INSTALLATION & OPERATION MANUAL



ITEM : Turbine Flowmeter(Battery Type)

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1. Specification

1.1 General

◈ **Display**

- 5-digit 7-segment LCD for rate display (digit dimension : 10mm * 4.5mm)
- 8-digit 7-segment LCD for total display (digit dimension : 6mm * 3mm)
- Rate descriptors : /SEC, /MIN, /HR, /DAY
- Tantalizer descriptors : m3, lit, gal, ft3

◈ **Display Update Rate**

: Seconds

◈ **Decimal Point**

: Fully programmable for Rate and Total

◈ **Time Base**

: The Rate can be displayed in unit per sec, per min or per hour or per day

◈ **Data Retention**

: Set up parameters and totals stored in EEPROM with 10 years retention.

◈ **Temperature**

- Storage Temperature : -20℃ to 65℃
- Operating Temperature : -10℃ to 55℃

◈ **Power**

- Battery Powered Operation
- Supplied with 1 D size 3.6V lithium battery

1.2 Flow Inputs

◈ **Frequency (pulse) Input**

- Frequency Range : 0 to 5kHz
- Signal Type : Sine wave, open collector
  Reed switch, proximity
  switch Voltage and current
  pulse

◈ **K- factor Range**

- (Selectable K-factor Decimal Point)
  – 99999.999 (the pulse per unit)
  – 999999.99 (the pulse per unit)
  – 9999999.9 (the pulse per unit) – 99999999 (the pulse per unit)

1.3 Pulse Output (Option)

◈ **Function**

- Open collector output with a pulse produced on each increment of the accumulated total.
- Selectable Pulse output ON/OFF (for Battery power saving)

◈ **Pulse Width**

: 20ms, 100ms

◈ **Duty Cycle**

- 24 pulses / sec. Max. (20ms)
- 5 pulses / sec. Max. (100ms)

◈ **Output**

- Current sinking output transistor 20mA, 30 VDC max. (Pulse output is suitable for driving remote counter or PLC's)

1.4 Analog (4-20mA) Output(Option)

◈ **Function**

: The Rate is Output.

◈ **Output Type**

: DC12V-DC24V Ext Powered 4-20mA Output.

◈ **Isolation**

: Non-Isolated.

◈ **Resolution/Accuracy**

: 12-bit / 0.05% of SPAN

◈ **Maximum Load**

: 500 Ohm @ DC12V, 950 Ohm @ DC24V.

1.5 Enclosure

◈ **Dimension**

: 75mm(H) × 55mm(W) × 109.5mm(D)

◈ **Material**

: Aluminum

◈ **Certification(Option)**

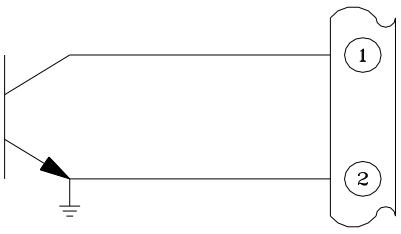
: Ex d IIB T6 (2004-1115-Q1)

2. Connection

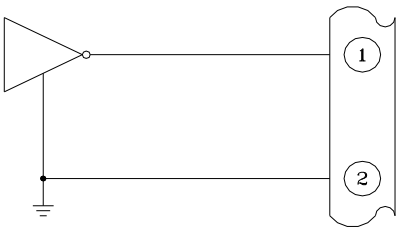
2.1 Input Connection

Input Signal Type	Terminal		Dip Switch Setting							
	+	-	1	2	3	4	5	6	7	8
1.Open Collecto	1	2	off	off	off	off	on	off	off	on
2.Voltage Pulse	1	2	off	off	off	off	off	off	off	on
3.Reed Switch	1	2	off	off	off	on	on	off	off	on
4.Coil (20mVp-p min)	1	2	off	off	off	off	off	on	off	off
5.Coil (low mpedance)	1	2	off	on	off	off	off	on	off	off

(1) Open Collector Pulse



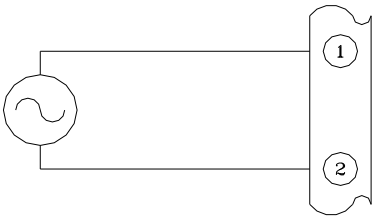
(2) Square Wave, CMOS or Logic



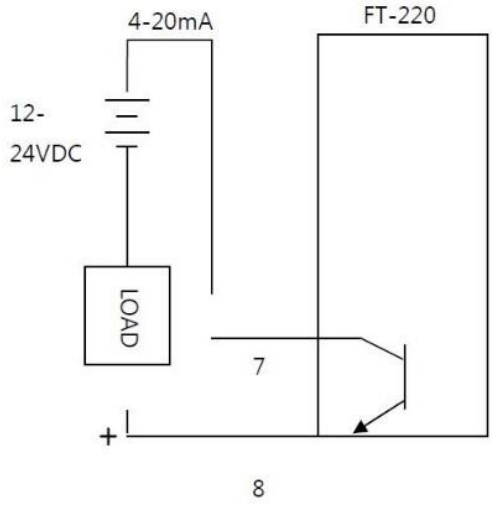
(3) Reed Switch



(4) Coils



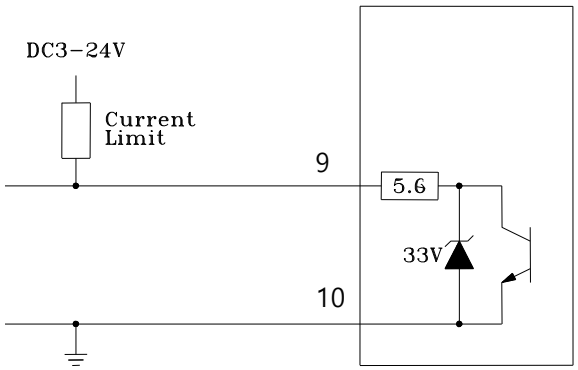
2.2 4-20mA Analog Output Connection(Option)



2.3 Pulse Output Connection(Option)

It consist of Open-Collector, therefore if you connect the polarity incorrectly, it does not operate. You can select the Pulse output width such as 20ms, 100ms, Pulse OFF and if the pulse output width is 20ms, the pulse output is Max 24 pulse per second.

When use the Open Collector



<Output circuit>

3. Operation

3.1. Display Mode

1) When press MODE button for 1 sec, the flow rate and flow rate and flow total display will be converted as Acc Toital display and this function is rotated for each pushing.

2) In PROGRAM MODE, UP(set) key is used for increasing number to each place to set to value, or selecting for each item. If press the “UP(set)” key, displayed each items and is able to move in all items by each pressing of UP key. And also, in NORMAL condition, when press the UP(set) key for 3 sec, enter to the SETTING MODE.

3) In PROGRAM MODE, SHIFT(SAVE) key is used for that when setting the value, for moving to desired place. If press this key for 4sec, the present
Gross Total and total will be saved in memory at the NORMAL condition. This function is able to use when the battery is consum became the “Low Battery” conditon, push the SHIFT(SAVE) key for 4sec, save the value, and replace the battery finally, The replacement time is showed on screen as “Lo Batt”

4) When set program, pressing if need to pass to the next itme, use the ENT key and long pressing of ENT key is make clear for present flow total..

5) When enter the PROGRAM mode to press “SET key long, the model name and version is displayed on screen, if press the ENTER key only one time, it is progressed as below.

3.2. Setting Parameters

In the Parameter input a figure, use a “Shift” Key, “Up” Key and in the parameter select, use a “Up” Key. In each parameter, push the “Enter” Key and so display the next parameter, after end of programming.

Display	Description	Value
Fac-P	Select the suitable decimal point before input the K-factor and it is applied to K-factor setting that is next item. If press “UP” key, the decimal point is moved and put the desired place.	0 0.0 0.00 0.000
FAc	Case of Frequency Output Type Flow Meter, Input the K-Factor (the Pulse per Unit). Unit is selected unit at Flow Unit.	0000 000.0 00.00 0.000
Unit	Input the unit for necessary to Resettable Total and Accumulated Total.	m3/Liter/gallon / ft3/none
t-dp	Input the decimal point of the Total and Acc-Total.	0 0.0 0.00 0.000
r-dp	Input the decimal point of the Rate	0 0.0 0.00 0.000
Time-E	Set time base.	/sec /min /hour /day
Po-h	Select Pulse Width of output Pulse	20m s
Po-d	Select scal by q’ty of pulse output. This is notion of “Divide”, for example if select the “d1”, each time the flow total validity figure “1”increasing “1” pulse is able to output, and if select the “d10”, each time the lfow total “10” increasingm “1” pulse a unit lulse is able to output. When set as “off”, pulse output dose not use. If you do not need the pulse output, must set as “OFF” to reduce of	Off D1 D10 D10 0
AO-E	Select the “Enable” of Analog Output. If select the “Yes”, output is “Enable” and if select the “No”, output(4-20mA) is “unable”. If you do not need the 4-20mA output, must set as “NO” to reduce of	Ye s No

Acc-r	Reset Acc Total	
caL-4	Progress the calibration regarding 4mA. If you press “Up key”, the value of analog increase, if you press “Shift Key”, the value of analog decrease.	
caL-20	Progress the calibration regarding 20mA. If you press “Up key”, the value of analog increase, if you press “Shift Key”, the value of analog decrease.	
AnL 4	Set the flowrate of 4mA. (Generally “0”). The decimal point is same with the instantaneous flowrate.	0 ~ 99999
AnL 20	Set the flowrate of 20mA. (Generally “Max flowrate”) The decimal point is same with the instantaneous	0 ~ 99999
End	End of program setting	

4. Wiring Designations

Terminal	Frequency Flowmeter
Main 1	Sensor Signal (+)
Main 2	Sensor Signal (-)
Terminal 7	Analog Output (+)
Terminal 8	Analog Output (-)
Terminal 9	Pulse Output (+)
Terminal 10	Pulse Output (-)

5. Other Precautions and Warranty Period

1) Do not attempt to disassemble or reassemble the instrument.

2) If you do not observe any of the above precautions, the product may fail. Make sure to observe every and each precaution.

3) The warranty period of this product is as follows, unless otherwise specified.

⚠ **Warranty period**: We will provide free repair or replace the product for a failure whose cause is clearly our manufacturing defect up to 12 months after delivery.

⚠ **Scope of warranty:** The following cases are excluded from our warranty.

① Failure by force majeure such as acts of God.

② Failure caused by wrong handling of the product.

③ Failure caused by improper environmental conditions.

④ In case the user disassemble or modify the product.

⑤ In case the product was used beyond the stipulated specifications.

⑥ In case our company determines that the failure is not our responsibility.

Thank you very much for using our product.

INSTALLATION MANUAL

SAFETY PRECAUTIONS (CAUTION)

- Turn off mains power before conducting wiring work.
- Wiring while power is applied can cause electric shock.
- Turn off mains power before working on pipes.
- Working on pipes while power is applied can cause electric shock.
- Do not conduct wiring work with bare hands.
- Remaining electric charge even if power is turned off can still cause electric shock.
- Do not work on piping and wiring with wet hands.
- Wet hand may result in electric shock.
- Do not conduct wiring work with wet hands.
- Wet hands may result in electric shock.
- Use an appropriate device to carry and install the turbine flowmeter.
- If this product falls to the ground, injury, or malfunction of or damage to the product, can be caused.
- Do not modify or disassemble the turbine flowmeter unnecessarily.
- Modifying or disassembling this product can cause electric shock, malfunction of or damage to this products.
- Do not conduct wiring work when power is applied.
- Wiring while power is applied can cause electric shock.

HANDLING PRECAUTIONS

- Do not store or install the flowmeter in :
- Places where there is direct sunlight. If this is unavoidable, use an appropriate sunshade.
- Places where there is snow and ice.
- Place where excessive vibration or mechanical shock occurs.
- Places where high temperature or high humidity conditions obtain.
- Places where corrosive atmospheres obtain.
- Places submerged under water.
- Place where there is slop floor. To put the flowmeter temporarily on the floor, place it carefully with something such as stopper, to support it so that the flowmeter will not topple over.
- Select cable paths away from electrical equipment (motors, transformers , or radio transmitters), which causes electromagnetic or electrostatic interference.

● If the inside of the converter is wetted or humidified, it may cause insulation deterioration, which can result in fault or noise occurrence. So do not conduct wiring in the open air on rainy days.

Also, be careful not to wet down the converter even in the case of indoor wiring , and complete wiring work in a short period of time.

● Observe the following precautions when you open the converter housing cover:

- Do not open the cover in the open air unprotected against rain or wind. This can cause electric shock or cause damage to the converter .

● Do not open the cover under high ambient temperature or high humidity conditions or in corrosive atmospheres. This can cause deterioration of system accuracy or cause damage to the converter.

Article 1: General

Turbine Flow Meter utilizes the proportional nature of the rotation speed of the turbine positioned in the center of the flow to the velocity of the a moving fluid as to measure the velocity of the moving fluid(rate of flow) by determining the number of rotation of the turbine. Depending on the installed direction of the turbine for the flow, it is generally categorized into Tangential Flow Method and Axial Flow Method. The Tangential Flow Method is a structure of rotating the turbine installed in the measurement compartment in the direction of the tangential flow, as demonstrated through an example of a waterwheel. On the other hand, the Axial Flow Method installs the turbine as to guarantee the axis is in parallel with the flow. This allows the entire flow of the turbine to propel the rotation, often referred as the windmill. However, common characteristics of these two methods are as follows:

a. Simple structure based on compact and light weight structures.
b. Easy handling
c. Effective response to high pressure due to basic cylindrical shape
d. Reduced pressure damage
e. Easy to convert into flow as the rotation of the turbine is proportionate to the velocity of the moving fluid(rate of flow)

Article 2 Structure

The Turbine Flow Meter can largely divided in two parts: parts coming into direct contact with the fluid for measurement like the HOUSING and ROTOR, and another part without contact with the fluid to calculate the number of rotations like the pickup and the Free Amplifier delivering the pickups.

The rotating rotor when coming into contact with the fluid is located at the center of the housing, and rotates pivoted on the axis with the bearing on the side. The axis itself is composed of a stator, a corn designed to prevent the disorderly flow of the fluid and the supporting fixture known as the Clip to support the stator.

Article 3 Characteristics

a. It exhibits high level of accuracy and excellent reproducibility
b. The signal for the rate of flow can be printed digitally.
c. The applicable scope is broad ranging from -30℃ of extreme low temperature to 120℃ fluid matters.
d. The small size allows for measuring large amount of flow measurement.
e. The inspection of the structure and maintenance is simple.
f. It exhibits high responsive rate.
g. It exhibits large range of rate of flow including the viscosity of the fluid.
h. When used on fluids having pulsating flow and adhesive property, sufficient technological review is necessary and mandatory.
i. It is not compatible for fluids with large amount of sludge.

Article 4 Correct Method of Usage

When using the Turbine Flow Meter, special attention must be paid to specifications on rate of flow, temperature and low viscosity to guarantee high level of accuracy and life span.

4.1. Installment and Piping

(1) Piping Conditions for upper and lower flows (meter run)

The accuracy of the Turbine Flow Meter, like other indirect methods for measuring the rate of flow, is strongly affected by the piping conditions. Generally, the JIS Z 8765 is used to eliminate the effects of the piping conditions, and it is demonstrated under [Diagram 3]. In addition, other aspects of precautions for piping conditions can be implemented by incorporating the JIS Z 8765 regulations as provided below.

a. The interior of the Meter Run (excluding measuring the rate of flow) must be free of all projections. For example, projections as a result of wielding, projection of the gasket, and projection of thermometer protection screen. Furthermore, during the installment process, extra caution should be taken to check whether the central axis of the meter run is consistent.

b. When the flow of affected by the pipe layout of the upper side of the meter run, as for the case of when the globe valve, half-opened valve, and existence of two ball valves on different surfaces, the installment of direct piping on the upper surface of the meter run must be executed with extreme precaution. When using the strainer, it must be installed on the upper surface of the meter run.

c. When the measuring fluid can easily be evaporated or vulnerable to mixing with gas, a gas stripper must be installed on the upper surface of the meter run.

d. Any valve like the bypass valve with possibility of affecting the measurement must be subject to seal weld and inspection measures.

e. The flow meter must be protected from high pipe-stress and vibrations.

f. When installing the control valve of the flow meter, it must be installed on the lower surface of the meter run.

g. It is highly recommend to select a location which can easily be repaired.

h. In cases where there exists factors that could affect the measurement like when significant time is required for the temperature of the pipe to reach those of the fluid, when the fluid within the pipe is likely to evaporate, or when the unstable fluids in the pipe is unlikely to be removed, a separate manifold path must be installed to allow for significant flow of the fluids.

i. When measuring two different types of fluids in turn within the

Same pipe, necessary measures must be implemented to limit the possiblity of these fulids from mixing during the process of interchange.

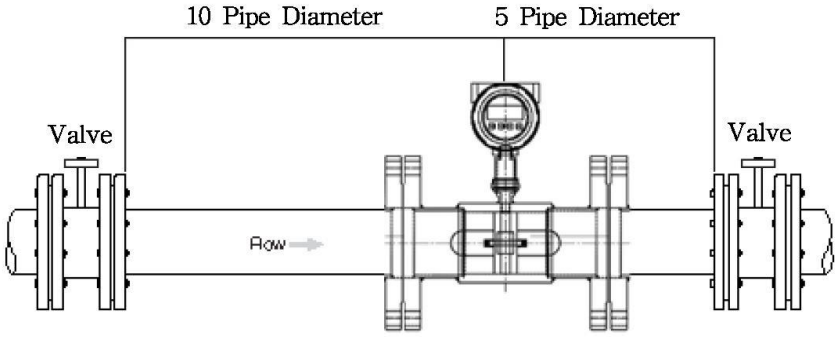
j. When measuring high or low temperature fluids, necessary insulation must be implemented for the pre-amplifier.

k. When it is impossible to limit the flow of fluid in one direction, necessary measures must be implement to either prevent the back-flow or eliminate any damages in the occurrence of such back flow.

l. The measuring ares for the temperature, pressure, and concentration of the fluid must be installed on areas on either the upper or lower part of the meter run free from the effects of the flow.

m. Piping Installation drawing

To ensure specific accuracy over widely varying process conditions, install the flowmeter with a minimum of ten straight upstream and five pipe diameters downstreamfrom the electrode plane, as shown below. This flowtube placement is usually adequate to allow for disturbances created by elbows, valves and reducers.



Upstream and Dlownstream Straight Pipe Diameter

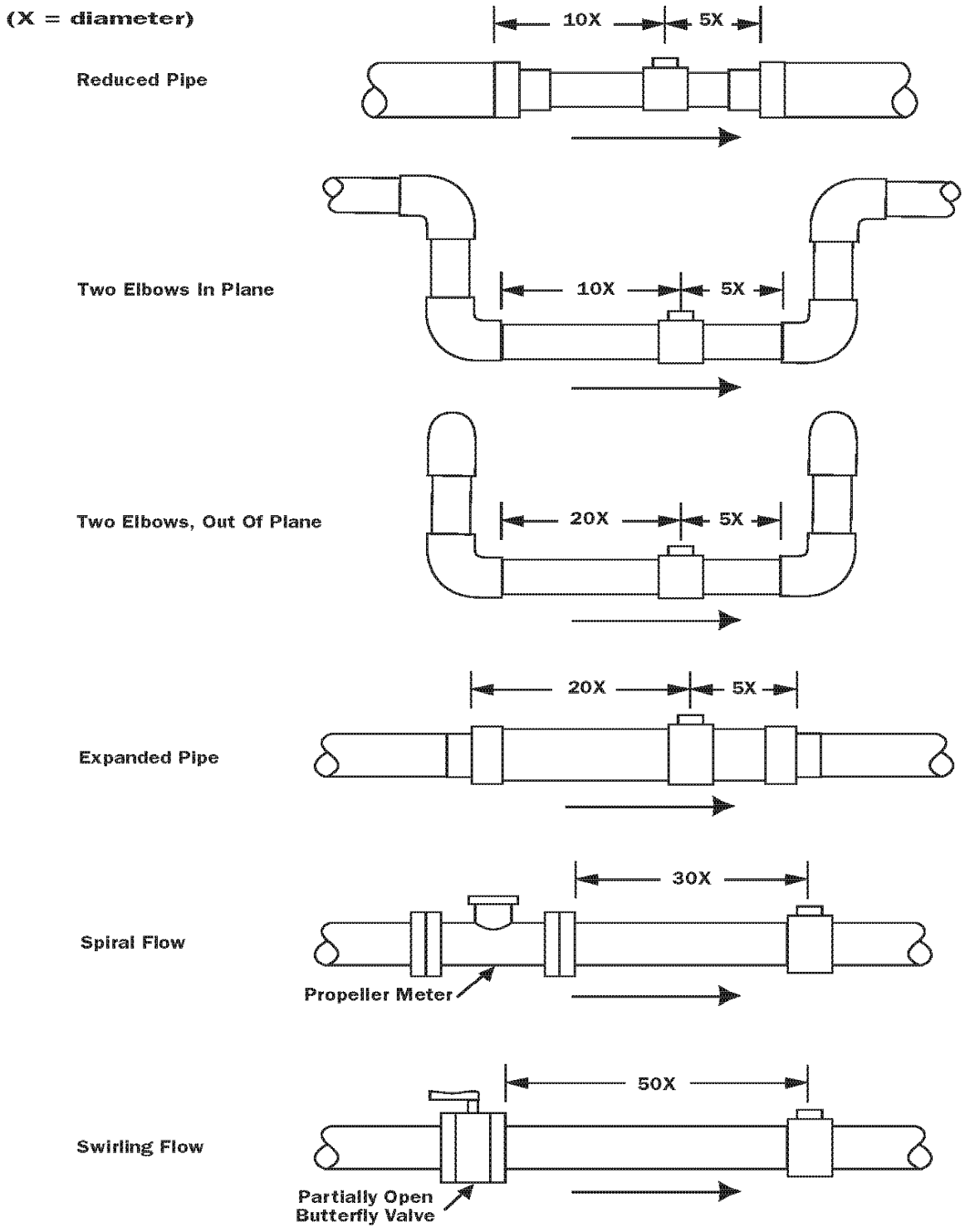
* Note : It can be measured a correct flowrate only when a detector is full with fluid inside completely. Make sure to operate it with fluid in full inside.

n. Required Pipe Length on Piping Connections

If Various joints are used upstream of the detector outlet, the straight pipe length as show in figure below is required.

STRAIGHT PIPE RECOMMENDATIONS

(X = diameter)



(2) Strainer

Depending on the type of foreign substance in the fluid, there is a significant risk of damage to the rotor and the abrasion of the bearing in the Flow Meter, thus installment of a strainer on the upper surface is highly recommended. In order to reduce the damage caused by pressure, a larger sized strainer is more preferable. Furthermore, the number of mesh of the strainer depends on the size of the diameter, in generally, 10 - 60 are used.

(3) Heat(cold) Insulation Work

High(low) temperature fluid or fluids coagulating at high temperatures must be subject to a heat(cold) insulation work. When performing such work, the position of the turbine Flow Meter should be temporarily heated(cold) without fixing as to ease future inspections. By doing so, you can remove the connection bolt of the turbine Flow Meter without damaging the loop of the heat insulator.

(4) Flashing of the Pipe

For all newly installed pipes, there is a possibility of scale and sludge residue remaining within the pipes, so flashing must be performed using a bypass piping. If there is no bypass piping available, insert a stub tube(short tube) instead of the Flow Meter and perform the prescribed flashing. When performing the flashing task, clean water or gas must be need whenever possible, and a recommended velocity of the moving fluid during this process is 4~6m/s. Furthermore, if permitted, these flashing processes should be prolonged for substantial period of time.

(5) Installing the main body of the Flow Meter

The positions of the installed Flow Meter should be assigned to a location guaranteeing easy maintenance and inspection, and it should be places as distant as possible to any vibrating machineries including but not limited to the pump and refrigeration machine. Furthermore, when there is vibration to the piping, the supporting fixture of the Flow Meter should be affixed to a part of the piping system free of vibrations. The generally installment direction is of horizontal nature, and all installments should accord with the directions and method provided.

4.2 Recommendation for Operation

(1) Verification and Preparation before Operation

Before each operation, the following must be verified and prepared.

a. Appropriate maximum reading for each specification

b. Verifying the existence of any penetrations for each related machinery and failures in the wiring

c. Verifying for any failures in the pre-amplifier connection

d. Verifying for the correct setting of the receiver before each operation

e. Verifying whether the voltage provided for the pre-amplifier connection is in accordance with the governing regulations

f. Verifying whether the valve at the either end of the turbine Flow Meter is open

(2) Drying

When using LPG and other low temperature fluids, purge must be performed using nitrogen and all water/moisture in the Flow Meter must be dried. This is to prevent the rotary failure resulting from the freezing of the existing water. In addition, the purging should be performing under the minimum allowed rate of flow for the Flow Meter.

(3) Cool Down

When you apply sharp disturbance to the fluid for low temperature-fluids like LPG, it could result in producing excessive force on the Flow Meter due to thermal contraction. ,In order to prevent such phenomenon, gradually lower the temperature and re-commence the operation. The recommended speed for reducing the temperature is 20℃/hour.

(4) Operation

When in operation, special attention must be afforded to the following.

a. Slowly open the valve of the inflow axis of the turbine Flow Meter until it is fully opened. When the valve is half-open, the disturbance in the flow sometimes makes it difficult for accurately measuring the rate of flow. Furthermore, during this entire process, special attention must be paid for any leakage in the connecting parts.

b. Slowly open the valve of the outflow axis of the turbine Flow Meter. However, if you suddenly open the valves when the interior of the pipes are empty, it could cause unwarranted vibrations, resulting in damage to the Flow Meter.

c. Special Note for filling water inside of pipe lines completely before operating

It should be the essential condition to operate the turbine flowmeter on condition of being filled with liquid inside of pipe line. If not, the manufacturer cannot give the user any guarantee on measuring correct flowrate.

If there is any bubble inside of the operating turbine flow meter, the detector of it will not be able to sense the condition which is filled with liquid fully inside of pipe causing by passing bubble to the detector inside of turbine flow meter.

And the bubble will be caused obstruction of corrective measuring flowrate by hitting the impeller of turbine flow meter because the impeller of turbine flow meter will not be rotated correctly by impacting bubble irregularly. So, the user must remove bubble-causing factors from the operating system immediately.

4.3 Maintenance and Inspection

The turbine Flow Meter exhibits a simple structure, and cemented materials are used for the bearing components, exhibiting high level of durability. Therefore, when used under the recommended condition, it provides prolonged safe functions. However, when there are impurities within the used fluids, scales and other impurities can adhere to the interior, disturbing the performance of the regular function. Therefore, periodic disassembling cleaning of the turbine Flow Meter is highly recommended.

(1) Time for Disassembling Inspection

The disassembling inspection should be performed at least once annually during the early years of the operation, and gradually increase the annual inspection frequency.

(2) Inspecting Parts

In general, the area of inspection include the housing, rotor, bearing, detecting parts (pick-up) free amplifier and etc.

(3) Item of Inspection before Disassembling

a. Verify whether any impurities exist within the interior of the machine or the rotor.

b. Verify whether the rotor rotates lightly and smoothly. In general, the rotor can be rotated by either a light breath of air or by using a short rod. If the rotation is heavy, and does not rotary fully, you should presume something is wrong.

c. Verify whether the rotary movement of the rotor produces metallic scratching sounds. However, this does not includes cases when used with low temperature fluids like LPG and the lubrications of the bearing line disappears and starts to make this metallic scratching noise.

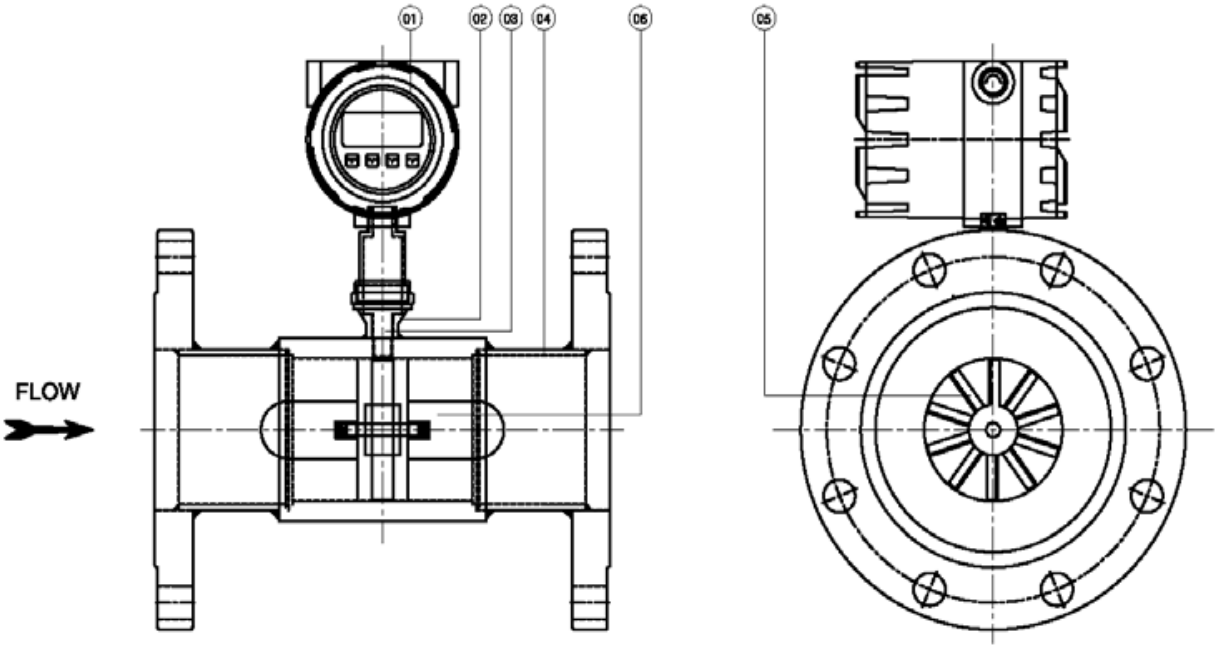
(4) Cleaning

A foreign substance and an adhesion might be caused on the rotating impeller of turbine flowmeter when using it for a long term without clearning, and they cause the instruction decrease and/or the stop-rotating impeller. Please confirm whether to cause the foreign substance and/or adhesion on the impellers of turbine flowmeter when the phenomenon of instruct decreasing or no-output signals while operating it. Please remove a foreign substance on the impeller and/or clean with a soft brush etc., and remove the adhesion thing. The instruction can be indicated a normal value by removing the foreign substance and/or adhesion. If it can't be operated even if a foreign substance is removed from an impeller, you should contact to your nearest distributor for repairing immediately.

When using it in the line to which such a phenomenon occurs easily, it is recommended that the impeller should be cleaned up regularly (at least once a year). Use always new packing materials when mounting the turbine flowmeter in the pipeline.

(5) Operative Life

The operative life of turbine flowmeter is 3 years from the date of delivery. **And our warranty period is 1 years from the date of delivery.** The life of the flowmeter differs depending on the environmental conditions and the way it was used. To extend the life of the flowmeter, inspect and clean the flowmeter periodically. If it will be used with corrosive fluid, it will be shortened life-time seriously from its operative life-time.



① INDICATOR ② PICK UP ③ PICK UP HOUSING
④ BODY ⑤ IMPELLER ⑥ GUIDE

[Diagram1] Illustrated Breakdown of the Turbine Flow Meter