Type KF500

Turbine Flow meter

Instruction

Manual

Foreword

First of all, we would like to thank you for using the turbine flow meters supplied by our company.

Prior to delivery, Type KF500 turbine flow meters have been accurately regulated as per technical data specified in orders. Prior to applying the transducer, please read through this instruction manual to have a sufficient understanding of the characteristics of the turbine flow meter and a good exercise over its operating methods. Thus to ensure proper operation and to bring its characteristics into full play. In case of anything not clear, please consult the marketing agents of the instruments or the marketing personnel of our company.

This instruction manual has not yet provided descriptions in respect to different characteristics of users. By the way, when modifying technical parameter, structure or parts of the flow meter, as long as such modifications cause no impacts on functions and operation of the flow meter, this instruction manual will not be revised accordingly each time.

1. Caution Matters

Before shipment, the KF500 turbine flow meters have been thoroughly tested at the factory. And when receiving such products, users perform a visual check to assertain they have not been damaged during shipment.

1.1 Check of models and specifications

Both model and important specification parameter of the flow meter are marked in the name plate on the body, please check whether they are the same as those specified in the order.

In case of need, contact us. Please make sure to describe model and serial number (No). from the data plate.

1.2 Cautionary statements for transportation and storage

After the flow meter's arrival at the site of installed, please keep the packing state when we delivered such product, so as to avoid damage from carelessness.After arrival at the application site, the flow meter should be installed in time, so as to protect it from unexpected damages.If the product needs to be stored for a quite long period, please oberve the following.

a) where possible store the flow meter without unpacking.

b) select a storage area that is::

- Equipped against precipitation, moisture and sunshade.
- Relatively free from mechanical vivration or impacts shock.
- The flow meter shall be stored in an indoor place featuring a temperature from 5℃ to 40℃, a relative humidity not higher than 85%, a good ventilation, free of corrosive gases.

Note: 1. The flow meter is of big weight, please take care not to be hurt during operation.

2. An important parameter of the flow meter--K-factor is recorded in the acceptance certificate. Please take care to keep it properly.

2. Overview:

This instruction manual describes the standard specifications, model, installation, operation and maintenance of the turbine flow meter.

Type KF500 turbine flow meter is a velocity flow meter.It is used to measure volume flow rate of a liquid that fills a closed pipeline and flows continuously in it.

In actual application, Type KF500 turbine flow meter integrates with relevant flow indication instrument-XSJ Series flow integrating instrument, also, it may combine with KF500 /TBS converter display to form a integral type to measure and indicate flow raterate and quantity of a liquid, to pulse output signals and/or standard current signals and to provide power-off data protection.

The turbine flow meter is suitable for measuring a liquid flow rate of low viscosity, featuring a high accuracy and a strong bearing capacity of high process pressure.The product may be widely applied in petrochemical industry, metallurgical industry and other fields of scientific research. It may also be applied in food service industry and hydraulic systems. The pre-amplifiers are classified into common type, 4~20mA standard current signal output type and explosion proof type, and the flow detectors fall into common type, wearing resistant type and anti-corrosive type, among them, for the wearing resistant type, aside from its bearing and shaft made of hard metal (for a diameter lower than 25mm, red corundum will be used.), it has been designed to a pattern providing a proper reverse thrust to the impeller, which has made it more suitable for measuring liquids of poor lubrication.performance, such as gasoline etc.

The acting standard of this product: **Q/TDUU02-2006 KF500 turbine flow meter**

3. Major technical performances

3.1 Performance Index

For technical performances of the turbine flow meter (transducer), namely Nominal Diameter, Nominal Pressure, Max. Pressure Loss, measuring Range etc., please see Table 1 for details. Unit: m^3/h

Nominal diameter Dn (mm)	Flow rate						Nominal pressure **PN** (**Mpa**)	Max pressure loss (**Mpa**)
	Intrinsic error limit **±0.2%**		Intrinsic error limit **0.5%**		Intrinsic error limit **1.0%**			
	Lower limit	Upper limit	Lower limit	Upper limit	Lower limit	Upper limit		
2*	-	-	-	-	0.010	0.130	1.6	0.15
3*	-	-	-	-	0.040	0.250	1.6	0.12
4*	-	-	-	-	0.04	0.25	6.3	
6			0.1	0.6	0.1	0.6	6.3	0.08
10			0.25	1.2	0.2	1.2	16*	
15	1	4	0.6	4	0.4	4	25*	
20	1.5	7	1.1	7	0.7	7	25	
25	2	10	1.6	10	1	10	40*	0.04
32	3.2	16	2.5	16	1.6	16	2.5	
40	4	20	3	20	2.5	25	2.5	
50	8	40	4	40	4	40	2.5	
65	12	60	6	60	6	60	2.5	
80	20	100	10	100	10	100	2.5	
100	25	160	20	160	16	160	1.6 or 2.5	
150	50	300	40	300	40	400		
200	120	600	100	600	80	800	1.6	
250*	200	1000	160	1000	120	1200		
300*			250	1600	180	1800		

Note: “*” stands for special order.

When the nominal diameter is 2mm and the flow rate range is 0.040~0.13m^3/h, the intrinsic error is: ±1% of reading, and when the flow rate is ≤0.040m^3/h, the intrinsic error is ±1% of full scale value.

When the nominal diameter is 3mm and the flow rate is 0.085~0.250m^3/h, the intrinsic error is: ±1% of reading, and when the flow rate is ≤0.085m^3/h, the intrinsic error is ±1% full scale value

The flow rate ranges indicated in the table are regular values, if needed, they may be properly expanded as user's requirements. The minimum flow rate may be extended to about 0.3m/s, ,it may be still lower for some specifications, and accuracy in the extended area will be indicated as the relative error of the full range value.

- Measured medium: liquid (avoiding multiphase flow)
- Viscosity range of medium:**≤5mPα·S**
- Calibration: calibrated with water before leaving the factory

3.2 Normal Operating Conditions

Fluid temperature range:-**20**～+**100**℃，high temperature type **-20~+150**℃

Ambient temperature：-**25**～**55**℃

Ambient humidity：**≤80%RH**（non-condensing）

Supply voltage: preamplifier 24V_{DC}

Type **KF500/TBS converter 24 V_{DC}±10**% or battery power supply.

3.3 Installation

- Installation pattern: installed on a horizontal pipeline
- Connecting pattern:**KF500-2～3，PN1.6MPa non thread sealing pipe thread connection**

KF500-4～25，PN6.3MPa pipe-thread connection of non thread sealing

KF500-40～300，flange connection

The patterns listed below should be determined at time of ordering:

KF500- 4～25，PN16MPa，PN25MPa ferule type connection

KF500- 6～32，PN4.0MPa wafer type connection

KF500- 10～25，PN4.0MPa Flange connection

KF500- 15～100，quick release type connection

Flanges, bolts, qaskets, ferules, clamps and other such products for the purpose of pipe connection will be prepared by the user.If we are supposed to provide such products, please come up with such proposal at ordering.

3.4 wetted parts materials to contact with liquids:

- Body, guide holder: **1cr18Ni9Ti**
- Impeller：**2cr13**(or **329J**)
- Bearing：

  Model A: impregnating resin graphite (or use tetrafluoroethylene with filling)

  Model B: Hard alloy (in the case of DN≤25mm, red corundum may be chosen.)

  Model C: Materials compatible with the user's medium.
- Shaft:

  Model A：**1cr18Ni9Ti**　　Model B：Hard alloy（in the case of DN≤25mm,9Cr18 quench hardening protection and wear-well plating coat or 17～4PH titanized alloy may be used.）

4. Structure and Operating Principle

A turbine flow meter is composed of

（**1**）Body;

（**2**）Front support；

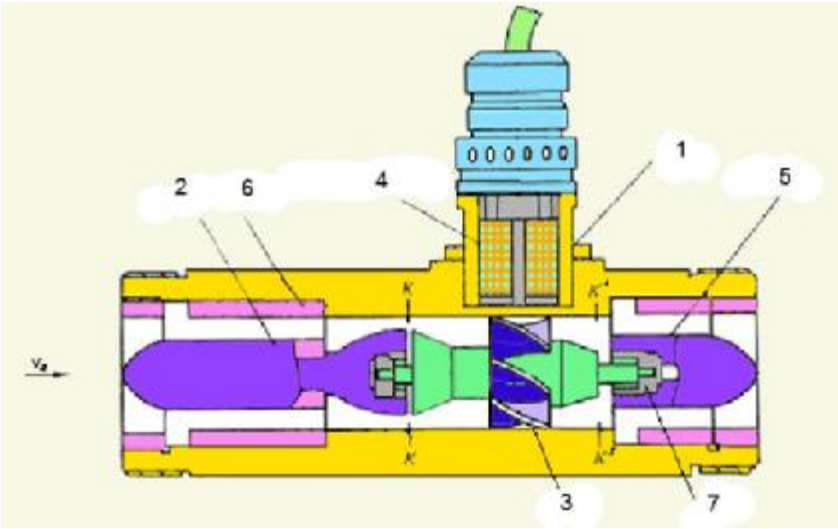
（**3**）impeller；

（**4**）preamplifier;

（**5**）Back supportor；

（**6**）Fluid director；

(**7**) Bearing etc.



A permanent magnet, an induction coil and an amplifying unit are placed in the preamplifier. When the measured fluid is flowing across the flow meter, it drives the turbine to rotate, and the turbine periodically changes reluctance value of the magnetic circuit, which makes the magnetic flux passing the coil vary periodically, thus to induce in the coil the pulsating current signal, which is delivered to a secondary instrument after amplification and treatment, or provide in-situ display, so as to achieve flow rate accumulation.

Within the measuring range, the impeller rotate is positively proportional to the flow rate, namely the impulse total is in direct ratio to the quantity flow.Ratio of the two is termed as K-factoryt, which is indicated by letter “K” (P/L).The instrument constant value of each flow meter is educed by means of actual flow calibration.Divide impulse frequency f and impulse total N measured by the flow meter by instrument constant K of it respectively, the flow rate rate q (L/s) and the quantity Q (L) will be calculated.i.e.

q = ***ƒ*/K** (**L /s**)……（**4-1**）

Q = **N/K** （**L**）……（**4-2**）

5. Explanation of Model and Suffix Code

Table for Model & Specification Codes of LWGY Turbine Flow meter Table 2

Model	Specification code	Note:
----------		Turbine type flow instrument
	----------	Flow meter
	----------	Liquid
Nominal diameter	-2 ---------- -3 ---------- -4 ---------- -6 ---------- -10 ---------- -15 ---------- -20 ---------- -25 ---------- -32 ---------- -40 ---------- -50 ---------- -65 ---------- -80 ---------- -100 ---------- -150 ---------- -200 ---------- -250 ---------- -300 ----------	2mm（pipe thread G1/4"） 3mm（pipe thread G1/4"） 4mm（pipe thread G1/4"） 6mm(pipe thread G3/8”, wafer type, flange type and quick release type) 10mm(pipe thread G1/2”, wafer type, flange type and quick release type) 15mm(pipe thread G1”, wafer type, flange type and quick release type) 20mm(pipe thread G1”, wafer type, flange type and quick release type) 25mm (pipe thread G1 1/4”, wafer type, flange type and quick release type) 32mm (pipe thread G1 1/2”, wafer type, flange type and quick release type) 40mm (flange type, quick release type) 50mm (flange type, quick release type) 65mm (flange type, quick release type) 80mm (flange type, quick release type) 100mm (flange type, quick release type) 150mm (flange type) 7.87in (flange type) 9.84in (flange type) 300mm (flange type)
Integrated type	M	Symbol for a flow meter integrating with a converter
Structure No. of flow meter	A ---------- B ---------- C ----------	Common type Wearing resistant type Anti-corrosive type
Accuracy grade	A ---------- B ---------- C ----------	Intrinsic error limit ±1.0% Intrinsic error limit ±0.5% Intrinsic error limit ±0.2%
Connecting patterns*	G ---------- R ---------- F ---------- J ---------- K ----------	Pipe thread type of non thread sealing Pipe thread type of thread sealing Flange connection type wafer type Quick release connection

Nominal pressure	S1 ---------- S2 ---------- S3 ---------- S4 ---------- S5 ---------- S6 ---------- S7 ----------	PN1.6Mpa PN2.5Mpa PN4.0Mpa PN6.3Mpa PN16Mpa（DN≤50mm） PN25Mpa（DN≤50mm） PN40Mpa（DN≤50mm）
explosion-proof requirement	/NE ----- /EX -----	Non explosion proof Explosion proof grade
Options	/□	Example: HT, AC, AG

Note: **1**、Flange connection size is as per **JB/T 81-1994 or JB/T 79-1994.**

2、Explanation for options: **HT**—high temperature type**-20**℃～**150**℃； **AC** —anti-corrosive type；**AG—anti-fouling**

TZ-specialty

［Example ］**KF500-80ABS$_2$/EX/AC**

Meaning: liquid turbine transducer, DN 80mm, common type, accuracy 0.5%, rated operating pressure 2.5MPa, normal temperature corrosion resistant.

Explosion proof grade: **EX dⅡBT4**

6. Overall dimensions:

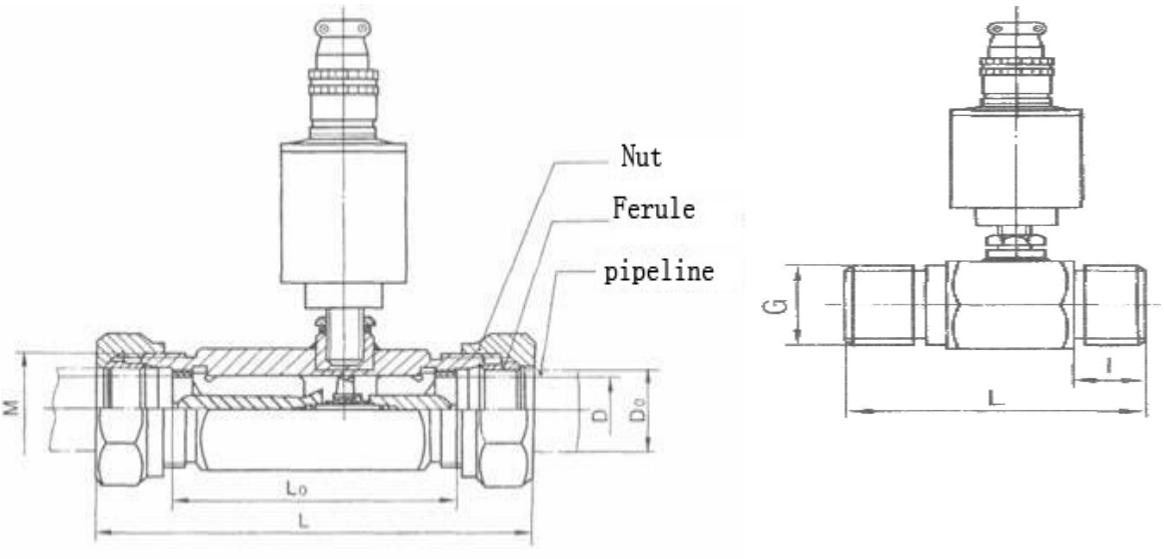
6.1 Thread connection:

●Nominal Diameter **DN2、3mm**（nominal pressure**1.6MPa**）

●Nominal Diameter **DN4-25mm**（nominal pressure **6.3MPa**）

●Nominal Diameter **DN4-25mm**（nominal pressure **PN 16,PN25MPa**）

●Nominal Diameter **DN32mm**（nominal pressure **2.5MPa**）



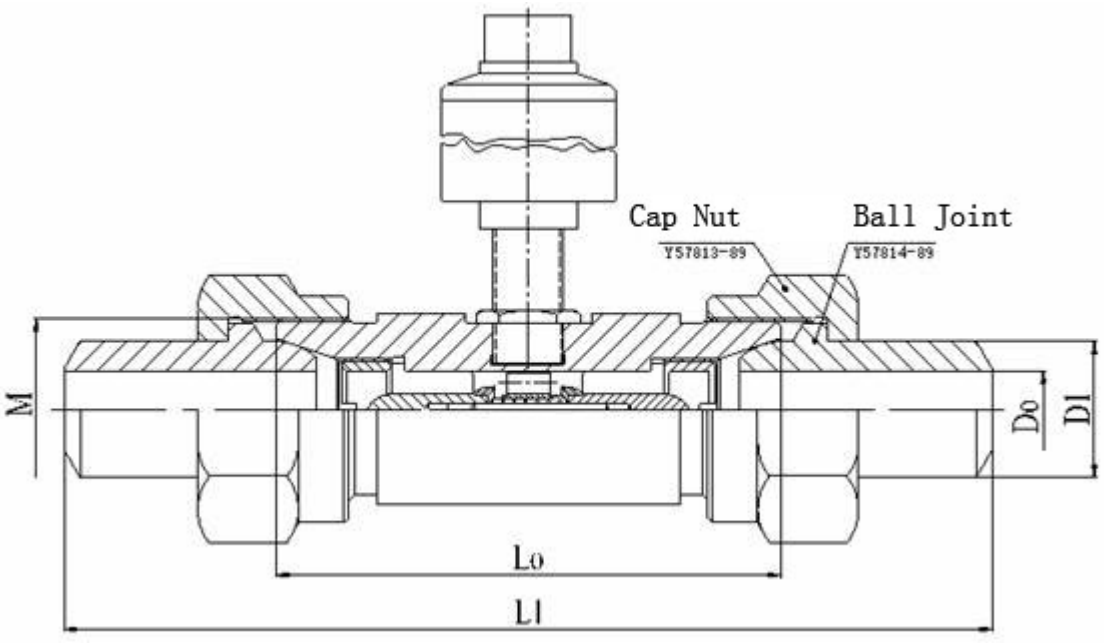
Nominal diameter(mm)	2*、3*、4*			6	10	15	20	25	32
G	G1/4			G3/8	G1/2	G1	G1	$G1^1/4$	$G1^1/2$
L_1(mm)	7			11	16	18	18	23	25
L(mm)	40	55	40	50（42）	60（55）	75	75	100	120
Weight (Kg)	0.5	0.7	0.5	0.6（0.5）	0.65（0.6）	1.0	1.2	1.7	2.2
Pitch P	1.337				1.814	2.309			
Thread number per inch n	19				14	11			

Table 3

Nominal diameter(mm)	Lo	L	Do	D	M	Weight kg
2*4*（6）	40	80	12	6	M18*1.5	0.8
6	50	90				0.9
10	（55）	（97）	16	10	M22*1.5	1.0
	60	102				1.1
15	75	126	25	15	M33*2	1.5
20	75	130	28	20	M36*2	1.6
25	100	155	32	25	M42*2	2.0
32	120	170	40	32	M48*2	2.9

Table 4

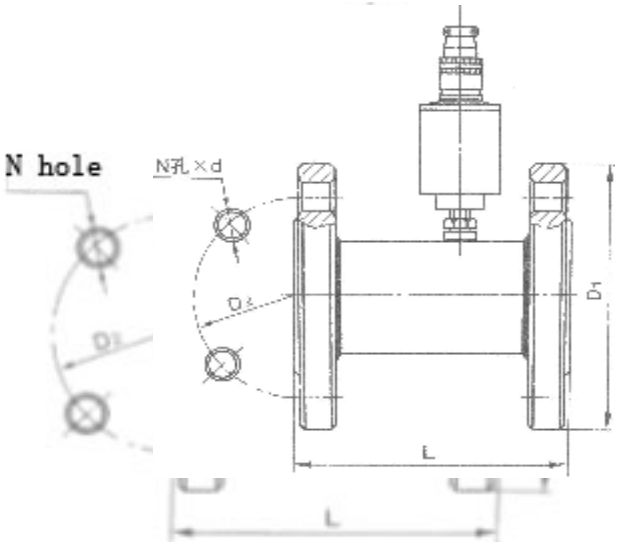
Note: Items marked with "*" are special orders, and the data indicated in ( ) is for user's choice.



Nominal diameter(mm)	Lo	L1	Do	D1	M	Weight kg
6	68	135	6	16	M22*1.5	1.2
10	81	158	10	20	M27*1.5	1.6
15	103	185	15	27	M36*1.5	2.2
20	103	195	20	31	M39*1.5	2.6
25	138	235	25	42	M52*2	2.8

Table 5

6.2 Flange connection:



● Nominal Diameter **DN10-50mm**（nominal pressure **PN4.0MPa**）

- Nominal Diameter **DN65-150mm**（nominal pressure **PN16, 25MPa**）
- Nominal Diameter **DN200-300mm**（nominal pressure **PN16, 25MPa**）

Table 6

Nominal diameter (mm)	10	15	20	25	32	40	50	65	80	100	150	200	250	300
D1	90	95	105	115	140	150	165	185	200	220 (235)	285 (300)	340 (360)	405 (425)	460 (485)
D2	60	65	75	85	100	110	125	145	160	180 (190)	240 (250)	295 (310)	355 (370)	410 (430)
d	14				18					18(22)	22(26)		26(30)	
N	4							4(8)	8			12		12(16)
L	60	75	75	100	120	140	150	180	200	220	300	360	400	420
Weight Kg	1.9	2.0	2.9	3.7	5	7	9	11	14	21 (22)	36 (44)	57 (70)	75	850

Note:（**1**）The Flange connection size is according to **JB/T81-1994 or JB/T79-1994**（**PN1.6、PN2.5**）**\GB/T9119-2000(PN4.0).**

（**2**）Nominal diameter **DN10～50mm**，flange dimension at a nominal pressure of **PN４.０ Mpa.**

（**3**）Of the flange dimensions in the range of nominal diameter**DN65～150.**.The item bearing parentheses is the flange dimension for a nominal pressure of PN2.5Mpa and PN4.0Mpa.

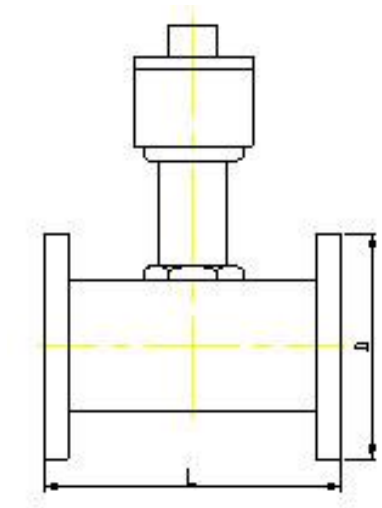
(**4**) Of the flange dimensions for nominal diameter **DN200～300**，items bearing parentheses is the flange dimension for a nominal pressure of **PN25Mpa.**

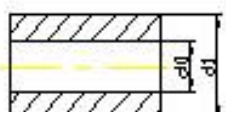
（**5**）In normal cases, flanges are manufactured as per 1**.6Mpa.**

6.3 Wafer type:

- ●Nominal Diameter **DN2~3mm**（nominal pressure **PN1.6MPa**）
- ●Nominal Diameter **DN4~25mm**（nominal pressure **PN4.0MPa**）

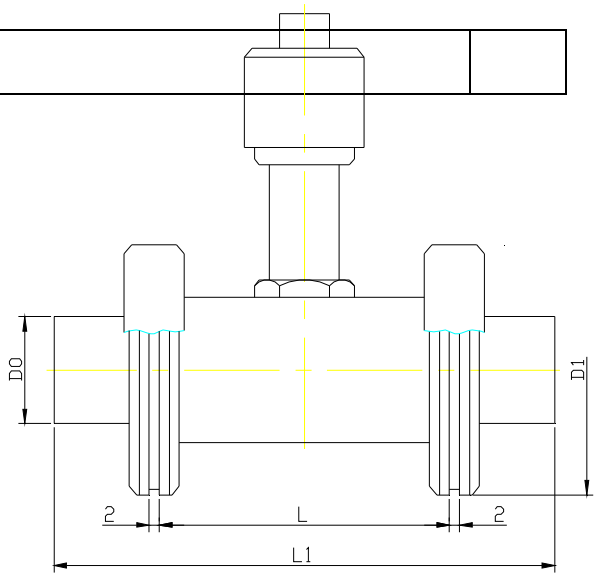
Nominal diameter(mm)		2	3	4	6	10	15	20	25	32
body	D	43					48	58	68	78
	L	40	55	40	50	60	75	75	100	120
Centering sleeve	d_0	12								21
	d_1	17.8								21.8





device			

6.4 Quick release type:



Nominal diameter(mm)	15	25	32	40	50	65	80	100
L	75	100	120	140	150	180	200	220
L_1	122	147	167	187	197	227	247	284
D_0	19.05	25.4	31.8	38.1	50.8	63.5	76.2	101.6
D_1	50.5	50.5	64	77.5	91	106	119	145
Pipe joint	outsourced		Tailor made				outsourced	Tailor made

7. Installation

1) Installation area

- The installation area should be in conformity with a temperature range of -**25**～+**55**℃，a humidity＜**80%RH**（non- condensing）
- Good ventilation, free of solarization and rain.
- A place free of vibration or stress from piping.
- Avoiding a place apt to strong heat radiation and radioactive impacts
- The disturbance of detection signal resulted from outside strong electromagnetic field must be avoided.If such disturbance can not be averted, such measures as a shield enclosure should be added on the amplifier of the flow meter (transducer) to eliminate interferences.
- At a place requires explosion proof measures, explosion suppression amplifiers shall be applied.
- The installation position should be tailored to easy installation, operation and maintenance.

2) Installation posture and position

In order to ensure a high measuring accuracy, the flow meter (transducer) shall be horizontally installed on a horizontal pipeline, and the arrow sign on the flow meter that indicates the flow direction shall be made consistent with the liquid flow direction.In case a vertical installation is a must, the liquid shall be made flow from the down to top, so that the body of the flow meter will be ensured full of liquid.

3）Piping requirements

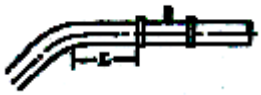
- To eliminate influences of the measuring accuracy resulting from uneven flow velocity distribution of cross section inside a pipeline, both the upperstream and the downstream of the flow meter shall be installed with definite straight lengths, or be installed with flow straighteners to substitute some straight lengths.

  Normally, the upperstream straight length shall be no smaller than **15D**, and the downstream straight length no smaller than **5D** (**D** stands for the nominal diameter of the flow meter.).In normal cases, the recommended upperstream straight length

is given below:

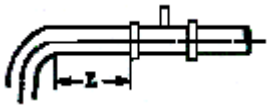
Concentric reducing pipe: **L=15D**（Figure **7-1a**）; an elbow smaller than **45°**：**L= 20D**（Figure **7-1b**）; double **45°**elbows in the same plane：**L= 25D**（Figure **7-1c**）; double space **45°**elbows：**L= 30D**；right angle elbow：**L= 40D**（Figure **7-1d**）；full-opening gate valve：**L= 20D**，half-opening gate valve：**L= 50D**（Figure **7-1e**）。

（a） L=15D

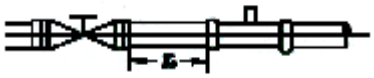


（b）L=20D

(c)L=25D



(d)L=30D



(e)L=40D

- In order to eliminate the influences of reverse flow, uneven flow velocity distribution and rotational flow, flow straighteners may be installed in the upperstream of the flow meter(please see Figure 7-2 for structure of such flow straightener.), in that case, the straight length in the upperstream of the flow meter **L=10D** will be OK. If the length is **15～20D**， the measuring accuracy may meet the calibrated accuracy.
- When the measured liquid contains solid impurities, a filter shall be installed in the upperstream of the flow meter, and the filter mesh number shall be **20~60** meshes (**3~9**mesh/ cm^2). In case of a small diameter flow meter，the mesh number will be bigger.When determining the installation position of the filter, easy removal and fitting of filter screen shall be considered.
- When the liquid is mixed with gases or when measuring a liquid prone to gasification, an air separator (eliminator) shall be installed.
- If the measured liquid is prone to gasification, in order to prevent cavitation, pressure at the outlet end of the flow meter shall be higher than the calculated value Pmin in the formula below:

Pmin = **2△P** + **1.25Pv**

In the formula: **Pmin**— Minimum pressure; **△P**— Pressure loss of flow meter

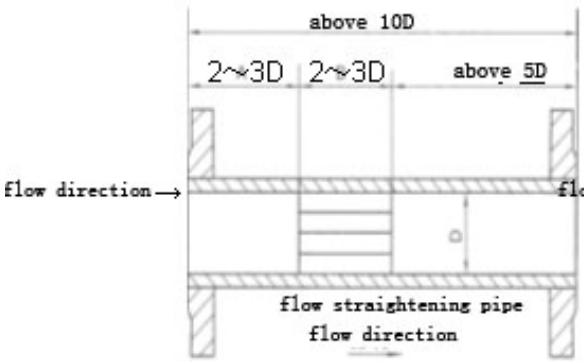
under the maximum flow；

Pv— Saturated steam pressure of the measured liquid under the maximum operating temperature

● An excessively big flow passing through the flow meter will result in an excessively short life of the bearing. Normally, the flow is regulated to a proper level with a valve, which shall be installed in the downstream of the flow meter.

●In order not to interrupt fluid transmission during an overhaul, shut-off valves will be installed in both the upperstream and downstream of the flow meter, and besides, bypass pipelines will be laid. And it shall be ensured that there is no leakage from the bypass pipelines when the bypass valves are closed during the measuring process.

The typical installation of a pipeline system for a flow meter is as shown in Figure **7-3**.



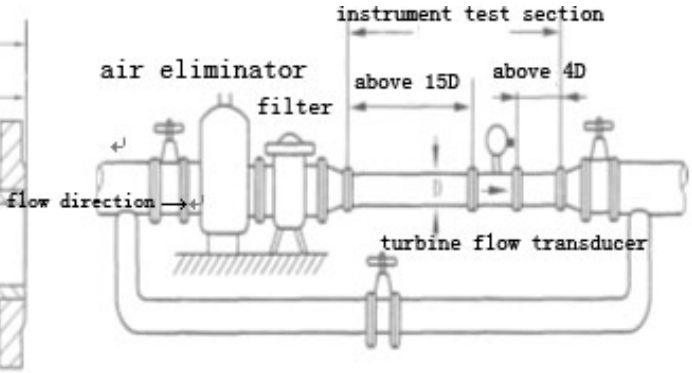


Figure 7-2 Figure 7-3

● In case of a possible reverse flow, a check valve should be added, so as to prevent reverse flow of fluids.

● The flow meter’s body should be concentric with the pipeline, and the seal ring should not protrude into the pipeline.

● In order to avoid accumulation of gases inside the flow meter, it shall not be installed at the highest point of a horizontal pipeline.

● If the flow meter is installed at a low point of the pipeline, the pipeline shall be installed with a discharge valve to discharge sediments on a regular basis.

● The front and back pipeline of the flow meter should be firmly supported, without any obvious vibration.

- When cleaning a newly laid pipeline, a short pipe should first be connected to the position where the flow meter will be installed, and after the cleaning, the flow meter will be installed.
- When measuring of fluid temperature is required, it shall be measured at the length 5 times the pipe's nominal diameter at the downstream of the flow meter.
- When measuring of fluid pressure is required, it shall be measured at the length 10 times the pipe's nominal diameter at the upperstream of the flow meter.

8. Wiring

8.1.1 For technical parameter and connection terminal diagram for Type **LWF-P-1** pulse output pre-amplifier, see Figure **8-1**.

（1）Through thread **M14*1**, Type **LWF-P-1** pre-amplifier is screwed into installation thread holes on the body of the turbine flow meter, and then is locked with locknuts.It is a kind of small-sized amplifier of low driving power, suitable for application in association with normal display instruments.

The output signals are delivered by the connector plugs through 3-wire shielded cable, with metal shielded network grounded. The connection is as per Figure 8-1.

● a. Connection terminal diagram for Aviation Connector Plugs

●b. Connection Terminal Diagram for Connecting Terminals

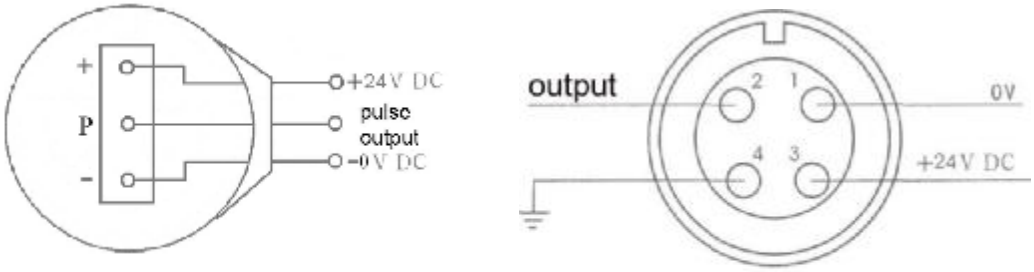


Figure 8-1 Connection Terminal Diagram of Type LWF－P Pre-Amplifier

● Power supply source: $\mathbf{V_{DD}}$ is the nominal value 12$\mathbf{V_{DC}}$

● Output signal: square wave

Low electrical level：**≤1V_{DC}**

High electrical level：Power supply voltage **V_{DD}-3V_{DC}**

Output signal frequency: (at lower limit of flow) not lower than **20Hz**

（**2**） Type **LWF-P-2** pulse output pre-amplifier is a preamplifier featuring strong load capacity and adaptability of power supply source, and it may provide reliable pulse signals to PLC.

For wiring connection, please see Figure **8-1**, in which **+12V_{DC} is modified to +24V_{DC}.**

- Power supply source: **V_{DD}** is the nominal value**24V_{DC}**
- Output signal: square wave

  Low level：**≤1V_{DC}**

  High level：Power supply voltage **V_{DD}-3V_{DC}**

Output signal frequency: (at lower limit of flow) not lower than 20Hz

（**3**）Type **LWF-P-3** pulse output preamplifier is a preamplifier designed for high temperature conditions of materials and structures of the detector parts on the basis of Type **LWF-P-2** amplifier. Under the precondition that the ambient temperature is not higher than 55℃, the medium temperature may come up to 150℃.

8.1.2 Technical parameter and connection terminals of Type **LWF-**(Ⅰ) (current output) preamplifier

（**1**）**Type LWF-**(Ⅰ)**-1** preamplifier output 4~20mA current analog signals, three-wire system. Before leaving the factory, each amplifier has been calibrated together with associated turbine flow meter. In order to ensure the accuracy, mixed use is not allowed.

- Operating power supply：**V_{DD}=+11~26V_{DC}**
- Output signal: current output I=4~20mA

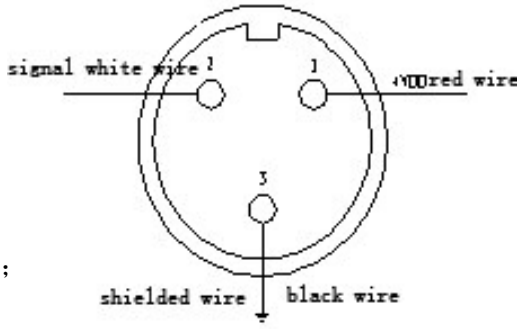
Intrinsic error :±0.5% full scale value

Load resistance：**0~RΩ（R=50(V_{DC}-11)+250)**

Operating condition: ambient temperature：**-25～+55**℃;

Relative humidity＞**85%**RH

Installation: Installed on the body of flow meter through M16X1 thread and slightly locked with locknuts.



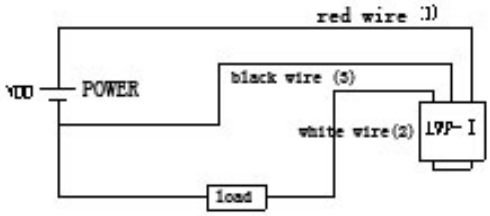


Figure 8-2 Wiring Connetions Diagram of Type LWF-I-1 Amplimer

Wiring connections: as per Figure 8-2 Wiring connections Diagram of Type LWF-I-1 Pre-amplifier Figure 8-2 Connection Diagram of Type LWF-I-1 Amplifier

Note: The thick black line is used to shield outside interference and must be earthed!

（**2**）Type **LWF-Ⅰ-2** pre-amplifier may simultaneously output current and pulse signals and can drive the PLC controller, and besides, it has explosion proof function and anti-spray function.

- Operating power supply：$\mathbf{V_{DD}}$**=+11~26**$\mathbf{V_{DC}}$
- Output signal: current output I=4~20mA

  Pulse output: Wave form: square wave

  Low electrical level: **≤1V**

  High level：power supply voltage-3V
- Ambient temperature：**-25**～**55**℃
- Relative humidity≯**85%**RH
- Installation: Installed on the body of flow meter through M16X1 thread and slightly locked with locknuts.
- Enclosure classification:IP65
- Explosion-proof classification: EXdⅡBT4

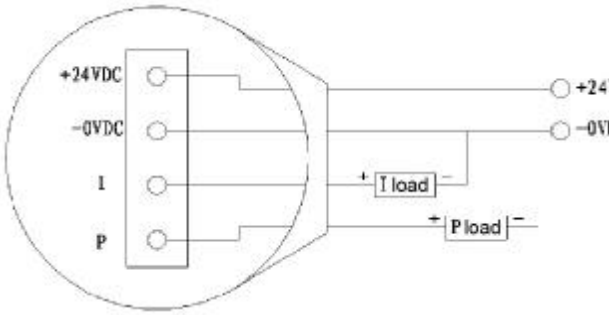


Figure 8-2 Wiring Connections Diagram of Type LWF-Ⅰ-2 Amplifier

8.2.1 KF500/TBS-Ⅰ（external power supply）in-situ converter display

(1), Display: LCD display with backlighting

Indicating length of flow rate: 5 digits of decimal number

Indicating length of quantity: 8 digits of decimal number

(2), Accuracy: quantity display error: reading±0.1% of Reading ±1 indicating unit

Flow rate display error:±0.5% of Reading ±1 indicating unit

(3), Output:● impulse output signal: square wave low electrical level：**≤1V**

High level：power supply voltage $\mathbf{V_{DD}}$**-2V**（when the load resistance is **3K**Ω.）

- Analog output:**4~20mA**$_{DC}$(or **1~5V special order of user)**

Intrinsic error limit of output current signal：±0.3%F.S

Load resistance：250Ω

Constant current performance：≤0.15%/△250Ω

Memory function: all data will be retained at time of power cut, and the retaining period is no less than 5 years.

Error correction: corrected section by section

(4), Power supply source: voltage **V_{DD}：24V_{DC}±10**%

Power consumption：≯**2.5W**

(5), Normal operating conditions:Ambient temperature：-**20**～+**55**℃

Relative humidity≮**85%**RH(non-condensing)

Process temperature：-**20~120**℃

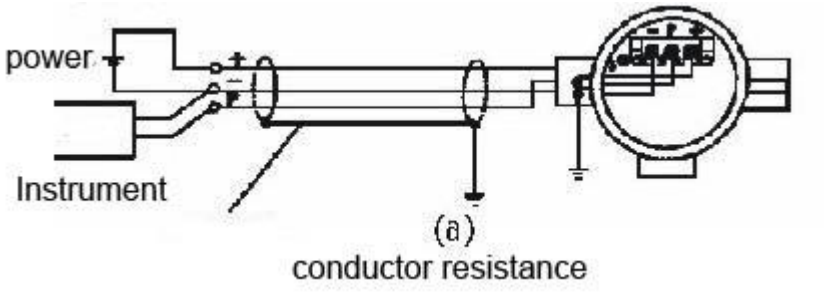
(6), Material of amplifier casing: aluminum alloy

Enclosure classification: **IP 65**

Electrical classification：**EXd**Ⅱ**BT4**

(7). Wiring Connection

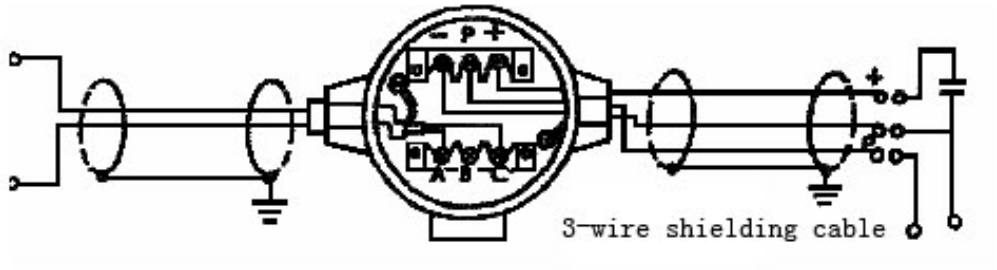
● Connection of pulse output type



(a)

conductor resistance

● Wiring connection of current output type



(**b**)

Figure **8-3 KF500/TBS-I** Wiring connection Diagram

Note: (**1**). **KF500/TBS-I** Series converter may simultaneously export a standard DC signal

and a pulse signal.

(**2**). If simultaneous application of both a flow pulse signal and a standard DC signal is required, connect the wires as per Figure **8-3(b).**

(**3**). In case that only single output flow pulse signal is required, make the lead wire at the left end of Figure **8-3(b)** not connected.

(**4**). In case that only single output flow standard DC signal is required, make the lead wire **P** at the right end of Figure **8-3(b)** not connected.

8.2.2 Type KF500/TBS-Ⅱ（Power supply by lithium Battery） in-situ converter display

(1), Power source：3.6V Lithium battery（replacing the battery for 1~3 years）

(2). Display:LCD display

Indicating length of flow rate: 5 digit of decimal number

Indicating length of quantity: 8 digit of decimal number

(3), Accuracy: quantity display error: reading±0.1% of reading ±1 indicating unit

Flow rate display error: reading±0.5% of reading ±1 indicating unit

(4) Operating condition: ambient temperature：-20～+55℃；

Relative humidity：**5~85%**RH(non-condensing)

Process temperature range：-**20~120**℃

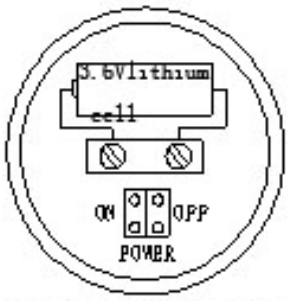


figure8.4 switch on the power

(5), Material of casing: aluminum alloy

(6), Output function: no output

Memory function: all data are preserved at time of power cut

(7), Error correction: 5 points (4 sections), corrected section by section

(8), Enclosure classification: IP 65

(9), Electrical classification: Explosion-proof classification **EXiBI.**

(10), Power supply by battery: open the back cover, and draw the power source wire jump out from the “OFF" position and plug it in the “ON” position, then the instrument may be operated.

8.2.3 Installation and Operation

1. Installation of type **KF500/TBS-Ⅰ and type KF500/TBS-Ⅱ in-situ converter displays**

Type LWGY/TBS-Ⅰ and type LWGY/TBS-Ⅱ in-situ converter displays are installed

on the body of the turbine flow meter through M14X1 thread, which shall be screwed up to the extreme as possible, and then be slightly locked with locknuts.If indicating direction is to be changed, simply loosen the set screws for the purpose of fixing the thread seat, then turn the instrument head towards intended direction and screw up the set screws again.Note: the turning angle shall be no bigger than 360°.

2 As for operation of Type **KF500/TBS-Ⅰ and type KF500/TBS-Ⅱ in-situ converter displays, please see appendix 1 Operating Instruction of Type KF500/□□□ Displays for details.**

8.3 Selection of connection cables

（1） For connection between Type LWF-P(Ⅰ) preamplifier, Type LWF-11A（C）explosion-suppression type preamplifier and the display instruments, three-wire stranded copper wires with external braid shield and covered with plastic or oil-resistant rubber will be applied, and the effective cross-section area is within the range 1.25～2mm^2; for output of type KF500/TBT-Ⅰ converter display, in a place apt to interference of electrical noises, shield cable shall be applied.

（2） In atmospheres where oils or solvents,corrosive gases or liquids use suitable wires or cable.

8.4 Caution matters for wiring

（1） Make every effort to use a complete piece of cable line

（2） The wiring position shall be as far as possible away from electrical noise sources (such as big power transformers, motors and strong power lines) and shall avoid wiring in parallel with power supply lines.

（3） It is recommended that at the end of a thick leadwire, non soldering clamping type that crimp-on type solderless lugs will be applied .

（4） To prevent water and mechanical damages, it is best to put cable wires into metal guide tubes, but in the same guide tube, cables for high power transmission purpose are not allowed, (when the maximum power delivered by one transmission cable is bigger than 10 times the minimum power transmitted by the flow meter signal cable, the two cables can not be installed in the same guide tube.)

（5） For areas with very strong outside magnetic field, the axial line of the detection

device shall be made perpendicular to the magnetic flux direction of the outside magnetic field, or material of high magnetic conductivity will be applied to shied the flow meter or the outside magnetic sources.

（6） For connection of explosion proof type turbine flow meter cables, the standards for explosion proof amplifier concerned shall be abided by strictly.

8.5 Grounding

（1） The shielded wire can only be grounded at one end, and it is preferred that the end of display instrument is to be grounded.

（2） To ground with 600V polyvinyl chloride insulated wire.

（3） The grounding shall be good and reliable, and grounding of explosion proof instrument grounding needs to be smaller than 10Ω.

8.6 Type **XJS** digital flow integrating instrument

It may be applied in association with many kinds of flow meters exporting electrical pulse signals.

8.6.1 Type **XJS-201** digital flow integrating instrument

1. Function: a. Indicating flow rate and quantity

b. Capable of achieving upper limit and lower limit alarm with hysteresis

c. Exporting 4~20mA standard signals（Type XJS-201(Ⅰ)）

d. Preserving data at power cut and the retaining time will be no less than 5 years.

2. Display：LED display, may indicate flow rate and quantity in the same screen simultaneously. Optional indicating units of the flow rate are m^3/h or m^3/min, and L/h or L/min, and LED indicates the currently selected units.

Indicating length: a. Quantity: 11 digits of decimal number

b. Flow rate: 5 digits of decimal number when the unit is m^3/h, L/h.4 digits of decimal number when the unit is m^3/min and L/min.

c. Setting range of transducer pulse equivalent: 4 digits of decimal number

3. Input signal: input impedance of this instrument ≥3KΩ

Frequency range：**20～5000H$_Z$**

Amplitude value requirement:≥3V$_{PP}$（20~5000H$_Z$) or ≥10V$_{PP}$（2~20H$_Z$)

Wave form: sine wave or basically symmetrical square wave

4. Accuracy: a. Intrinsic error limit of quantity±1 indicating unit

b. Flow rate display error limit:±0.2% of theoretical value ±1 indicating unit

c. Intrinsic error limit of alarm:±0.2%±1 indicating unit

d. Intrinsic error limit of current output：±0.1%FS

e. Continuous current ≤0.1%/△250Ω

5. Output signal：

a. Upper and lower limit alarm, two independent open contacts, whose max capacity is 25V×0.5A（non inductive load）

b. Current signal （ XSJ-201(Ⅰ)）： **4~20**mA standard current signal, load resistance≯300Ω

6. Normal operating condition: ambient temperature：-10～+45℃；

Relative humidity≯**85%**RH

7. Electric supply: source voltage and frequency：**187~242**V，**47.5~52.5**H$_Z$

Electric consumption：10VA

8. Wiring Connection

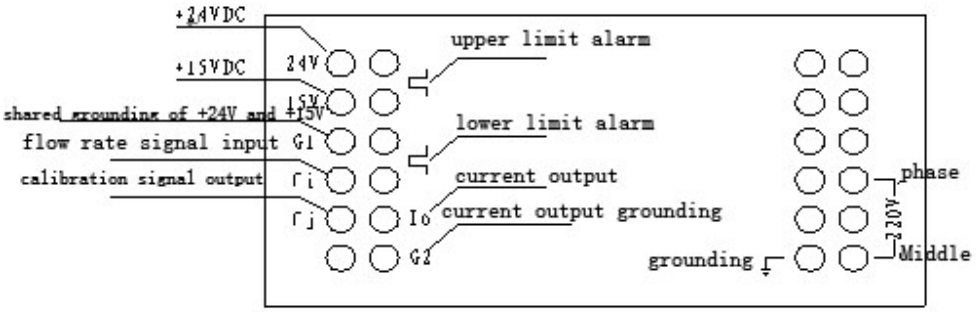


Figure 8.5 Schematic Connection Diagram of Type XSJ-201(I) Back Panel

Note: Type XSJ-201 has no I_0 and G_2 terminals.

9. Regulating and Operating

Please see relevant sections in Appendix 1 Operating Instruction for In-situ Display

Instrument & Secondary Instruments of Flow Meter for details.

8.6.2 Type **XJS-202** digital flow integrating instrument

1, Function: a. Indicating flow rate and quantity

b. Preserving data at power cut and the retaining time will be no less than 5 years.

2. Display: Display in 4 frames with 8 pieces of LED nixie lights

a. Quantity: 12 digits of decimal number, 6 digits of identifiers “H” for the higher part, and 6 digits of identifier “L” for the lower part

b. Flow rate: Identifier “F”, 6 digits of decimal number

c. Setting range of transducer pulse equivalent: 4 digits of decimal number

3. Input signal: input impedance of this instrument ≥3KΩ

Frequency range：20～5000H_Z

Amplitude value requirement:≥3V_{PP} （ 20~5000H_Z) or ≥10V_{PP} （2~20H_Z)

Wave form: sine wave or basically symmetrical square wave

4. Accuracy: Intrinsic error of quantity ±1 indicating unit

Intrinsic error of flow rate: better than ±0.5% of theoretical value (±1 indicating unit)

Intrinsic error limit of alarm:±0.2%±1 indicating unit

5. Normal operating condition: ambient temperature：**-10～+45**℃；

Relative humidity≯**85%**RH

6. Electric supply: source voltage and frequency：**220±10%V，50±5%H_Z**

Electric consumption：**≤10VA**

7. Wiring Connection

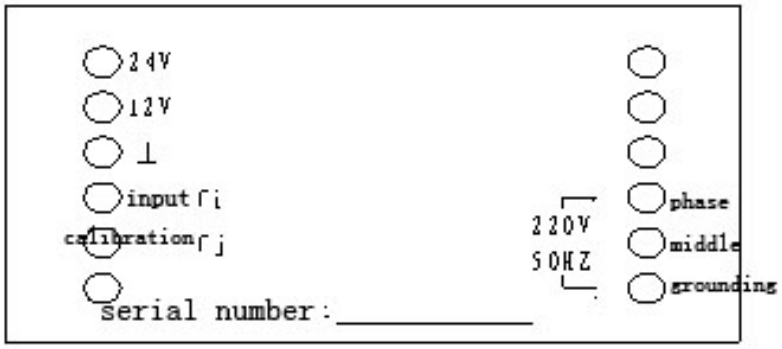


Figure 8.6 Schematic Connection Diagram of Type XSJ-202 Back Panel

8. Regulating and Operating

Please see relevant sections in Appendix 1 Operating Instruction for In-situ Display Instrument & Secondary Instruments of Flow Meter for details.

8.6.3 Type **XJS-203** digital flow integrating instrument

1. Function: a. Indicating flow rate and quantity

b. Preserving data at power cut and the retaining time will be no less than 5 years.

2. Display: Display in 4 frames with 8 pieces of nixie lights

a. Quantity: 8 digits of decimal number

b. Flow rate: Identifier “F-”, 6 digits of decimal number

c. Before leaving the works, pulse equivalent of the transducers have been set, so the user is not required to set the automatic indicating (the user may conduct fine tuning of the pulse equivalent.).

3, Input signal: input impedance of this instrument ≥3KΩ

Frequency range：20～5000H_Z

Amplitude value requirement：≥3V_{PP}～20V_{PP}

Wave form: sine wave or basically symmetrical square wave

4. Accuracy: Intrinsic error of quantity±1 indicating unit

Intrinsic error of flow rate: better than ±0.5% of theoretical value (±1 indicating unit)

Intrinsic error limit of alarm:±0.2%±1 indicating unit

5. Characteristic: capable of achieving a maximum of 5 sections of automatic compensation of flow coefficient (namely indicating section by section to improve the accuracy.)

6. Normal operating condition: ambient temperature：**-10～+45**℃；

Relative humidity≯**85%**RH

7. Electric supply: source voltage and frequency：**220±10%V，50±5%H_Z**

Electric consumption：**≤10VA**

8. Connection

Please see Figure 8.6 Wiring Connections Diagram of Type XSJ-202 Back Panel, and it is the same case for type XSJ-203.

9. Regulating and Operating

Please see relevant sections in Appendix 1 Operating Instruction for In-situ Display Instrument & Secondary Instruments of Flow Meter for details.

9. Inspection of Flow meter Before Operation

（1） Make sure that the pipeline is cleaned. If it needs to be cleaned again, the rinsing solution should flow through the bypass pipeline.

（2） Make sure that all auxiliary devices have been distributed and installed correctly.

（3） Make sure the connection of electric circuits is correct.

（4） Make sure there is no leakage of pipeline, and the control valve in the downstream of the flow meter can be regulated flexibly, without leakage at time of closing.

（5） Slowly open the control valve in the downstream of the flow meter, confirm the flow sensor is providing normal indication.

（6） Make sure the pipeline is supported reliably and produces no vibration under the maximum flow rate.

（7） Make sure the pressure in the downstream of the flow meter is bigger that $\mathbf{P_{min}}$.

（8） Make sure there is no leakage of bypass valve.

10. Operation and Maintenance of Flow Sensor

（1） The flow meter shall be operated as per the flow range and nominal pressure specified in the certificate of quality as well as the flow direction marked on the transducer.

（2） The process temperature and ambient conditions of the measured liquids shall be in conformity with the requirements of this instruction manual.

（3） It will supply power to the flow integrating instrument. And in the case that the valve in its downstream is closed, the flow indicated in the flow integrating instrument shall

be zero.

（4） When putting the flow meter into operation, the operator shall first open all bypass valves, then slowly open the valve in the downstream of the flow meter, and then slowly open the valve in its upperstream till full opening, and finally slowly close the bypass valves.In case of no bypass valve, the operator may slowly open the valve in the upperstream of the transducer, and then slowly open the valve in its downstream.Please take care not to let the impeller reach to a very high speed suddenly.

（5） When measuring liquefied gas and gasoline, the pressure close to the flow meter shall be maintained higher than the saturation liquid vapour pressure by **0.1MPa**, so as to prevent the impeller speed from growing too high as a result of volume increase at time of liquid gasification, which may result in excessive wearing of the bearing in a short period.

（6） The instrument constant of the flow meter is obtained by means of calibration with water under normal temperature prior to delivery.. When operating it, in the case of an accuracy not higher than **0.5 grade,** and the measured liquid viscosity lower than **$5*10^{-6}m^2/S$**(**$\mu m^2/s$** = **cst**), the instrument will not need to be recalibrated.When the viscosity of the measured liquid is very high, it is recommended that the actual measured liquid or a substitute liquid of equivalent viscosity would be applied to conduct a calibration, so as to calculate the instrument constant or to use corrective curve to correct it.

（7） When an accurate measuring is required, the user may have following error correction.

- Correction of transducer linearity error:

$$Q_i = Q_{oi}\ (1-ei) \quad \text{（10-1）}$$

In the formula：Q_i—the corrected fluid flow；

Q_{oi}—the flow indicated on the flow indicatorlay

ei—Instrument relatively error at the flow point

- When there is gap between the process temperature and the calibrated temperature, for changes of flow area resulted from temperature, the below formula may be used to correct the instrument constant.

$$K_T = K_0[1-(\lambda_1+2\lambda_2)(t-t_0)]\quad\text{……(10-2)}$$

In the formula：K_T—the instrument constant under process temperature；

K_0—the instrument constant under calibrated temperature；

t —the liquid temperature in process condition；

t_0—the liquid temperature in calibration；

λ_1— the coefficient of expansion from temperature change of impeller material；

λ2— the coefficient of expansion from temperature change of body material；

- For size change of the flow meter resulted from a pressure change, the below formula may be used to correct the instrument constant.

$$K_P = K_0(1-Y\triangle P)\quad\text{……(10-3)}$$

$$Y=\frac{(2-u)\cdot(2R)}{E(1-S/\pi R^2)\cdot(2\delta)}$$

In the formula：**Kp**—the instrument constant under process pressure；

K_0—the instrument constant under calibrated pressure；

△**P**—the difference between process pressure and that under calibrated pressure（**Pα**）

u—Poisson's coefficient

R—Inner radius of the body（mm）

δ—Wall thickness of the body（mm）

S—Cross-section area of impeller（mm^2）

E—stretching elasticity modulus of body material（**Pα**）

- When measuring a liquid of high viscosity, if the flow range is of small fluctuation, error correction may be achieved by a simple method to modify K-factor.At this time, the K-factor may be adjusted to Kμ：

$$K_\mu = K_0 \times Q_0 / Q\quad\text{……(10-5)}$$

In the formula：K_0—K-factor for at factory calibration or for the previous adjustment；

Q_0—flow indicated by the instrument；

Q—actual flow

Set $\mathbf{K_\mu}$into the flow meter of the flow integrating instrument, such operation may be repeated for many times, until the setting is satisfactory.

（8） In normal operating conditions, a transducer will have a repair and a calibration for every half to one year. The period for such repair and calibration will be determined based on what extreme operating conditions of the instrument are. In case of heavy wearing of the shaft and bearing, they shall be replaced in time, and the transducer shall be calibrated again.

（9） At time of repair, screw down the pressing rings at the transducer's both ends, and take the guide holder and the impeller out from the body successively.

- Check whether there is any adhering foreign matter and wearing of all parts.When removing the foreign matter, take care not to damage the parts.After replacing any part, the instrument shall be recalibrated.
- Magnetization of impeller blades may cause influences on modulation of signal voltage, thus to cause errors.Therefore, do not allow strong magnets to be close to the impeller.
- After the repair, install the front and back guide holders and impeller as per the original positions and direction, and then screw up the pressing rings.After that, confirm whether the impeller is turning flexibly, whether the clearance between the impeller top and the inner wall of the body is even, and whether there is signal output from the amplifier.

(10) As the detection coil impedance will be changed after long time of service, the on-impedance and the insulated impedance of the coil (bigger than 2M) shall be compared with the normal values.

(11) After recalibration, in the case that the instrument constant of the transducer K is changed, do not forget to modify the setting values of the display instrument.

(12) During shutdown for hose sweeping, steam is forbidden to flow through the transducer.

11. Faults and Trouble-Shoot Methods

For faults and trouble-shoot methods, please see Table 6 below:

Faults	Possible causes	Trouble-shoot methods
The liquid flows regularly, but the equipment fails to provide indication and increase of quantity	1) Broken supply circuit or signal circuit or bad contact	1)Use a universal instrument to check the circuits and remove the breakdown point.
	2) Failures or bad contacts of PCB and connectors	2) replacing PCB
	3) Breakdown of pre-amplifier	3) Use a iron bar to move quickly under the detecting head, in the case of no signal output, check whether there is line cut and sealing-off at the soldered dot in the coil.
	4) Voltage supplied for the pre-amplifier is too low	4) Rise source voltage up to the required level.
	5) The impeller is clamped down and cannot move.	5) Remove the foreign matter and clean or replace the damaged parts, and after replacing the parts, the transducer should be recalibrated.
Flow indication is lowering gradually.	1) The filter is blocked up and the pressure loss is growing bigger to reduce flow.	1) Remove foreign matters in the filter.
	2) The valve plug on the pipeline is loosening, and the valve opening is reduced.	2) Repair or replace the valve.
	3) The impeller is blocked up by impurity or foreign matters enter the clearance between bearings, which bring about bigger resistance, thus reducing the speed.	3) Clean the flow meter, if necessary, recalibrate it.

When the fluid is not flowing, but the indication is not zero, and the indication value is not stable.	1) Bad shielding and grounding of the transmission line, interference of outside electromagnetic field.	1) Check the grounding and eliminate the interference.
	2) Pipeline vibration causes shake of impeller.	2) Fasten the pipeline or add supports in front and back of the flow meter.
	3) Leakage of globe valve	3) Repair or replace the valve.
	4) Circuit or electronic components in the display instrument are damaged and bring about interference.	4) Take “short-circuit” method or check them one by one to find out the breakdown point.
The indicated flow is not in conformity with the actual flow.	1) The impeller has been corroded and the blades are deforming.	1) Repair the impeller or replace it and then recalibrate the transducer.
	2) Impurities have stopped the impeller from turning.	2) Remove such impurities.
	3) The output signal of detecting coil is not normal.	3) Check the insulation resistance and on resistance of the coil.
	4) Fluid temperature is too high or too low, which results in too big change of clearance between bearing and shaft. 5) Inadequate back pressure to result in cavitation. 6) Fluid viscosity is becoming bigger as a result of temperature influence. 7) Reverse flow as a result of failure to install a clack valve.	Take tailor-made measures to remove the fault.
	8) Leakage of the bypass valve	8) Close the bypass valve, if necessary, replace it.
	9) Distortion of flow velocity distribution in the upperstream of the transducer or a pulsating flow.	9) Try to find out the cause of such distortion or pulsating flow and take appropriate measures to eliminate such influence.
	10) Display instrument fault	10) Repair the display instrument
	11) Incorrect connection of display instrument	11) Try to correct the connection
	12) Wrong setting of display instrument	12) Try to correct the setting
	13) The actual flow surpass the specified flow range.	13) Replace the flow meter with one of proper diameter.

The user must contact us in case of failure of transducer during operation. In that case, please make detailed description of the instrument fault, operating conditions, measured fluid characters, model and serial number and other details of the faulted instrument.When it

is necessary, please attach the schematic diagram of the installed pipeline as well as major technical parameter, for purpose of our better service for you.

12. Guide for order

1) At ordering, details listed below should be made definite.

- Make sure the model of the flow meter, and confirm what that model stands for is in compliance with your requirements for the nominal diameter, structural pattern, nominal pressure, flow rate, accuracy class, temperature range, explosion proof requirements, anticorrosive performance etc.
- Accessories need to be provided by our company, such as cables, pipe flanges, bolts etc.
- In order to help you with better sizing, if possible, please provide fluid name and physical and chemical character (such as viscosity, density, corrosiveness etc.), pressure, temperature and normal flow rate, maximum flow rate and minimum flow rate.

2) Briefing of associated display instruments that our company may offer.

See Table 7.

Type of secondary meters	Major functions
XSJ-201（I）	Simultaneously indicating the quantity and the flow rate, providing 4~20mA current analog signals or 1~5V DC standardized Voltage output signals.Providing output at contacts of both relays, so as to achieve upper and lower limit alarm or definite batch control.The upper and lower limit flow values and hysteresis value may be set through Key Setting on the panel.

XSJ-201	With all other functions of type SXJ-201(I) else than output in the range of 4~20mA DC output.
XSJ-202	Indicating quantity and flow rate by engineering unit, the quantity is indicated in 12 digits and the flow rate is 5 digits.
XSJ-203	Indicating quantity and flow rate by engineering unit, the quantity is indicated in 8 digits and the flow rate is indicated in 6 digits. And the instrument accuracy may be correction automatically using line-segment up to 5 sections.
SKJ-201	Providing batch canned control. During canning, it measures the volume and mass flow rate of a liquid, and indicates flow rate and guantity.The two relays export two groups of on-off signals, the contact rating is $28V_{DC}$，1A DC (non inductive load)

13. Packing list

3） Turbine flow meter（transducer） 1 set

4） Instructions manual 1 No.

5）Acceptance certificate 1 copy

6）Accessory indicated in the packing list

Influence on Stainless Steel from Corrosive fluids (Appendix:)

Medium/Material	Stainless steel 302 or 304	Stainless steel 316	Ti	Stainless steel 404C	Stainless steel
Acetaldehyde	S	S	-	S	S
acetic acid	F	F	S	X	F
acetone	S	S	S	S	S
acetylene	S	S	-	S	S
ethanol	S	S	S	S	S
aluminum sulphate	S	S	S	X	-
ammonia	S	S	S	S	-
ammonium chloride	F	F	S	X	-
ammonium nitrate	S	S	S	F	-
ammonium phosphate	S	S	S	F	-
ammonium sulphate	X	S	S	X	-

ammonium sulfite	S	S	S	F	-
aniline	S	S	S	P	-
glucose	S	S	S	S	S
hydrogen	S	S	S	S	S
hydogen peroxide	S	S	S	F	-
hydrogen sulphide (solution)	S	S	S	X	-
magnesium hydroxide	S	S	S	S	-
mercury	S	S	S	S	F
methanol	S	S	S	F	S
Milk	S	S	S	X	X
Natural gas	S	S	S	S	S
oleic acid	S	S	S	F	-
oxalic acid	F	F	F	F	-
oxygen	S	S	S	S	S
petroleum	S	S	S	S	S
phosphoric acid	S	S	F	X	-
asphalt	S	S	-	S	S
Beer	S	S	S	F	S
benzene	S	S	S	S	S
benzoic acid	S	S	S	S	S
boric acids	S	S	S	F	-
H_2so_4	S	F		X	F
Butane	S	S	-	S	S
calcium hypochlorite	F	F	S	X	-
carbolic acid	S	S	S	-	-
Medium/material	Stainless steel 302 or	Stainless steel 316	Ti	Stainless steel 404C	Stainless steel
carbon dioxide	S	S	S	S	S
carbon bisulfide	S	S	S	F	-
carbon tetrachloride	F	F	S	S	-
carbonic acid	F	F	-	S	S
chlorine gas(dry)	F	F	X	X	X
Citric acid	F	S	S	F	F
coke oven gas	S	S	S	S	S
copper sulphate	F	F	S	S	S
cotton seed oil	S	S	S	S	S
creosote oil	S	S	-	S	S
ethane	S	S	S	S	S

ether	S	S	S	S	S
ethyl chloride	S	S	S	F	-
ethene	S	S	S	S	S
glycol	S	S	-	S	S
formaldehyde	S	S	S	S	S
formic acid	F	F	X	X	F
freon	F	S	S	-	-
Urons	S	S	S	F	-
gasoline	S	S	S	S	S
picric acid	S	S	-	F	-
potassium chloride	S	S	S	X	-
potassium hydroxide	S	S	S	F	-
propane	S	S	S	S	S
rosin	S	S	-	S	S
silver nitrate	S	S	S	F	-
sodium acetate	F	S	S	S	S
sodium carbonate	S	S	S	F	S
sodium chloride	F	F	S	F	F
sodium chromate	S	S	S	S	S
sodium hydroxide	S	S	S	F	S
sodium hyposulfite	S	S	S	F	-
stearic acid	S	S	S	F	-
Sulfur	S	S	S	S	S
sulfur dioxide(dry)	S	S	S	F	-
sulphur trioxide(dry)	S	S	S	F	-
Medium/material	Stainless steel 302 or	Stainless steel 316	Ti	Stainless steel 404C	Stainless steel
sulfurous acid	F	F	S	X	-
tar	S	S	S	S	S
trichloroethylene	F	S	S	F	-
turpentine]	S	S	S	S	S
vinegar	S	S	-	X	S
Boiler feed water	S	S	S	S	S
Distilled water	S	S	S	F	-
Sea water	F	F	S	X	S
Wine	S	S	S	X	-
Zinc sulfate	S	S	S	F	-
Nitric acid	S	F	S	X	F
Alcium chloride	X	F	S	X	-

hydrofluoric acid	X	F	X	X	X
chromic acid	X	F	S	X	X
phosphoric acid steam	F	F	F	X	-
stannous chloride	X	S	S	X	-

Note: S stands for “may be used successfully”
F stands for “ usable, but neet to take care”
X stands for “ can not be chosen”