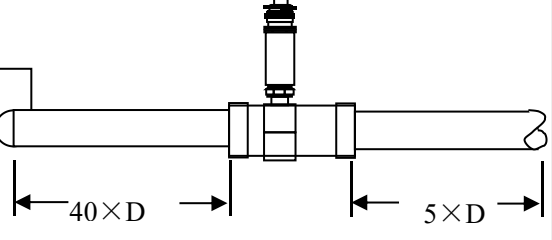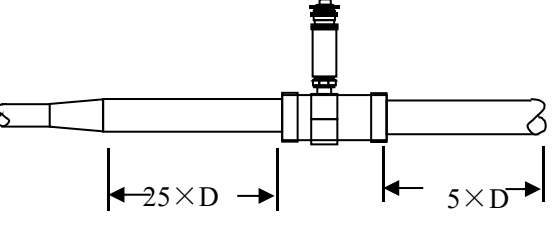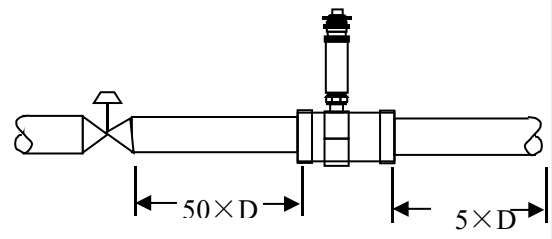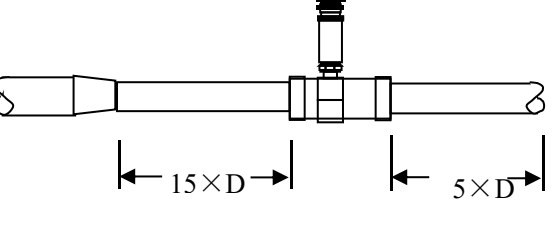
II. Installation Requirements
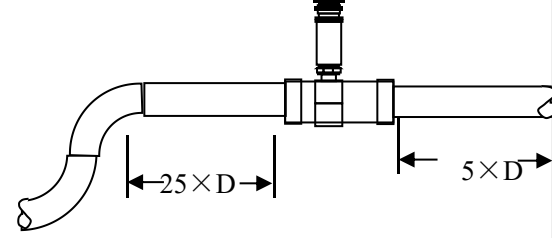
Flow meter may be installed horizontally or vertically. In the latter case the fluid shall be flowing from downward and fulfill the pipe to avoid bubbles; the flowing direction of liquid shall be consistent with the direction indicated by the arrow on casing of the sensor; as far as front and rear straight pipe sections are concerned (see Fig. 6), at upstream there shall be front straight pipe section at least 10 times of nominal drift diameter in length and at downstream no less than 5 times of nominal drift diameter in length. The internal wall of pipe sections shall be smooth and clean, free of defects such as indent, fouling and peeling. The pipe axis of the sensor shall be aligned with that of the neighboring pipe and the washers used for connection and sealing may not be embedded into depth of the pipe cavity; the sensors shall be kept away from foreign electric field and magnetic field, effective shielding measures shall be taken in case of necessity to avoid external interference.

In order that the normal transfer of liquid will not be affected by maintenance, it is recommended that bypass pipes be installed at position of sensor.

In case of open air installation, water proof measures shall be taken for purpose of amplifier and plug of the sensor. The wiring between sensor and display instrument is shown in Fig. 5.

When fluid contains impurities, filter shall be additionally installed. The number of filter screen meshes is determined in accordance with the flow and impurity, normally 20 to 60 meshes. When fluid is mixed with free gases, gas eliminator shall be additionally installed. The complete pipe system shall be well sealed. The user shall fully understand the erosion nature of the measured medium to protect the sensor from being eroded.

Fig. 6 Requirements on straight pipe section for installation of flow meter

One 90° elbow	20×D, 5×D	Two 90° elbows for two planes	40×D, 5×D
Concentric expander	25×D, 5×D	Control valve half-open	50×D, 5×D
Concentric shrinkage wide open valve	15×D, 5×D	Two 90° elbows for one plane	25×D, 5×D

III. Operation

◆ When sensor is used, the liquid to be measured shall be clean and free of impurities such as fiber and granules.

◆ When sensor is used, it shall be at first slowly filled with liquid, then open the outlet valve (which should be installed behind the flow meter). It is prohibited to render the sensor under impact of high-velocity fluid when it is not filled with liquid.

◆ The maintenance interval for sensor is in general half a year. In case of maintenance and cleaning, attention shall be paid not to damage the parts in the measuring cavity, particularly the impeller. During assembly, watch carefully the positional relation between guide part and impeller.

◆ When the sensor will be out of service for a long time, the internal liquid shall be cleaned. After dried, the sensor shall be provided with protection sleeves at both ends to protect against dust and it shall be placed in dry conditions for storage.

◆ The associated filter shall be cleaned on regular basis and the internal liquid shall be cleaned when it is out of service for a long time. Similar to sensor, the filter shall also be provided with dust protection and stored in dry conditions.

◆ The transmission wire of sensor may be overhead or buried (iron bushing shall be provided in the latter case).

◆ Prior to installation of sensor, the connection thereof with display instrument or oscilloscope shall be finished. Then switch on the power, blow the impeller with mouth or move the impeller with hand to make it rotate quickly, see if there is any reading. Install the sensor if there is reading. In case of no reading, the related sections shall be inspected to eliminate any fault.

3.1 Wiring

Warning:
Before wiring, cut off the external power. Wiring with electric is strongly prohibit.

3.1.1TB3WE Three-Wire System Electric Wiring

1.Main power supply and output signal terminals
(3-digit under-hang spinning terminals in the left).

Fout	-	+

Fout:Pulse Signal Output Terminal

"-"is the power supply "-" or current flow terminal

"+"is external 12-24VDC power "+"

When "+" "-"connect (or battery type power on),pulse output from "Fout".

2.Auxiliary Wire(small terminal)
The three-wire between main terminal and auxiliary terminal are pulse output switch.

If insert into the outside F0,there will be pulse output.

If insert into the inside NC,then no pulse output.

For two wire current type,only insert outside F0 while testing.

If use current,must insert inside NC to disconnect pulse output. Or else,the current will not be accuracy.

3.Battery Powered Type

+3V6	3V6-	B-	A+

1).Battery Wiring(the right side 1 and 2 in small terminal)

   +3V6: Connect 3.6V battery "+"

   3V6-: Connect 3.6V battery "-"

2)Communication Wiring

  (the left side 3 and 4 in small terminal, if without RS485,no terminal here)

   B-:Connect RS485 "B-"

   A+:Connect RS485"A+"

3.1.2 TB2WE Three-Wire System Electric Wiring

1.Main power supply and output signal terminals

Fout	-	+

"-":4-20mA output terminal

"+":15-24V power "+" terminal

"+" Connect with +24V external power, current output from "-" to computer/sample resistance of the display. After flow through some load resistance like sample resistance,then back to power "-".

2.Auxiliary Wire(3-digit small terminal)

4-20mA current output type with no auxiliary small terminals.

Fout: Pulse output terminal

When "+" "-" connect with external power then work,pulse output from "Fout".

The three-wire near main terminal are pulse output switch.

If connect to the outside F0,there will be pulse output.

If connect to the inside,then no pulse output.

For two wire current type,only insert outside while testing.

If use current,must insert inside NC to disconnect pulse output. Or else,the current will not be accuracy.

This pulse is origin pulse without any modify,usually use while doing calibration; Output signal is the open-collector output include 2K7 pull-up resistor.

System wiring please refer to the appendix "TB3WE three wire" and "TB2WE Two Wire".

3.2 Local LCD Operation Instruction

3.2.1 User Menu Operation

(1)Working Menu

After power-on,meter will be self-checking first,after then it will enter into LCD(figure 1)working display status.

```
                              XXXXX


          XXXXX.XXXm3


          XXXX.XXm3/h
```
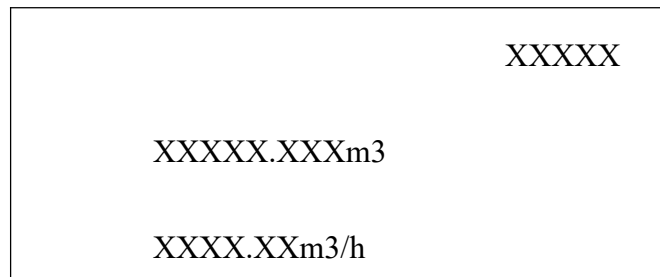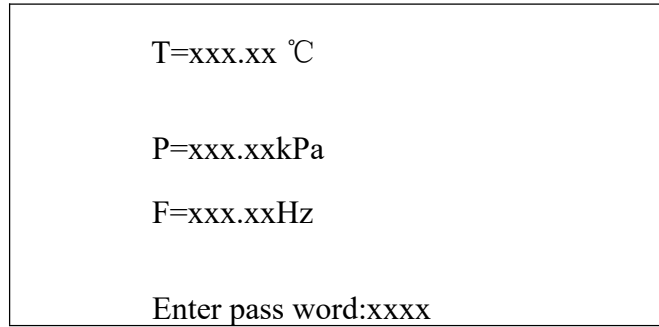
Chart 1 TB2/3WE working screen (Figure One)

The first line: High level of Accumulative flow; 5 fixed integer part number. If no,it'll display as "0".

The second line: Low level of Accumulative flow;3 decimals part number after the 5 fixed integer number. The unit is the same with instant flow non-time part.
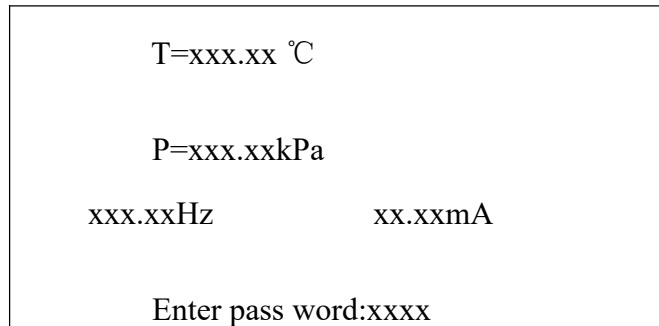
The third line:Instantaneous Flow; 5 or 6 integers and automatic keep 2 or 1 decimals. The unit can be set.

Press "<" or "+" to change the screen from Working Screen 1 and 2

```
                 T=xxx.xx ℃


                 P=xxx.xxkPa

                 F=xxx.xxHz


                 Enter pass word:xxxx
```

Chart 2 TB3WE Three-wire System working screen (Figure Two,Sub Screen)

```
                 T=xxx.xx ℃


                 P=xxx.xxkPa

       xxx.xxHz              xx.xxmA


                 Enter pass word:xxxx
```

Chart 3 TB2WE Three-wire System working screen (Figure Two,Sub Screen)

From Up to Down:
The first line:Temperature value setting for temperature compensation calculation,shows"T≡999.9℃",reserving 1 decimal.
The second line:Pressure value setting for pressure compensation calculation,,shows"P≡99999.99kPa",reserving 2 decimals.
The third line:For TB3WE is frequency value.
               For TB2WE is frequency value(left side) and current output(right side)

The four line:password entering set state.
Press the enter key of "<"(about 1.2seconds) to enter password initial input state.
Press the key of "+"(about

1.2seconds) to cancel entering state and return to figure two Subsidiary LCD.

Press "+"key in the input state to change the value of cursor circularly.
Press the shift key"<" to change the position of input cursor.
Press "<"key (about 1.2seconds) at the input state to submit the password.
If right,enter to menu.if incorrect,return to initial input state.

```
T=xxx.xx ℃

P=xxx.xxkPa

F=xxx.xxHz

Enter password:xx
```

Chart 4 Password Initial Input State

Password:User menu password 2010

3.2.2 User's Data Setting

1.Input operation
In the input state:
Pree "+"key in a long time to exit the input state.
Pree "<"key to confirm and save the input.

Press "+"key in the input state to change the value or symbol of cursor circularly.

Press "<"key to move the current cursor one position towards the right.

Max.8 digits inputting is allowed.(including the symbol,decimal).

2.Menu Operation

In the menu browse:

Press "+" key for page down;

Press"<"key for page up;

Long Press"<"key for entering into the sub-menu;

Long press "+" key for returning to the working screen figure 2;

In the sub-menu,long press "+" key to quit out;long press "<"key to enter into modified state;In the modified state,press "+" key for downward selecting;press "<"for upward selecting;long press "<"key for confirmation and saving.

Attention:When the parameter setting,it should long press "<"key for saving the displaying.Otherwise,the setting is invalid.
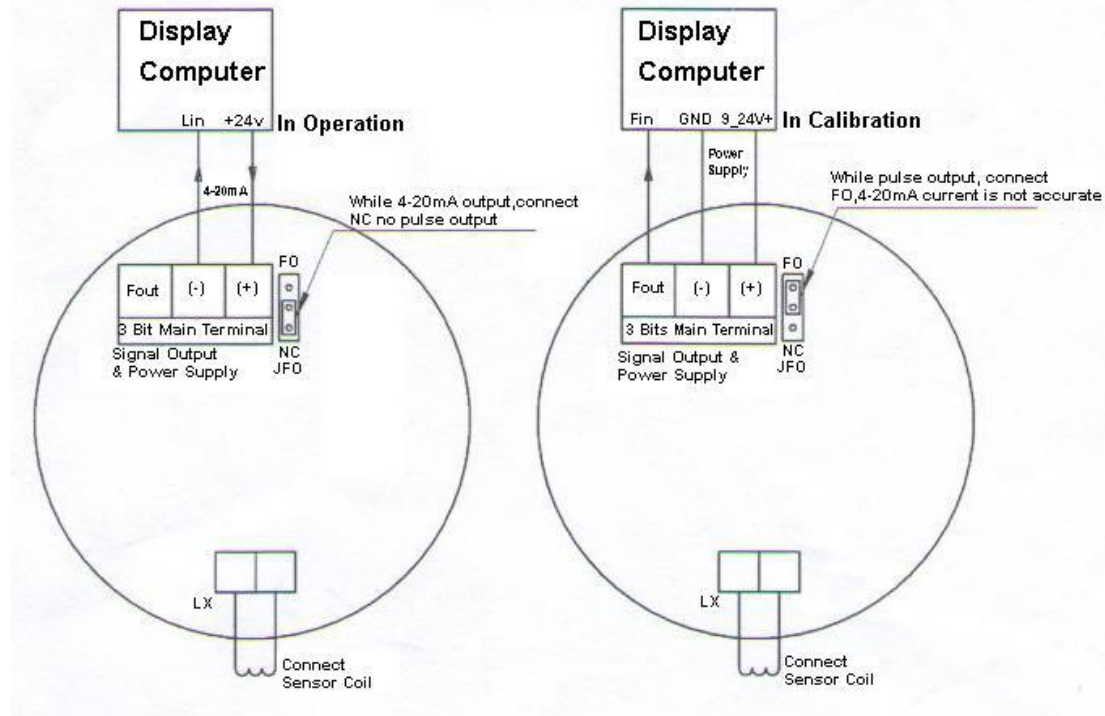
User Parameter Setting Menu

Sub-menu Series#	Display of menu	Definition	Alternative options or range of value
1	Flow Unit select	Flow Unit select (default 0)	0：m³/h　　　1：m³/m 2：l/h　　　3：l/m 4：t/h　　　5：t/m 6：kg/h　　　7：kg/m
2	Algorithm Selection	Algorithm Selection （default 0）	00:Conventional Volume flow 01:Conventional mass flow 02:Volume flow of conventional gases 03:Mass flow of conventional gases
3	Flow Coefficient	Flow Coefficient (default 3600)	Set the meter coefficient with the unit of P/m3
4	Maximum Output Flow	Max. Flow (default 1000)	When the meter outputs 4~20mA analog signal, must set the value and the value cannot be zero,the unit should be accordance with the flow unit.
5	Density setting	Density setting (default 1.0)	When Algorithm Selection is setting to mass flow(01,03),it must set this item,the unit is kg/m3
6	Temperature Setting	Temperature Setting (default 0.0)	Setting the temperature calculated value,when choose 02,03,04,06 algorithm,it must set this item,the unit is Celsius degree.
7	Absolute pressure setting	Gas Absolute pressure set （default 101.325）	Setting the absolute pressure of gas,when choose 02,03 algorithm,it must set this item,the unit is Kpa.(when vacuum is 0.0,it will cause the flow is 0)
8	Low flow cut off	Set percentage of resection	The value is between 0~100

		pulse input (Default 1%)	
9	485 Address	Set RS485 communication No. (Default 1)	For three-wire system TB3WE only.The meter uses RS485 communication should set this item,and should not equal to other equipment in the same system,the range is 0~255.
10	Damping time	Set current output damping time (Default 4s)	Setting current and displaying damping time,it is for avoiding the current's fluctuation too big along with the flow rate.The range is 2~32.
11	Reset Cumulant	Reset cumulant	If need to Reset cumulant,choose YES and press "E" key.

Appendix

Appendix 2: TB2WE Two-wire System Turbine Flow Meter Wiring Scheme

AKTEK Endüstriyel Ekipman ve Enstrümantasyon LTD.ŞTİ.
İMES Sanayi Sitesi B-Blok 204.Sok. No:40 Y.Dudullu-Ümraniye/İSTANBUL

Appendix 3: TB3WE Three-wire System Turbine Flow Meter Wiring Scheme