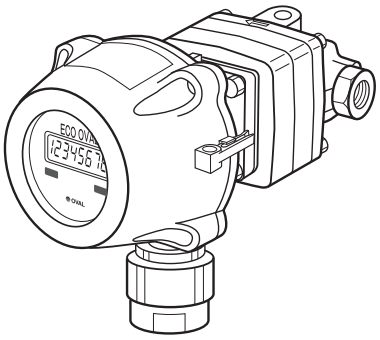
OVAL INSTRUCTIONS

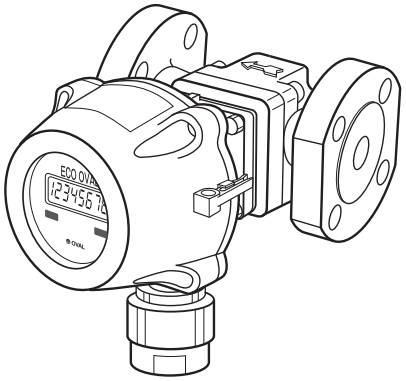
Ins. No. B-153-18-E

Oval Flowmeter
ECO OVAL

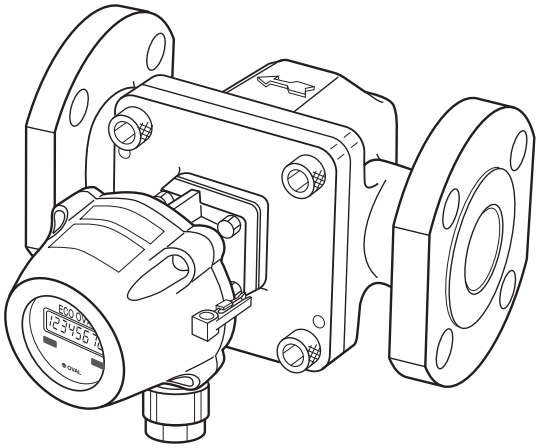
METER SIZES: 41, 45, 49, 50, 52, 53, 55, 56



Sizes 41 and 45 (V)



Sizes 49 and 50 (L)



Sizes 52, 53, 55 and 56 (L, W, D)

➡ NOTE: Meter body ID code

Code	Meter body	Rotors
L	FC250	Special resin
W	SCS13 equivalent	Special resin
V	SCS14	SUS316L,sintered
D	SCS13 equivalent	SUS316L,sintered

Every OVAL flowmeter is fabricated and shipped from our factory under strict quality control. In order to maintain its design performance throughout its life, this manual offers the operator the necessary installation, operation and maintenance information. Please be well familiar with these instructions before you place the meter in service and keep this manual ready for reference.

◆ Meter size designation ◆

The size of OVAL flowmeters is basically identified by a two-digit code.

For details, see Product Code Explanation [figures in brackets ( ) show meter body ID code] on page 11.

CONTENTS

The indications **NOTE**, **CAUTION**, and **WARNING** shown throughout this manual are to draw your attention to specific items:

➡ NOTE

Notes are separated from the general text to bring user's attention to important information.

⚠ **CAUTION**

Caution statements call attention to user about hazards or unsafe practices that could result in minor personal injury or property damage.

⚠ **WARNING**

Warning statements call attention to user about hazards or unsafe practices that could result in serious personal injury or death.

This brochure gives the instruction for the proper functioning of the product, the safety and the compliance with several CE-marking Directives. Follow the instructions specified in this instruction manual.

OVAL will not take responsibility for any damage, injury, or form of loss caused where the product is not installed and used as detailed in this instruction manual.

1. BEFORE YOU BEGIN

Every OVAL flowmeter is thoroughly tested before its delivery from the factory. When received, the product should be thoroughly inspected for indication of rough handling during transit. Necessary considerations in handling are described in this section; read the instructions carefully.

As for other information, find the respective sections from "CONTENTS" on page 2 and 3.

For any inquiries, please contact your nearest OVAL sales office.

⚠CAUTION: When making inquiries, please do not fail to include the product name, model No., serial No., ratings, and other pertinent information.

1.1 Confirming the Nameplate

Every OVAL flowmeter is assembled and adjusted according to individual customer specifications.

Product code and ratings appear in the counter tag on top of the register. Make sure that the product you received complies with the specifications in your order.

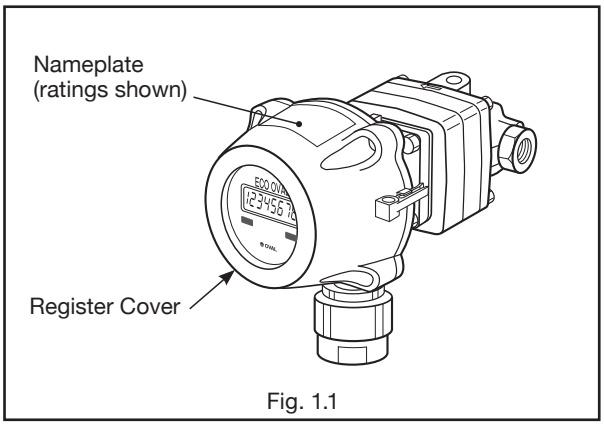


Fig. 1.1

1.2 Transportation Considerations

(1) OVAL flowmeter can best be transported to the installation site in the shipping container used for transit from our factory.

(2) OVAL flowmeter is adjusted and inspected with all components of the meter body, sensor, and register as one integral assembly; be sure to treat them as one complete assembly.

(3) The register is precisely configured and adjusted; do not attempt to remove its cover unless it is absolutely necessary.

1.3 Storage Considerations

If your flowmeter is stored for long periods of time upon receipt before installation, unexpected faulty conditions could result. If a long-term storage is anticipated, take the following precautions:

(1) Keep the meter in store in the same shipping container which used for transportation from OVAL if possible.

(2) Place of storage should conform to the following conditions:

★ Free from rain and water.

★ Free from vibration and impact shocks.

★ Temperature and relative humidity in the storage place are at or near room temperature and humidity (around 25℃ and 65%).

(3) Purge the meter that has once been placed in service with clean air, N_2 gas, etc. to prevent the metered fluid from adhering to the meter connections, piping inner walls, housing, etc. before storage. (Wash clean with suitable detergent if necessary.)

(4) In case the meter is stored for extended period of time, it is to be stored under the same good storage conditions as applied during the transit from the factory.

(5) Battery storage life is about 10 years after shipment. For details, see Sec. 1.9 "Battery Life."

1.4 Structural Considerations

(1) The register is of water/dustproof construction for outdoor service. After opening the register lid for battery replacement or other service, be sure to tighten the bolts firmly when closing it. Also, in case of using in non-explosionproof rating, or if you supply a lead-in fitting (such as a cable gland), confirm the compatibility of the finished outside diameter of the cable, etc., and be sure to apply that of IP66 (equivalent to JIS C 0920) and grade higher to protect from water/dust ingress.

(2) Do not attempt to replace component parts with third-party parts or make any circuit modification.

(3) In case of using in explosionproof rating (TIIS)

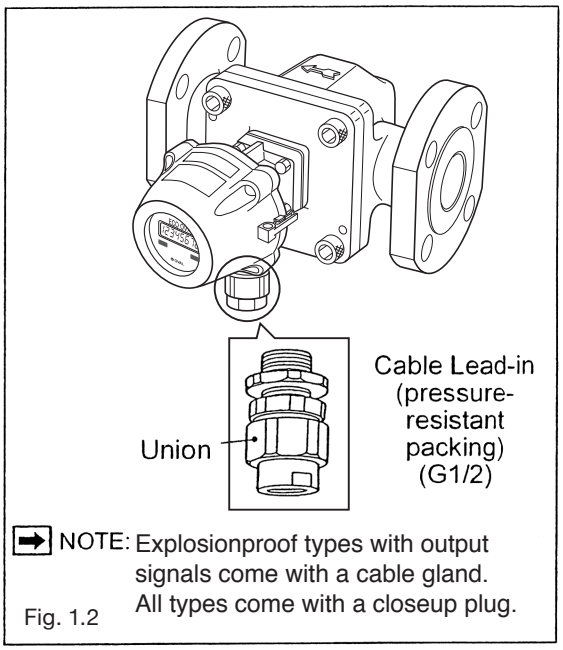
① Since the lead-in fitting constitutes of the flameproof configuration, please be sure not to use lead-in fittings (pressuretight packing) other than the furnished.
A set of four different packings (ϕ 9, ϕ 10, ϕ 11 and ϕ 12) are supplied. Select the proper size referring to the table below. (ϕ11 is furnished on the meter at delivery from the factory.)

Table 1.1 Applicable Cable O.D. (Units in mm)

Packing Code	Packing I.D.	Cable O.D.
9	9.0	8.5 to 9.0
10	10.0	9.1 to 10.0
11	11.0	10.1 to 11.0
12	12.0	11.1 to 12.0

② Explosionproof work using sealing fittings, if desired, requires parts specified:
Manufacturer: Shimada Electric Co., Ltd.
Model: SFT-16
"IV" cable shall be used as the lead-in cable. Also, if the ambient temperature exceeds the acceptable range, be sure to use proper heat resistant cables.

③ In case of using as ATEX explosionproof product, do not fail to use ATEX approved cable gland (NPT 1/2 or M20×1.5)



NOTE: Explosionproof types with output signals come with a cable gland. All types come with a closeup plug.

Fig. 1.2

Cable lead-in precautions

Explosionproof type

- Tighten up the pressure-resistant union securely upon wiring (strong enough to resist a pull of the cable).
- When using the product without pulling in the cable, remove the pressure-tight packing and attach a closeup plug.

Non-explosionproof type

- Apply a protective treatment to preclude moisture entry.

⚠ **CAUTION: Moisture allowed into the register causes blurred display glass and functional trouble.**

1.5 External Wiring Connections

(1) Removing the register cover provides access to the terminal block for external wiring connections.

(2) The register cover is coupled to its body with a chain to safeguard against potential damage to internal wiring by inadvertent pulling beyond its limit.

(3) On opening the cover, you can see the sensor leads (shielded). Disconnect sensor leads from CN2 on the substrate (lightly hold the connector with long-nose pliers, or similar tool, without giving a strong pull, and separate.).

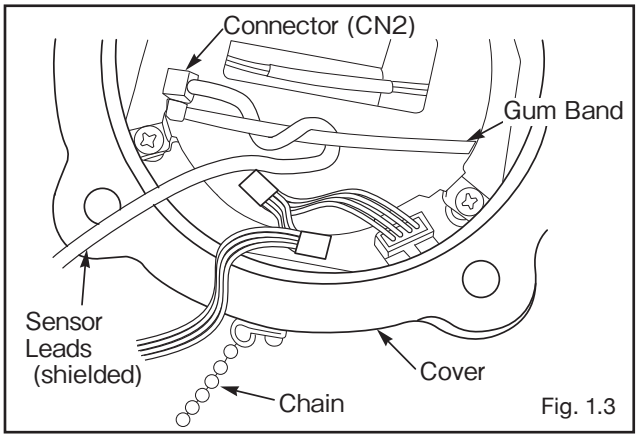


Fig. 1.3

⚠ **CAUTION: Pulling the connector by wire leads may lead to poor electrical contact at the connector.**

(4) If uncoupling the connector is not required, secure the cover such that it will not open up beyond 90 degrees. Forcing the sensor leads may cause trouble.
(Battery replacement is to be done in the same manner.)

(5) When making connections at the terminal block, exercise care to avoid tightening hold-down screws (M4) excessively.

(6) Output terminals are available in unfactored and factored pulses. Choose the ones that match the configuration of cable used.

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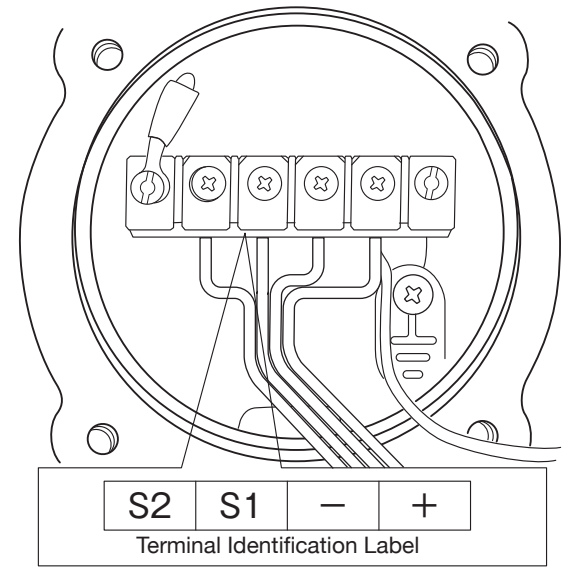
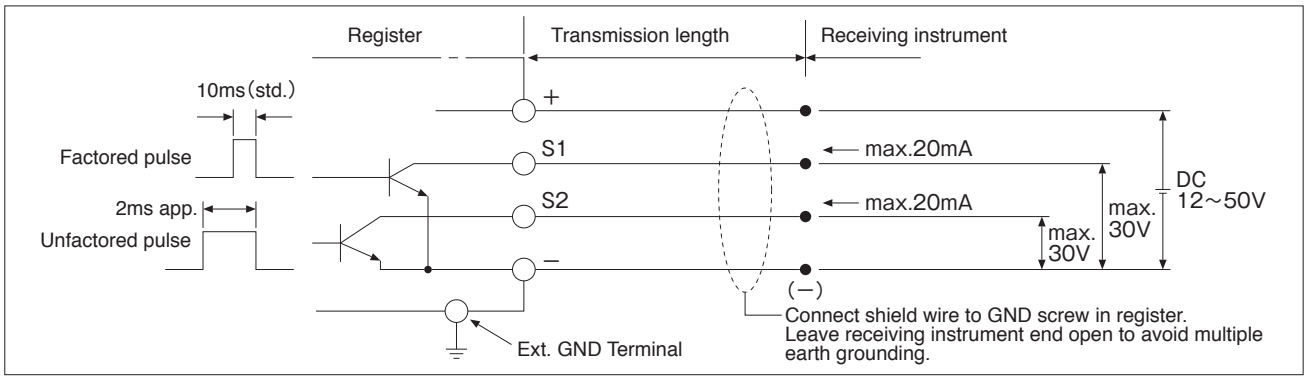
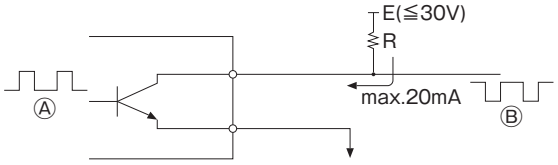


Fig. 1.4

1.6 Wiring Diagram



For reference purpose, an arrangement to convert open collector pulse into voltage pulse is shown.



NOTES: Select load resistance value R so as to hold the current flowing into the transistor below 20mA in relation with E. Waveshapes Ⓐ and Ⓑ are exactly inverted each other.

NOTES:

1. Both factored and unfactored pulse output are of open collector output. Couple a load at the receiving instrument so that the ratings are held within 30VDC and 20mA max.

2. Exceeding the rating and/or negligence of observing polarities in wiring connections may result in failure in the register.

3. Depending on the type of cable used, either the unfactored or factored pulse is selected.

4. Earth ground the register's EXT. GND terminal to the instrumentation ground earth.

1.7 Installation Location

(1) Applying a magnetic sensor on the sensing part, this register detects the magnetic fields created by signaling magnets embedded in the rotor. Separate the register from magnetic field generating sources. Installation of an electromagnetic valve around 10 watts requires separation at least 10 meters from the flowmeter typically. (The distance could differ depending on operating conditions.)

(2) For use in cold regions

Install the meter where ambient temperature does not exceed the specified operating temperature range given in Section 14.4.

① Install the meter in a vertical pipeline with a drain plug to facilitate drainage (see piping diagram on page 15).

② If heat insulation is applied, avoid heat retention over the register, strainer cover, and drain plug. In arranging the piping with the meter, please take an easy removal of the meter from the piping into your consideration.

(3) Register operating ambient temperature ranges from -20 to +60℃ . Provide a sunshade or similar protection where the register could possibly be exposed to higher temperatures over the range. Also provide a protection against frost and dew condensation for outdoor use to keep the product within the specified operating temperature range.

➡ **NOTE: The highest allowable temperature is +50℃ for explosionproof rating.**

1.8 Register Life

The electronic module in the register requires replacement every 10 years or so due to the life expectancy of LCD and other electronic component parts.

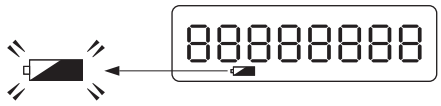
The electronic module life depends on operating conditions. Under such environmental conditions as listed below, it is suggested to replace the entire register assembly in 5 to 6 years.

- ◆ **High temperature environment**
- ◆ **High temperature process fluid measurement**
- ◆ **Field installation with widely varying temperatures**
- ◆ **Register LCD display exposed to the sun (ultraviolet rays)**
- ◆ **Frequent start / stop in process fluid operation**

1.9 Battery Life

(1) The lithium battery incorporated in the register is good for about 8 years for the battery powered model. (Life expectancy can be shorter depending on operating and environmental conditions.) If your meter is equipped with pulse generator for remote output, operating it on an external power source is suggested (by doing so, you can extend battery life).

(2) When the battery has almost run down, an alarm message "▭" comes on in the register front panel. This alarm prompts you to replace the battery within a week. (Battery replacement procedure appears on page 38.)



(3) Storage life of the battery is about 10 years after shipment.

Even in environment where the register operates on an external power source with virtually no power consumption from the battery, battery replacement is required in about 10 years due to storage life limitation. (It follows that, together with Section 1.8 "Register Life," register assembly replacement is required.) The following environmental conditions reduce storage life even more:

◎ High temperature environment

◎ High temperature process fluid measurement

◎ Cold region

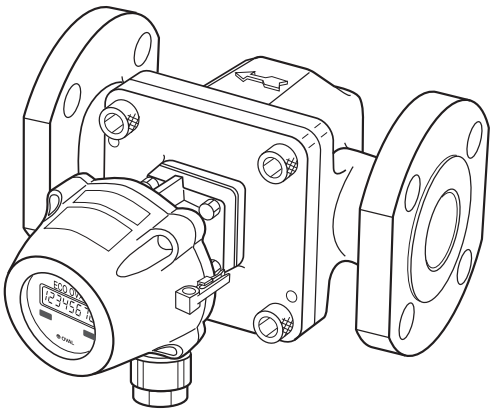
2. OPERATING CONDITIONS

To maintain the stated high accuracy and long service life of the meter, make sure that the flowrate, pressure, temperature and other variables be held within the ratings specified. These ratings appear on the top of meter register nameplate (tag). Read them carefully before you place the meter in service.

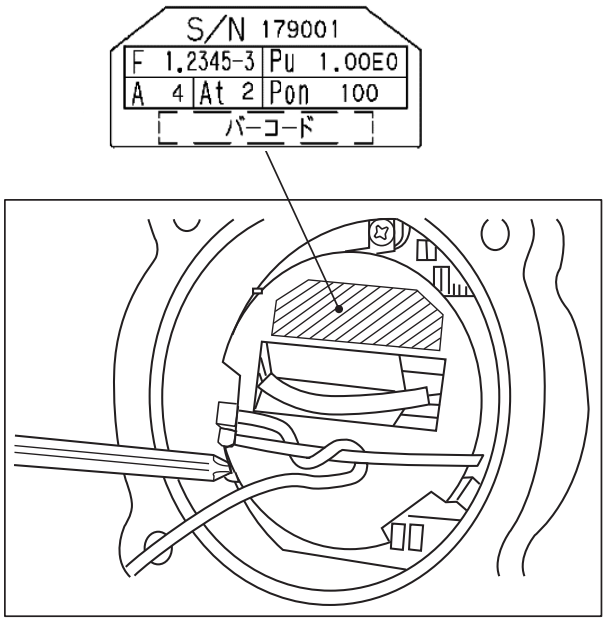
⚠CAUTION:

(1) In the light of approval requirements in the weights and measures law, this flowmeter is not serviceable in cerfifyling and authenticating legal tranactions.

(2) This flowmeter is not provided with subtract function. If pulsation in the flow (flowrate fluctuates due to pressure variations in the pipeline) or reversal of flow occurs, the total counter may show erratic reading, accumulating all incoming pulses irrespective of flow direction.



Parameter label



➡NOTE:

Parameter label appears inside the register.

The description of the Name plate

MODEL	LG	NPE-298 MEDE IN JAPAN	
BORE SIZE		MAX. FLOW RATE	
MAX. TEMP.			
MAX. PRESS.		S/N	
FLUID			
OVAL Corporation			

⚠CAUTION:

Where the register is potentially exposed to elevated temperatures by the sun or radiated heat, provide a sunshade or similar protection to ensure that the operating temperature be held within the rating.

Fig. 2.1

3. GENERAL

This flowmeter is unique in selecting measuring chamber material and in design. The state-of-the-art electronic expertise is used throughout with multiple-function, all-electronic register.

A magnetic sensor detects magnetic fields created by magnets embedded in the oval rotor in the wetted parts to obtain unfactored and factored pulses of extremely high sensitivity and reliability.

3.1 Features

(1) Accurate flowmetering is attributable to the inherent accuracy of oval gear flowmeter.

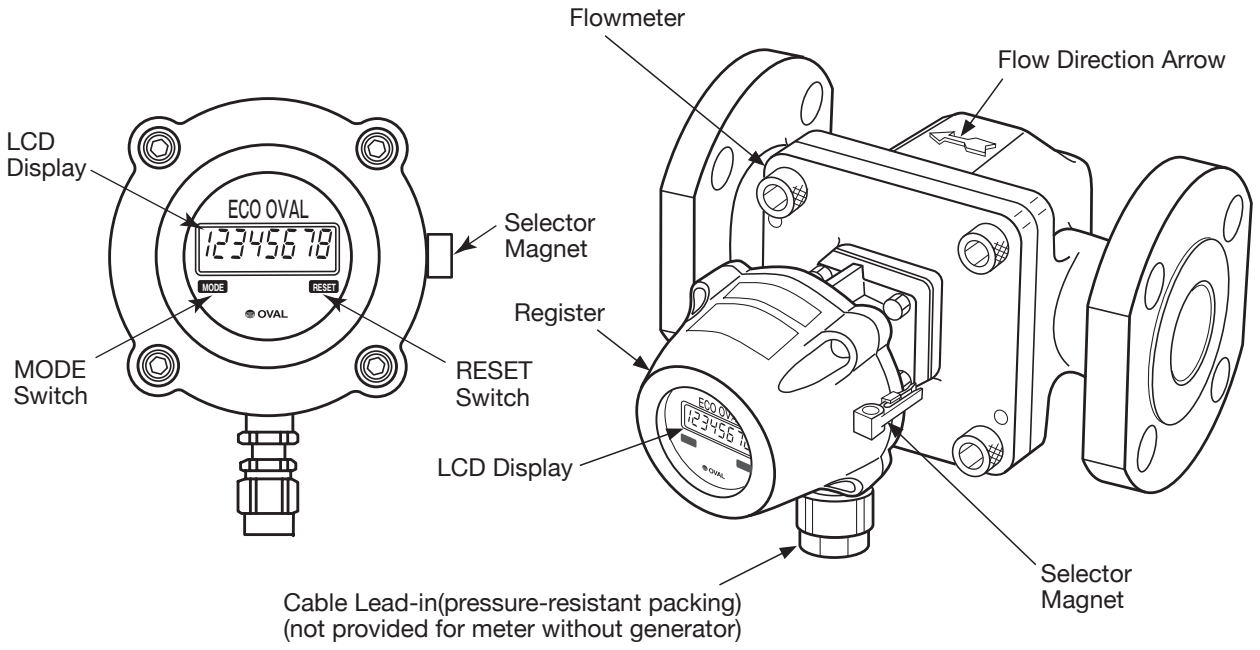
(2) The register contains an LCD counter with multiple functions. View angle is freely adjustable.
[Grand total flow, instantaneous flowrate (per-hour or per-minute), and resettable total flow selectable]

(3) The LCD changes display modes with MODE switch at left of the register.

(4) Small wetted parts count contributes to long life.

(5) Flow output signal is compatible with a wide choice of remote receiving instruments for control, adjust, record, and more applications.

3.2 COMPONENT NAMES



➡ NOTE: Shown here is an example of meter sizes 52, 53, 55, or 56 (meter boy ID code: L, W, D)

Fig. 3.1

➡ NOTE: Available flow units

Units of the registration display can be changed.

L (standard), kL, m^3, g, kg, t, /h, /min, (normal), none.

A change in the unit of registration by no means affects the process of calculation.

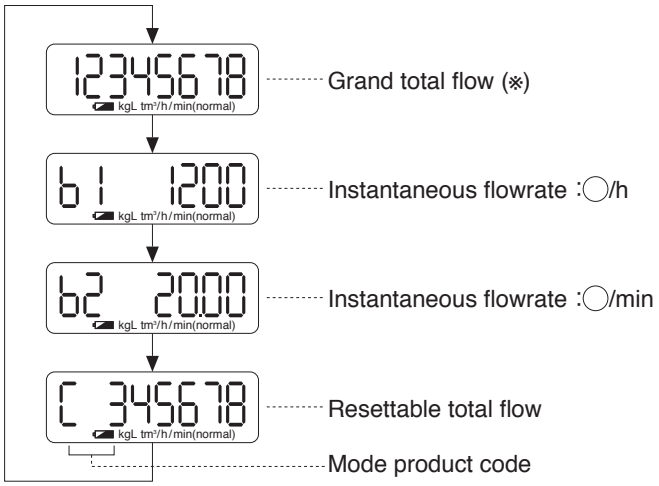
3.3 PRODUCT CODE EXPLANATION

Item	Product code ① ②	③	④ ⑤	⑥	⑦	⑧	—	⑨	⑩	⑪	⑫	Description			
Model	L G											ECO OVAL			
Meter body ID code (material code) Meter sizes		L										Meter body: FC250 Rotors: Special resin			
		W										Meter body: SCS13 equivalent Rotors: Special resin			
		V										Meter body: SCS14 Rotors: SUS316L sintered metal			
		D										Meter body: SCS13 equivalent Rotors: SUS316L sintered metal			
Meter sizes												L	W	V	D
			4 1									—	—	Rc 1/4 screw fitting	—
			4 5									—	—	Rc 3/8 screw fitting	—
			4 9									20mm(3/4")	—	—	—
			4 0									20mm(3/4")	—	—	—
			5 2									25mm(1")	20mm(3/4")	—	20mm(3/4")
			5 3									40mm(1 1/2")	25mm(1")	—	25mm(1")
			5 5									40mm(1 1/2")	40mm(1 1/2")	—	40mm(1 1/2")
			5 6									50mm(2")	50mm(2")	—	50mm(2")
Application				A								General purpose (Applicable to body ID codes "L, W, V".)			
				B								General purpose and solvent use (Applicable to body ID code "D".)			
Process connection					1							JIS 10K RF			
					2							ASME 150 RF (Not applicable to body ID code "W".)			
					3							Screw-in (Applicable to body ID code "V".)			
						0	—					Always "0"			
Power source								D				Battery powered (less pulse generator)			
								G				Powered from an external source (Battery incorporated)			
Explosionproof rating									0			Non-explosionproof (whre exp. rating is not required.)			
									1			TIIS explosionproof/Battery powered: Ex ia IIB T4 Externally powered: Ex d IIB T4			
									2			ATEX explosionproof/Battery powered: II 2G Ex ib IIB T4 Gb Externally powered: II 2G Ex d IIB T4			
Type of pulse generation										0		Pulse generator not provided			
										3		Factored pulse (pulse width 1ms) Unfactored pulse (pulse width 2ms)			
										5		Factored pulse (pulse width 50ms) Unfactored pulse (pulse width 2ms)			
										6		Factored pulse (pulse width 100ms) Unfactored pulse (pulse width 2ms)			
										7		Factored pulse (pulse width 250ms) Unfactored pulse (pulse width 2ms)			
Version code											A				

➡ NOTE: If external wiring is not connected, the TIIS explosionproof explosionproof enclosures meet the requirements for intrinsic safety configuration.

4. LCD COUNTER DISPLAY

4.1 "MODE" Switch



➡ NOTES:

1. **Shown above are screens scrolling in the basic mode.**
2. **To review parameters, see the Transition Chart of Parameter Status on page 22.**
3. **(※) About grand total reading, see CAUTION (2) on page 9.**

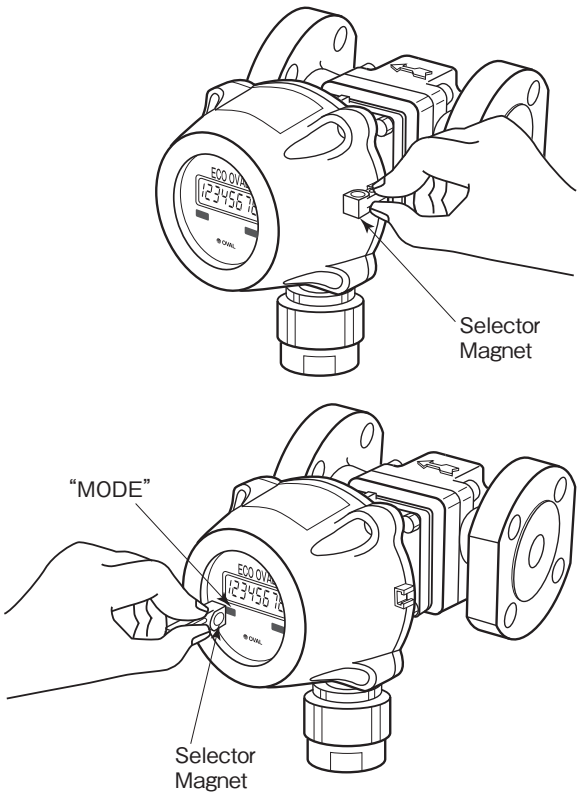


Fig. 4.1

4.2 "RESET" Switch

Only in the resettable total mode, or in Mode Symbol: "C ", the grand total reading is resettable.

➡ NOTES: 1. Switching the mode to the instantaneous flowrate while the flowmeter is in operation by no means affect operation in the total counter.

2. Instantaneous flowrate reads "0" at flowrates below the meter's minimum flowrate. However, total counter continues to count up.

3. Instantaneous flowrate reading may possibly vary with operating conditions and other factors.

⚠ CAUTION

Do not fail to install the selector magnet in its holder after use lest you will not lose it. Since a magnetic sensor is used in the meter, do not put the selector magnet on the meter body as it could cause erroneous operations. Also, the selector magnet is of an intensive magnet; never hold it close to floppy disks or other magnetic storage items.

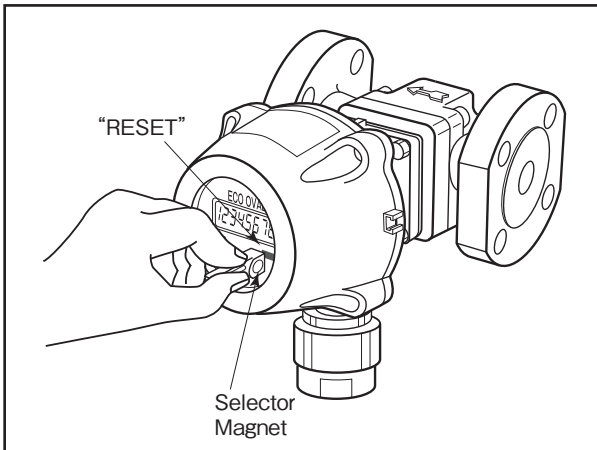
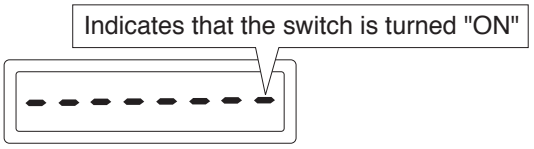


Fig. 4.2

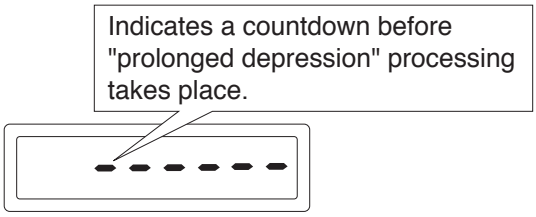
4.3 Displayed Messages during Operation

(1) Ordinary operation
"MODE" switch is turned "ON"
(Operating blade is contacted: See Fig.4.1)
⇒ 8 bars appear.



⇒ Immediately turning "OFF" moves the window to the next one.

(2) Prolonged operation
The switch is held turned ON without turning "OFF" immediately by removing the fingers.
⇒ Bars begin to disappear from the leftmost one.



⇒ Holding turned "ON" until the last bar disappears results in "prolonged depression" processing (※) to takes place.
(Turning "OFF" before the last bar disppears results in the same behavior as in (1) to take place.)

※ Prolonged operation: An operation reqired for Normal mode ⇔ Parameter review mode selection, finalizing the parameter setting, etc.

NOTE: While RESET switch is in a valid mode (resettable total mode, etc.), the same message as stated above appears in response to RESET switch operation.
(There is no distinction between ordinary depression and prolonged depression.)

5. INSTALLATION

5.1 Piping Guidelines

(1) Flush the piping assembly.
Flushing must be performed before meter installation. Instead of the meter, install a short pipe in place of the meter at this time (see diagram below).

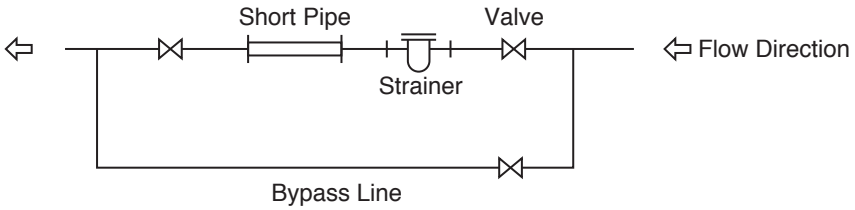


Fig. 5.1

(2) Upon completion of flushing, install the meter in the piping assembly exercising care to avoid pipe stress.
(3) The meter must be installed on the outlet side of the pump.
(4) If the meter is to be used under tank head, give a head pressure bigger than the total pressure loss of the piping system, strainer, meter, etc.

➡ **NOTE: Pressure losses of OVAL flowmeter and strainer are shown on the product general specifications.**

(5) Meter installation is correct if the flow direction conforms to the arrow mark on the meter body.
(6) The strainer is to be located upstream of, and as close to, the meter as possible.
(7) Since the sensing element of the OVAL flowmeter detects the change of magnetic flux density, it must be isolated from the influence of any external magnetic flux. In order to prevent the possible influence of external magnetic flux, meters shall be at least 5 meters away from existing power equipment and conductors - potential sources of creating large magnetic and electric fields, such as motors and generators.
(8) In case electric heating is desired, consult the factory.
(9) Lagging material, if used, must not cover the register.

5.2 Lagging Work

⚠ **CAUTION: In a cold region where freezing is anticipated, or where a fluid that tends to solidify (heavy oil, for example) is to be metered, lagging on the flowmeter and strainer is required.**

(1) Be sure to check for liquid leaks before working with lagging material.
(2) Take easy removal, disassembly and inspection of the meter into consideration.
(3) Lag the strainer so as to remove its top lid easily. Strainer net needs to be cleaned periodically.
(4) **Never lag the register and pulse generator.** Lagging them may cause excessive temperature rise which could lead to a trouble or accident. (See Fig.5.2)
(5) Avoid lagging the register's front cover seat.
(6) Lagging should be so made as to facilitate servicing (for easy disassembly and removal).

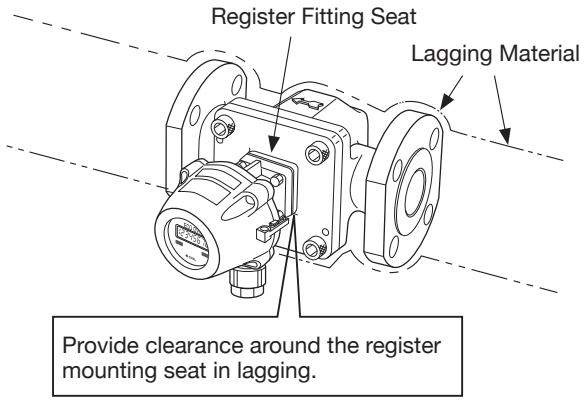


Fig. 5.2

● **Typical OVAL flowmeter Installations**

5.3 Standard Piping, Horizontal Run (Fig.5.3)

(1) The picture on the right is of flow direction, right to left. If the direction is to be changed from left to right, the meter and strainer are interchanged.

(2) Arrange piping for easy drain.

(3) Strainer net should be checked on a regular basis.

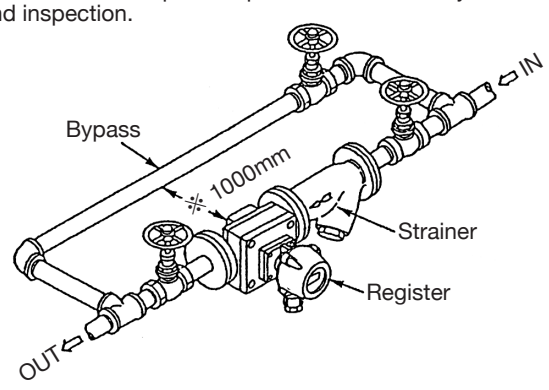


Fig. 5.3

5.4 Standard Piping, Vertical Run (Fig.5.4)

(1) If flow direction is from top to bottom, interchange the meter and strainer.

(2) If the strainer is located at point B, reinstalling the strainer net is difficult after cleaning it. We suggest to locate the strainer at point A.

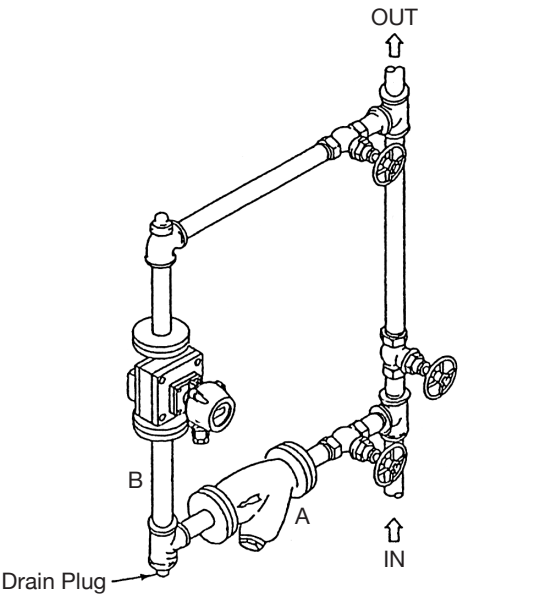


Fig. 5.4

5.5 Example of Wrong Installation (Fig.5.5)

Do not install the meter in a position like this.
Or proper flowmetering will not be achieved.

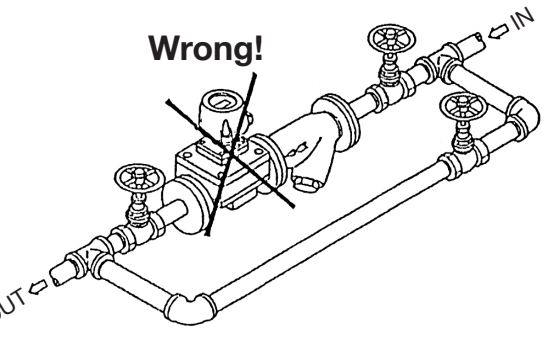


Fig. 5.5

6. HOW TO CHANGE FLOW DIRECTION AND PHYSICAL ORIENTATION

How to change flow directions

● The register is set to flow direction "right → left" at delivery from the factory. The register orientation, in accordance with a change of flow direction, can easily and readily be changed.

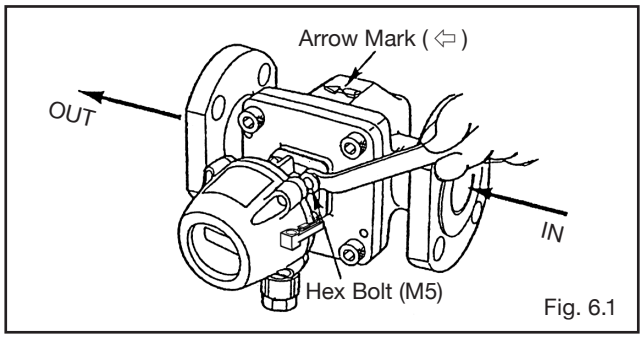


Fig. 6.1

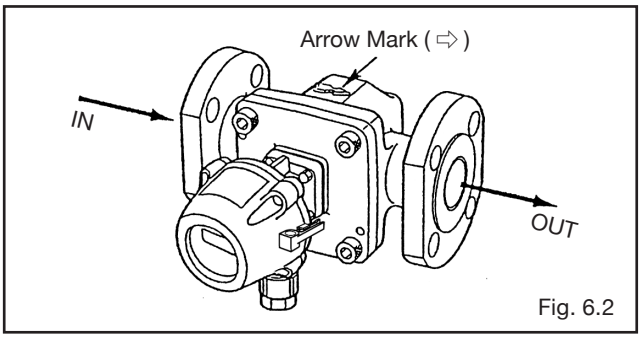


Fig. 6.2

① Remove the meter from the pipeline and separate the register from the meter body. Adjust the flow direction arrow (⇨) with actual flow direction. To change the flow direction from right → left to left → right, invert the meter body as shown in the figure and reinstall in the pipeline.

② Orient the register properly as shown in the figure, and secure it with bolts. The same procedure applies to changing from left → right to top → bottom, or to bottom → top.

➡ **NOTE: An example with meter sizes 53, 55, and 56 (meter ID codes L, W, D) is shown above. The same applies to other meter sizes.**

7. OPERATION

7.1 Operation Sequence

At operation start-up, carefully follow the valve operations sequence given below and ensure that the flow range is held within the specification (refer to the piping diagram below).

(1) Shut off valves (A) at upstream and (B) at downstream of the meter, respectively. Then open valve (C) in the bypass line to allow the fluid in the bypass line to remove weld chip, construction debris, and scale in the piping assembly.

⚠ **CAUTION: This is particularly important on the newly installed piping assembly.**

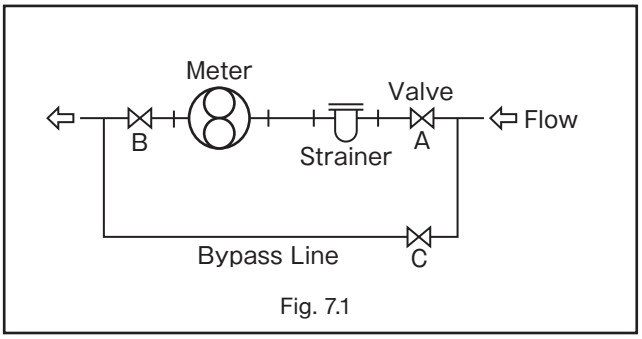


Fig. 7.1

(2) Carefully and slowly open upstream valve (A), and then slightly open downstream valve (B).

(3) Progressively close valve (C) in the bypass line, and make sure the register counter counts.
Maintain a flowrate at 10 to 20% of the max. flowrate (making sure in the instantaneous flowrate mode), allow the fluid to flow for more than 15 minutes, and make sure that air in the piping assembly has totally been expelled.
In applications where the temperature exceeds 60℃ in particular, a minimum break-in meter operation for 30 minutes is required to uniform heat distribution in the measuring chamber.

(4) Following the break-in run (preheating), shut off valve (C) in the bypass line completely, progressively open upstream valve (A) until fully open, and slowly open downstream valve (B) until the rated flowrate is obtained.

(5) Flowrate should be regulated with downstream valve (B) while confirming the flowrate in the instantaneous flowrate mode of the register, and maintain operation within the specified rate.

(6) The strainer net should be inspected for condition and cleaned periodically.
On a new installation, in particular, inspect daily first and, according to the net condition of clogging observed, inspection intervals may be reduced progressively to, say, once a week.

7.2 Considerations in Operation

(1) When changing flow rates

In changing flow rates, and in open/close of flow limit valves in batch applications, make sure not to have rapid change of flow rate on the flowmeter.

Operating the meter at flowrates in excess of the maximum allowable flowrate will nullity the guaranteed accuracy, reduce the meter life and may result in faulty conditions, such as the burn of bearings or the rotor-to-measuring chamber contact.

(2) Where the temperature of metered liquid changes

Avoid rapid temperature changes in the meter. Temperature changes of the liquid in the meter should be held within 3℃ per minute.

Extra care should be taken particularly in measurement in batch operation without the provision of heat tracing of the piping where the liquid temperature differs from atmospheric temperature.

If rapid temperature changes are anticipated, heat trace shall be applied on the piping assembly as well as on the meter.

(3) Liquids of low steam pressure

Temperature and pressure shall be well controlled in case operated with liquids of low steam pressure (less than 0.4mPas in viscosity) since the liquids are apt to vaporize.

During operation, the temperature of the meter bearings is usually higher than that of the metered fluid. Vapors around the bearings may causes faulty conditions, such as unusual noise and bearing burn.

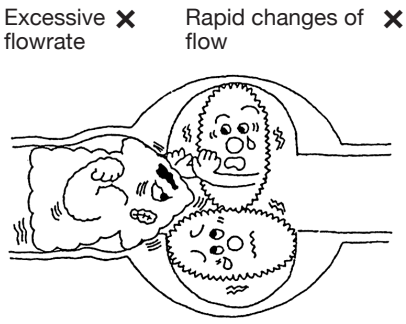


Fig. 7.2

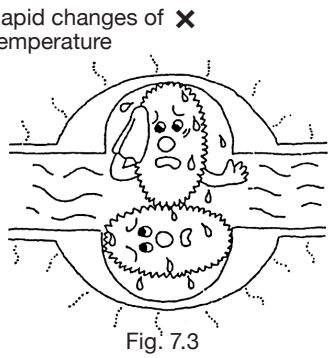


Fig. 7.3

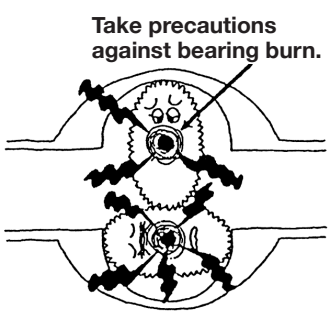


Fig. 7.4

7.3 Considerations in Shutdown

(1) Valves should be closed progressively.

Rapid valve closure could, under certain piping conditions, cause a sharp pressure rise by water hammer, or hydraulic shock, resulting in damage to the meter.

(2) Precautions against pressure buildup on closure:

Complete closure of valves upstream and downstream of the meter makes the affected section a totally enclosed chamber. Pressure rise within the chamber, may be caused by rise of atmospheric temperature, etc., raises internal pressure of the chamber and could lead to an unexpected damage to the meter.

(3) Liquids prone to adhere or gelate at no flow:

The meter internal must be washed out thoroughly by flowing detergents before shutdown in case operated with liquids that tend to adhere and solidify or gel at no flow, or, without the treatment, resume of the meter operation can not be done.

8. TROUBLESHOOTING

Status	Possible Cause	Action
1.Totalizer fails to count.	1.Flowrate is too low.	1.Open valves progressively.
	2.Insufficient pump pressure or head pressure.	2.Taking pressure loss of entire piping assembly into consideration, correct pump pressure or head pressure.
	3.Power line voltage is out of specification or current capacity of power source is insufficient.	3.Provide a 12 to 50VDC power to the register. Current capacity 10mA min. is required for power supply.
	4.Battery has run down.	4.Referring to Section 13, replace battery pack.
	5.Rotors jammed with foreign matter, rotors locked; metered liquid fails to run.	5.Referring to Disassembly and Inspection Procedure (Section 11), disassemble meter body and clean the rotors and other components thoroughly.
	6.Rotor installed in inverse direction.	6.Refer to "Assembly Procedure" in Disassembly and Inspection (Section 11) and reinstall the rotors.
2.Abnormal noise.	1.Air is entrapped.	1.Decrease flowrate and eliminate air in the piping assembly.
	2.Liquid in meter is vaporizing in the piping.	2.Decrease flowrate and control the liquid temperature and pressure to prevent vaporization.
	3.Rotors revolving being in contact with measuring chamber.	3.Refer to Disassembly and Inspection Procedure (Section 11) and disassemble and inspect for condition.
3."BATT" stays on.	1.Battery voltage is low.	1.Refer to Section 13 and replace battery pack.
4.Liquid leaking	1.Incomplete seal of the pipeline.	1.Inspect bolts at connections for tightness or replace gaskets.
	2.Incomplete seal on rear cover of meter body.	2.Retighten bolts at pipeline connections and replace O-ring with new one.
5.Counts while valve remains closed.	1. Valve and pipeline leaks.	1.Inspect valves and pipeline.
	2.Air pockets between valve and flowmeter; rotors in rocking motion in response to pump's pulsating pressure.	2.Vent air. Provide a check valve and accumulator.
	3.Supply power voltage fluctuates.	3.Eliminate voltage fluctuation.
6.Total flow over counting	1.Rotors in rocking motion in response to a pulsating flow.	1.Add a check valve and accumulator.
	2.Influenced by external magnetic fields (Meter sensor picks up external magnetic fields created by a motor, generator, etc.)	2.Keep out external magnetic fields.
	3.Air entrapped.	3.Provide an air vent.
7.Total flow under counting	1.Influenced by external magnetic fields.	1.Keep out external magnetic fields.
8.Process fluid flows but no total flow reading.	1.First and second rotors installed the wrong way.	1.Disassemble the meter body and reassemble correctly.
	2.Reassembled wrong after disassembly.	2.Disassemble and reassemble correctly.
9.Counting while valve remains closed (counts with no flow).	1.Due to liquid leak or air pockets between the valve and meter, rotors in rocking motion caused by pulsating pump pressure.	1.Provide an air vent. 2.Add a check valve and accumulator.
10.Message bdAtA appears.	1.Appears following MODE operation for 5 sec. min. in the basic mode scroll.	1.From bdAtA, continue MODE operation for 5 sec. min. to return to the basic mode scroll.

➡ **NOTE: If trouble is not covered in the table above, please contact your nearest OVAL office. In this case, supply us with complete information as to product name, model code, symptoms, etc.**

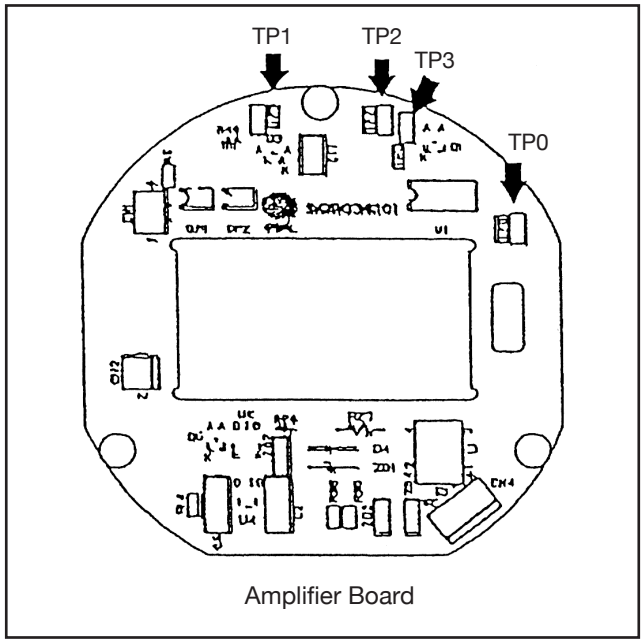
9. INTERNAL SWITCHES AND TEST PINS

Using test pins (TP0 through TP3) on the register amplifier board, you can monitor signal waveforms.

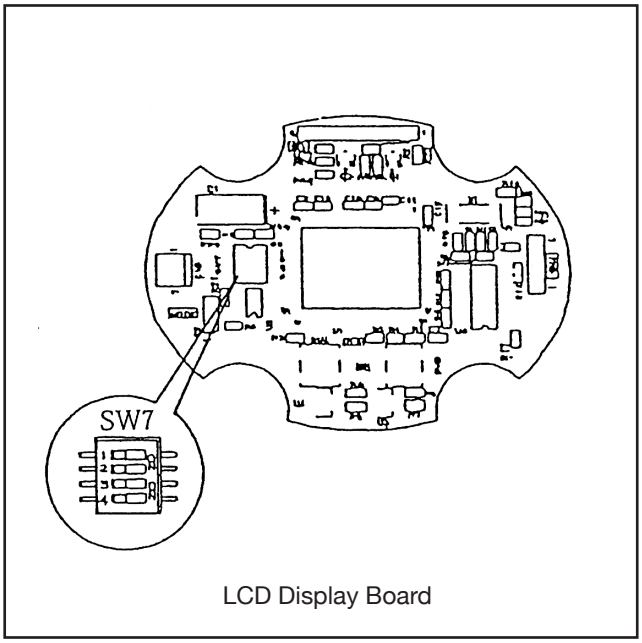
Amplifier Board

Name	Label	Description
Amplified waveform	TP0(-) to TP1(+)	Monitors waveform of amplified magnetic sensor signals.
Triggered waveform	TP0(-) to TP2(+)	Monitors waveform of triggered TP1 signal (square wave).
Waveform past doubler	TP0(-) to TP3(+)	Monitors the frequency-doubled waveform of TP2 signal. Monitors pulse waveform with constant width (2ms) at TP2 waveform rising edge and falling edge.

NOTE: SW7 on the LCD display board is only for adjustment at factory. Do not attempt to readjust. Factory set to "OFF" in all positions before shipment.



Amplifier Board



LCD Display Board

10. PARAMETER SETUP PROCEDURE (Manual setup)

10.1 Parameter Reconfiguration

Given below is the sequence of parameter changing.

① In "Measure Mode (normal mode)," keep pressing MODE switch for 5 seconds to go into "Review Mode."

↓

② Using MODE and RESET switches, show the parameter you want to change.

↓

③ Pressing MODE switch for 2 seconds to go into "Parameter Setup Mode."

↓

④ Using MODE and RESET switches, set up a new parameter.

↓

⑤ Following the parameter entry, pressing MODE switch for 2 seconds to go back to "Review Mode."

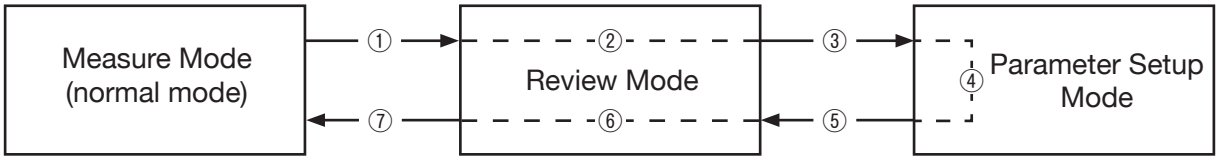
↓

⑥ Using MODE and RESET switches, display the title (= one from bdAtA or PuLSE).

↓

⑦ Keep pressing MODE switch for 5 seconds to go back to "Measure Mode."

A diagram to show parameter setup sequence



➡ **NOTE: For complete detail of MODE and RESET switch operation at ①, ②, ⑥, and ⑦, see Section 10.3 "Transition Chart of Parameter Change".**

10.2 Parameter List

Parameter	Code	Description	Setup Examples
Meter factor	F	· Meter factor (Unit : [□/Pulse]) · Setting range: 0.9999-9 to 9.9999E7	Ex.: Given meter factor 9.918mL/P to change the indicated flowrate to [L] → 9.918[mL/P] = 9.918 × 10^{-3} [L/P] Therefore set to (F9.9180-3) (L/P)
Conversion factor	H	· Unit conversion factor (Unit : [△/L]) △: Unit after conversion (If not converted △=□) · Setting range: 0.9999-9 to 9.9999E7	Changes units of total flow and instantaneous flowrate to any units desired. (If not converted, it should be H1.0000E0) Ex.: At 1.5kg per 1L, change the flowrate to read in kg. → Conversion factor is 1.5[kg/L](=1.5000 × 10^{0} [kg/L]) Therefore set to (H 15000E0) (kg/L) (Note 1)
Pulse weight	Pu	· Factored pulse output weight (Unit : [△/Pulse]) · Setting range: 0.99-9 to 9.99E7	Ex.: To change factored pulse wt. 1 L/P → 10L/P (=1.00 × 10^{+1} [L/P]) → Set to (Pu 100E1) (L/P) (Note 2)
Measurement units	Un	· Information shown below the LCD	Sets up the units of registration to read in the LCD.
Instantaneous flowrate decimal point	bP	· Decimal point location of instant. flowrate b1 · Setting range: 0, 1, 2	Ex.: To change the indicated min. reading in instantaneous flowrate from 1L/h → 0.1L/h (= decimal place 1 digit.) → Set to (bP .1)
Total flow Decimal point	SP	· Decimal point location of cumulative & resettable totals · Setting range: 0, 1, 2, 3	Ex.: To change the indicated min. reading in total flowrate from 1L → 0.01L (=decimal place 2digits). → Set to (SP .2)
Sampling time	At	· Upper time limit in instant. flowrate sampling (Unit : [sec]) · Setting range:1 to 999	If a set number of pulses fail to come during At [sec], the instantaneous flowrate shows 0.
Sampling cycle number	A	· Frequency of sampling · Setting range: 1 to 999 (Note 3)	Instantaneous flowrate is determined by measuring the time for incoming flow in a set number of pulses. If the spread of instant. flowrate indicated is too great, increasing the number of pulses eases the fluctuation.
Pulse width	Pon	· ON width of unfactored pulse output (Unit : [msec])	Ex.: To change pulse width from 1ms → 50ms → Set to (Pon 50) (ms) (Note 4)

NOTES:

1. A change in conversion factor (H) requires uniformity of units, such as pulse weight (Pu), displayed units (Un) and other related parameters to that after conversion.

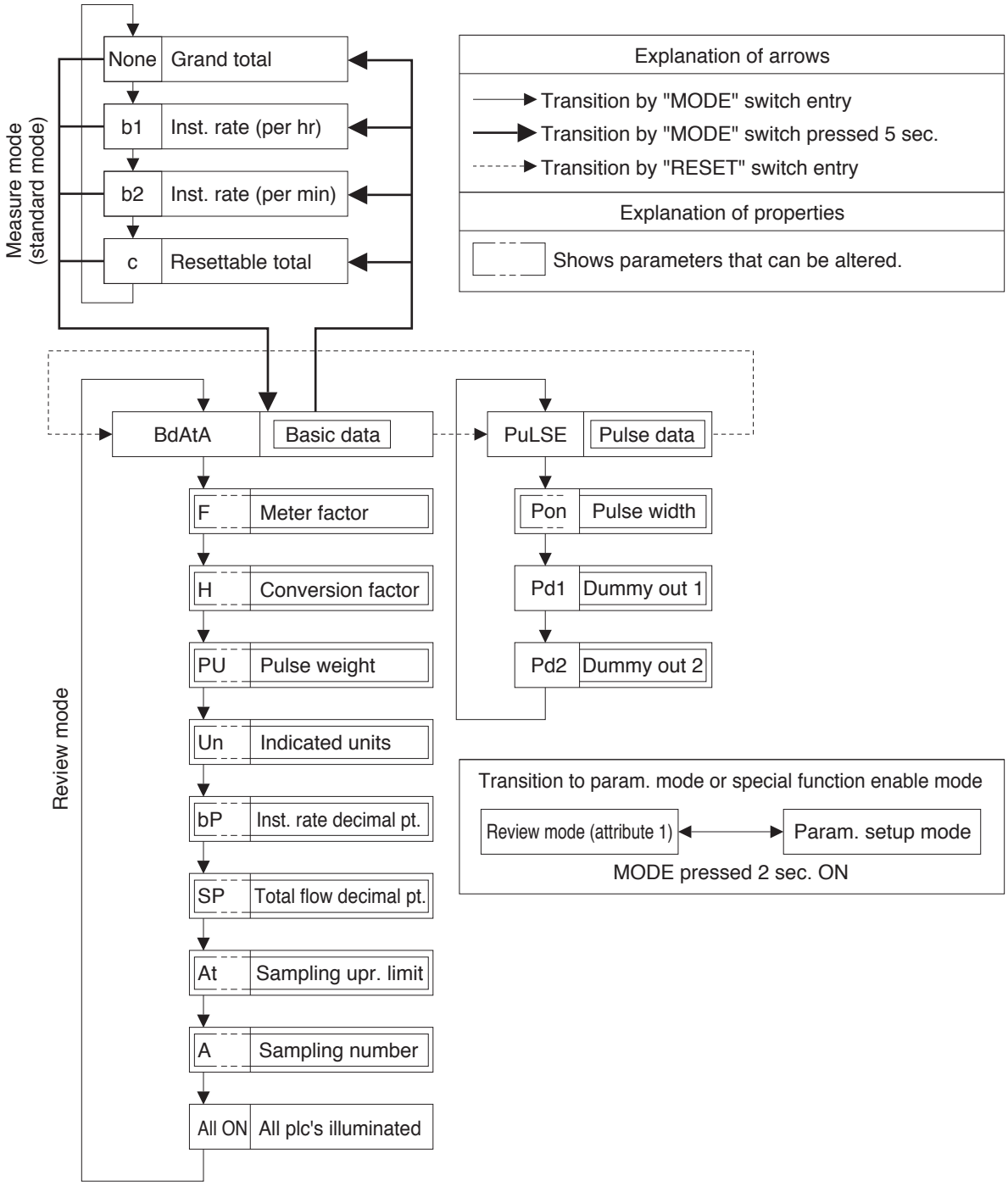
2. Do not fail to select a value that satisfies requirements $\frac{F \times H}{2} \leqq Pu \leqq F \times H \times 10000$.

3. To determine the most appropriate sampling cycle number, multiply the frequency (P/s) of flowrate used by the sampling time and choose the nearest value of 2^n
Example: If the frequency of flowrate used is 7Hz (7 P/s) with sampling time at 5 s, then we obtain 7 × 5 = 35. The nearest 2^n is 2^5 = 32. So 32 is the sampling cycle number to be chosen.

4. Select a value that satisfies without fail: Factored pulse "OFF" width > 1ms.

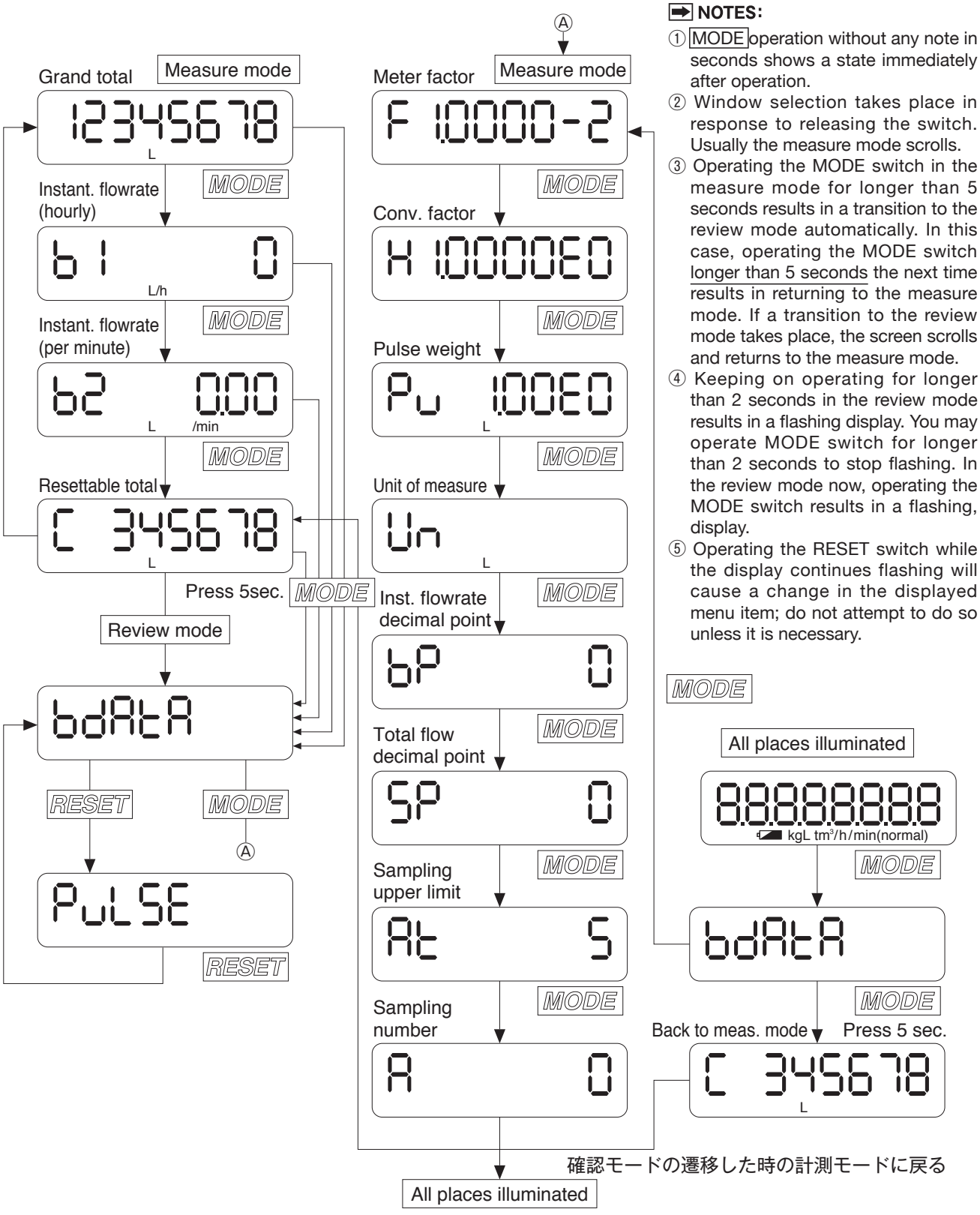
※ For the factory-set parameters, refer to "Default Parameter Settings" supplied with the product.

10.3 Transition Diagram of Modes and Parameters



10.4 Menu Selection

10.4.1 Transition from Measure Mode to Review Mode



NOTES:

① MODE operation without any note in seconds shows a state immediately after operation.

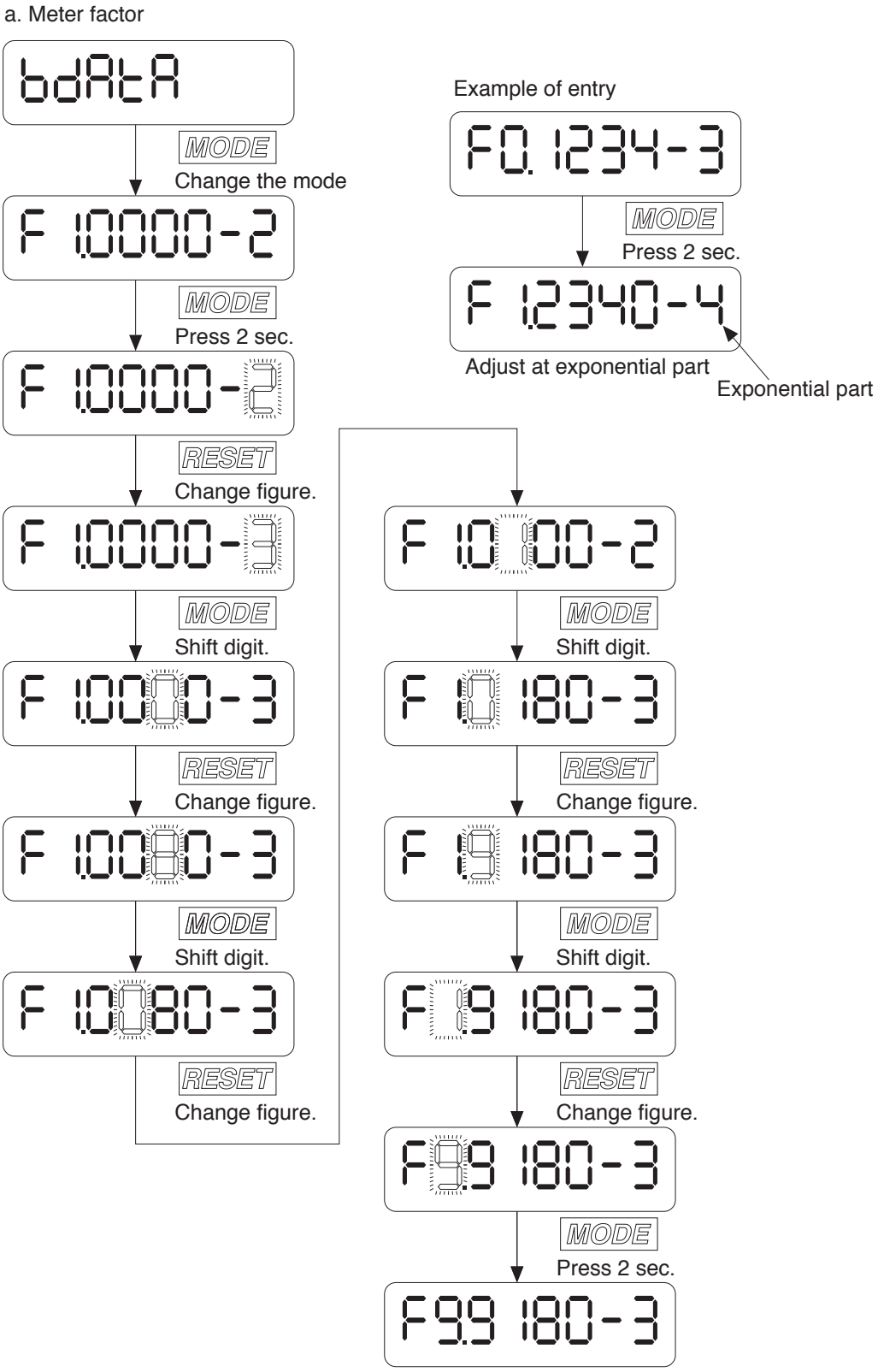
② Window selection takes place in response to releasing the switch. Usually the measure mode scrolls.

③ Operating the MODE switch in the measure mode for longer than 5 seconds results in a transition to the review mode automatically. In this case, operating the MODE switch longer than 5 seconds the next time results in returning to the measure mode. If a transition to the review mode takes place, the screen scrolls and returns to the measure mode.

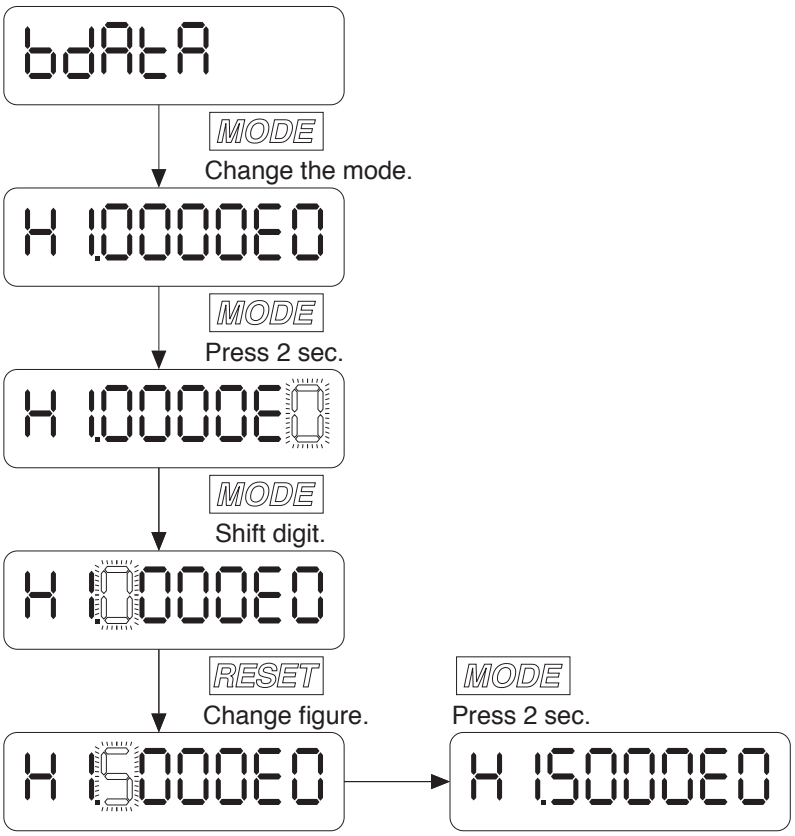
④ Keeping on operating for longer than 2 seconds in the review mode results in a flashing display. You may operate MODE switch for longer than 2 seconds to stop flashing. In the review mode now, operating the MODE switch results in a flashing, display.

⑤ Operating the RESET switch while the display continues flashing will cause a change in the displayed menu item; do not attempt to do so unless it is necessary.

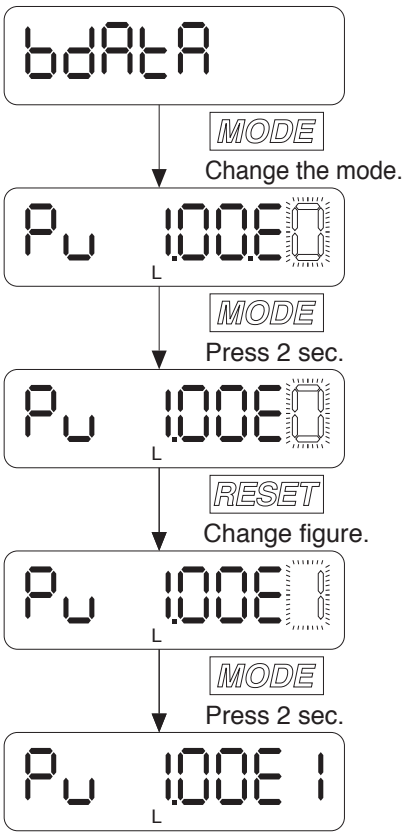
10.4.2 Menu Item Selection



b. Conversion factor

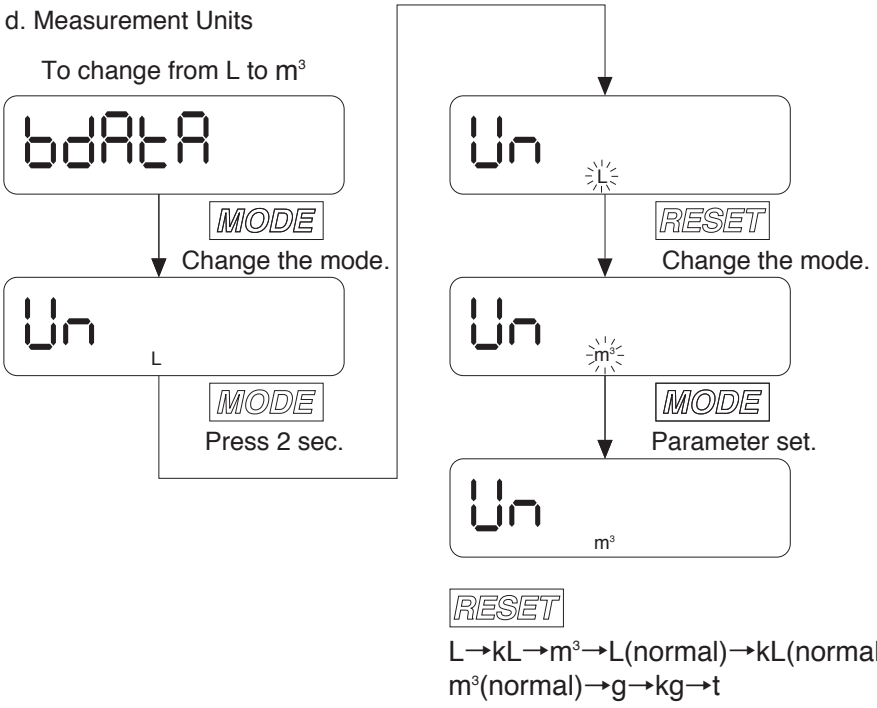


c. Pulse weight



d. Measurement Units

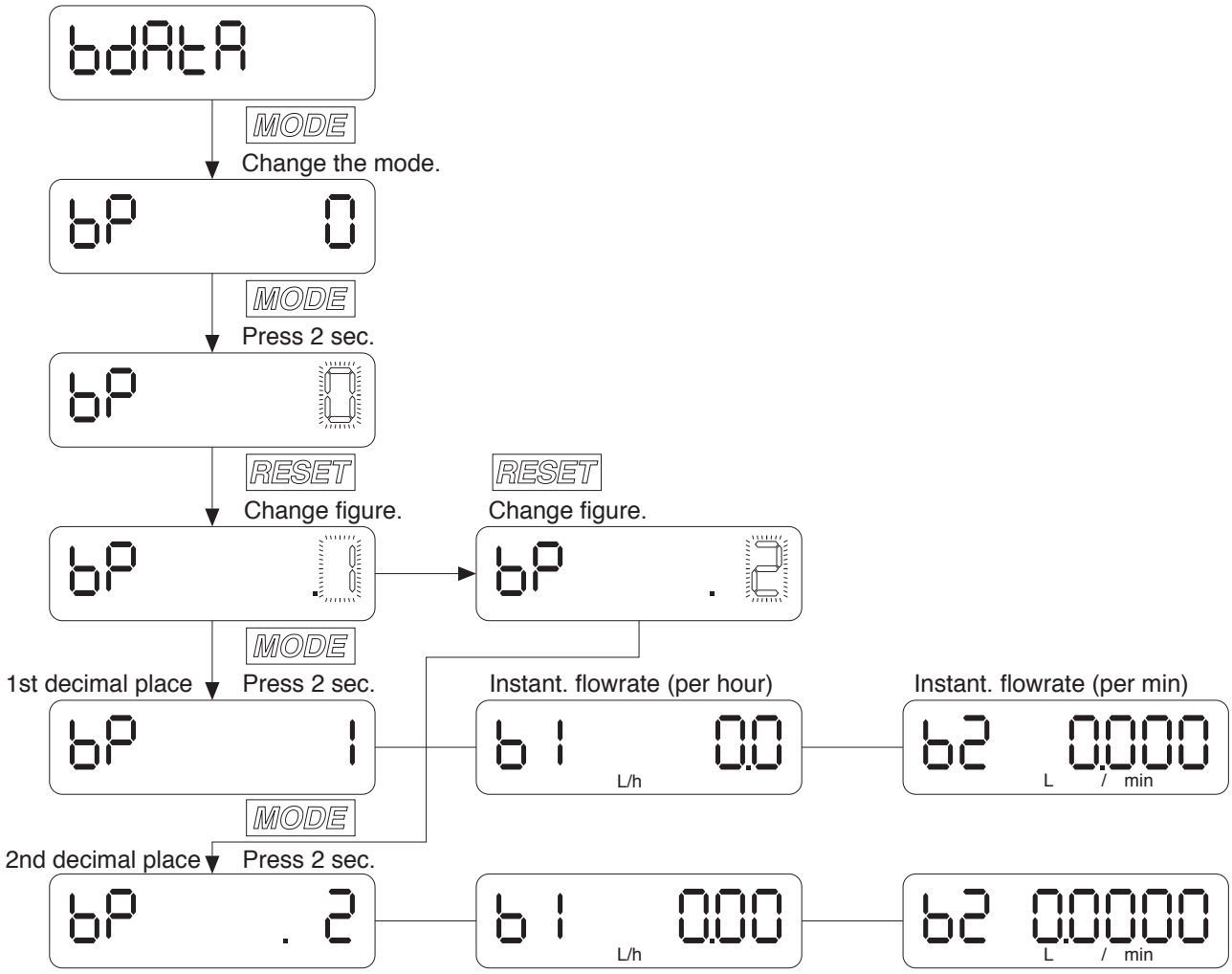
To change from L to m^3



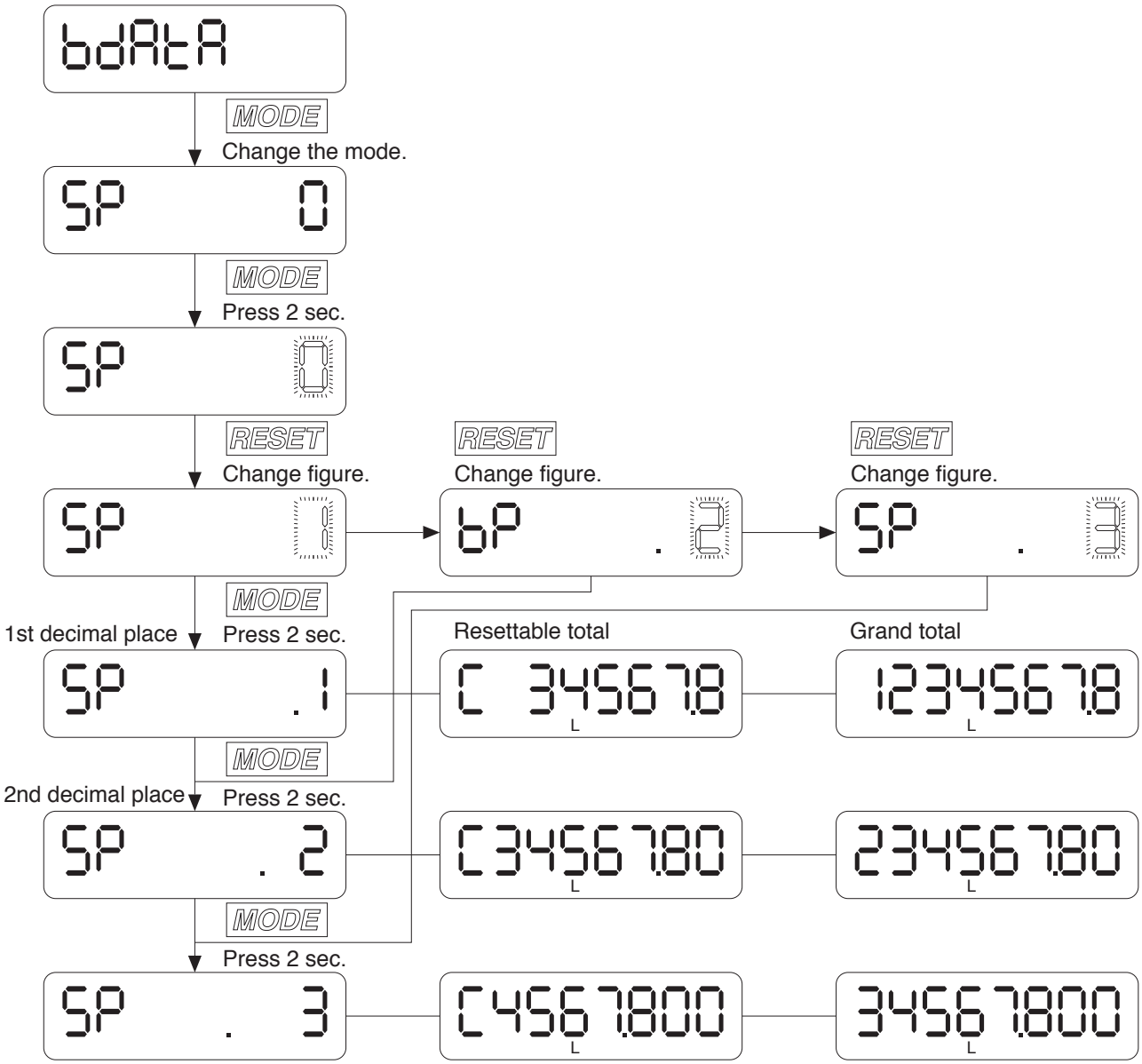
RESET

L→kL→m^3→L(normal)→kL(normal)
m^3(normal)→g→kg→t

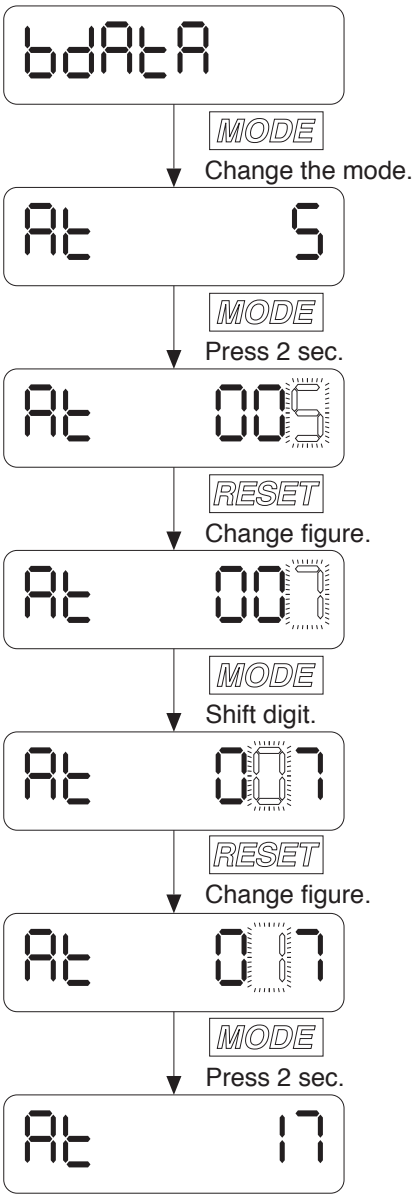
e. Instantaneous flowrate decimal point



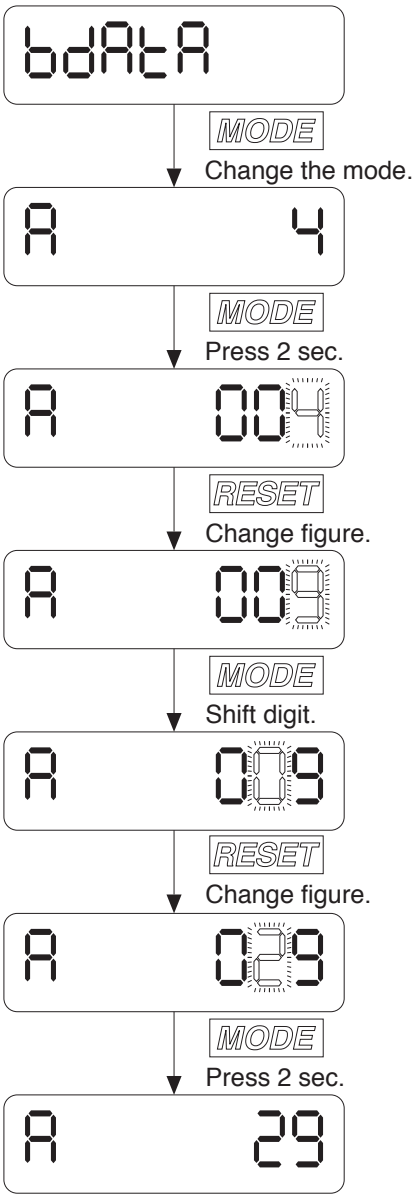
f. Total flow decimal point



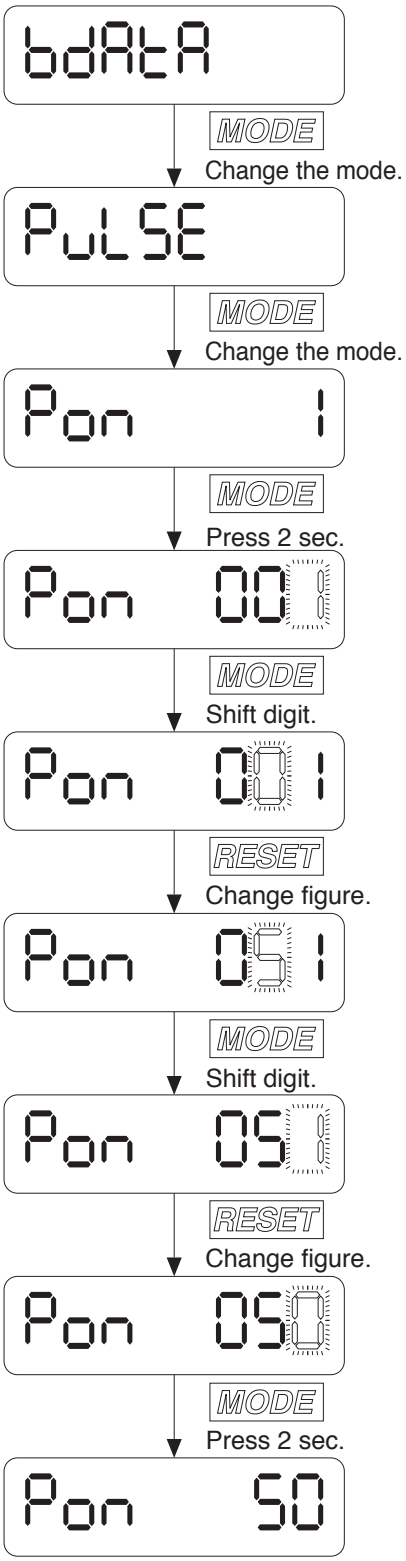
g. Sampling time



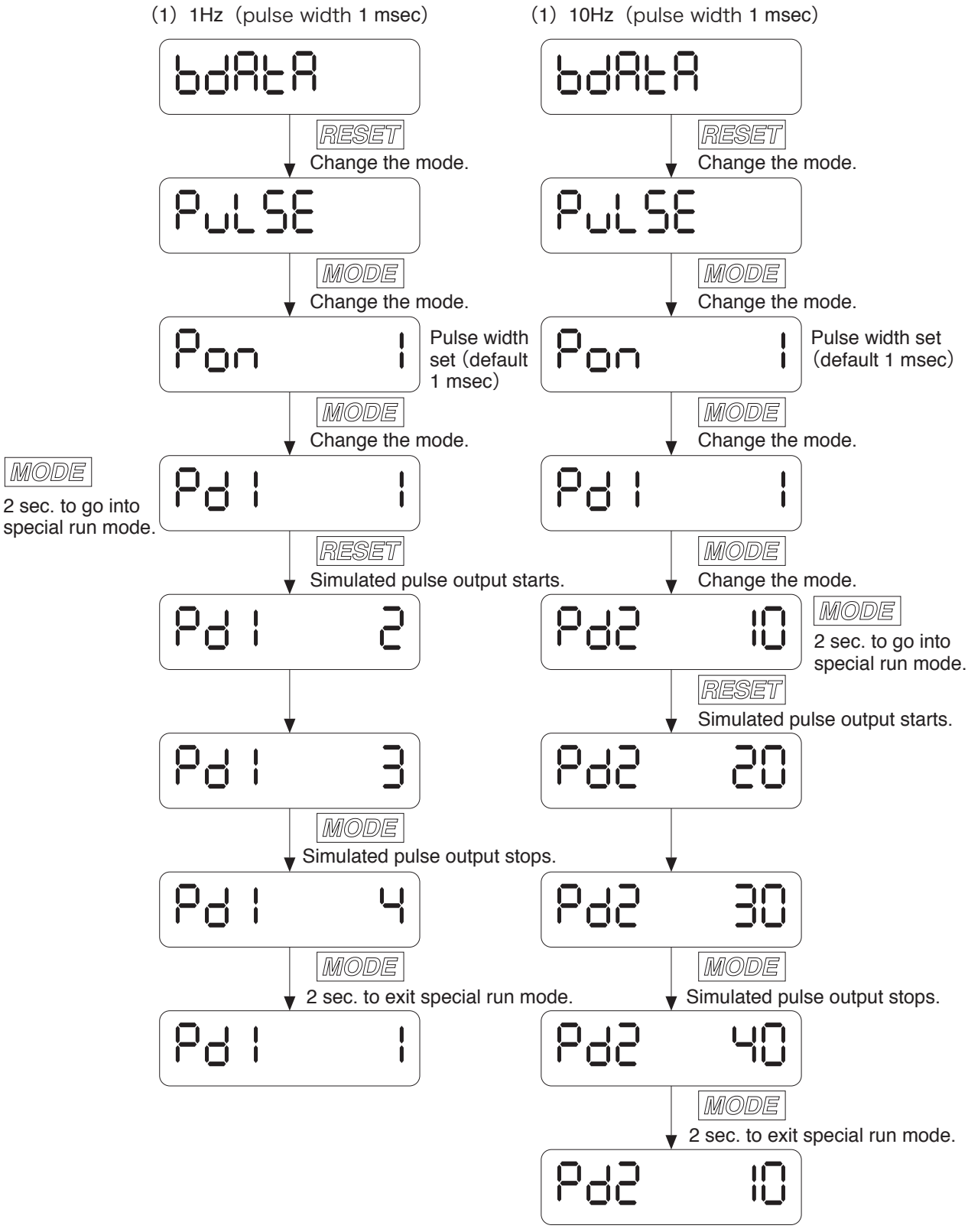
h. Sample cycle number



i. Pulse width



j. Dummy output



➡ **NOTE: In(2)10Hz dummy output above, typical indications are shown.**

10.5 How to Calculate Total Flow and Instantaneous Flowrate, and Factored Pulse Output

(1) Total flow:

In response to a single incoming pulse, an [FxH] is added up to the current total reading.

Where F: Meter factor H: Conversion factor

Down to the decimal places set up at SP (total flow decimal point location), the variable is shown.

As the counter reading reaches the maximum capacity (99999999), the counter returns to 0.

(2) Instantaneous flowrate:

On counting the number of incoming pulses within sampling time At (in seconds), their period T is measured and the instantaneous flowrate is determined by the following formula (resolution of measurement: 30 μ sec).

Flowrate/h b1 = 3600 × F × H × A/T

Flowrate/min. b2 = 60 × F × H × A/T

b1 reads to the decimal places set up at menu item bP.

b2 reads to the decimal places of b1+ 2 decimal places.

If incoming pulses are missing within sampling time At [seconds], the instantaneous flowrate reads "0".

10.6 Error Messages

The new register tells the operator on the front panel LCD the occurrence of any faulty conditions with error messages as shown in the table below.

Message	Name	Description	Action
PAErr.	Parameter setup error	An attempt is made to rewrite a parameter while parameters are write-protected. (In the standard model, write-protect feature is set in OFF and will not appear.)	Can be reset by placing No.1 of display board SW7 in OFF. (This enables you to change parameters.)
PAErr.1	Parameter error 1	Backup data retained for parameters has been damaged.	CPU initialization and then reconfiguration of parameters are required.
PAErr.2	Parameter error 2	Some of the backup data retained for the display mode, grand total flow reading, or resettable total flow reading have been damaged.	Measure mode can be restored with MODE switch, but the grand total flow and resettable total reading will be reset to 0.
PAErrPu	Pulse weight error	Pulse weight "Pu" setting is too small with respect to meter factor "F" and conversion factor "H".	Change the setting to an appropriate value that the relationship between F, H, and Pu satisfies the following formula: $\frac{F \times H}{2} \leqq Pu \leqq F \times H \times 10000$
OutErr.	Pulse output error	Pulse "OFF" width in the factored pulse output falls short of 1 msec for either reason: ① Flowrate excessive ② Factored pulse width setting too great	① Reduce flowrate ② Choose an appropriate factored pulse width "Pon" relative to the flowmeter specification.
" " (BATT mark comes on.)	Battery life	Supply voltage has dropped.	Replace the battery with a new one.

11. DISASSEMBLY AND INSPECTION

◎ **Intervals of periodic inspection may vary with individual operating conditions. However, in principal, once a year periodic disassembly and checking are recommended.**

⚠**CAUTION: Because ECO OVAL is a precision industrial instrument, disassembly and inspection should be performed indoors as a rule. If it is desired to disassemble and inspect it as installed in the field, internal pressure of the piping assembly shall be reduced to a safe level, shut off valves upstream and downstream of the meter fully, drain the piping assembly and then place a suitable fluid receptacle directly below ECO OVAL.**
Exercise care to keep disassembled parts free from grit and dust.

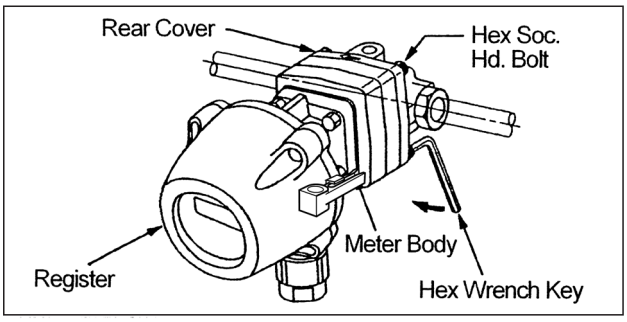
⚠**CAUTION: If the meter is of externally powered type, make sure to cut off the power before you work.**

◆ **Meter body inspection** ◆ **Process fluid fails to flow probably due to locked oval rotors with scale lodged between gear teeth.**

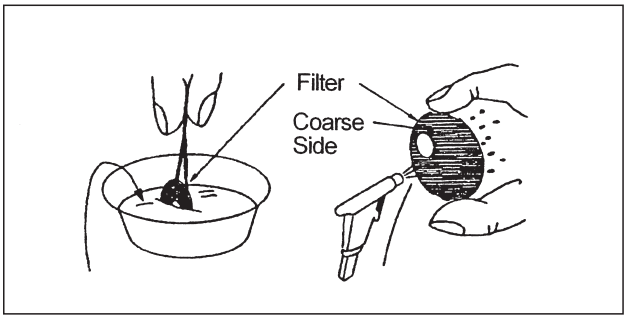
ADDITIONAL CONTENTS

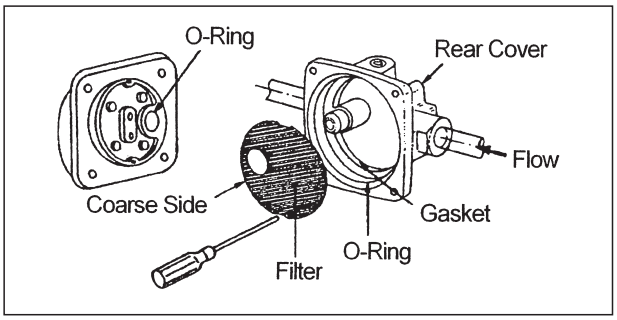
11.1 Meter Sizes 41 and 45 (meter body ID code: V)

11.1.1 Filter Cleaning



(1) Using the hexagonal wrench key, take off four bolts and separate the meter body and register assembly from the rear cover.



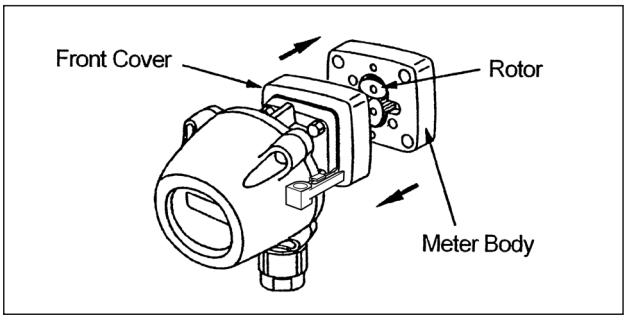


(2) The filter remains on rear cover side. Remove it with screwdriver, exercising care not to damage the gasket.

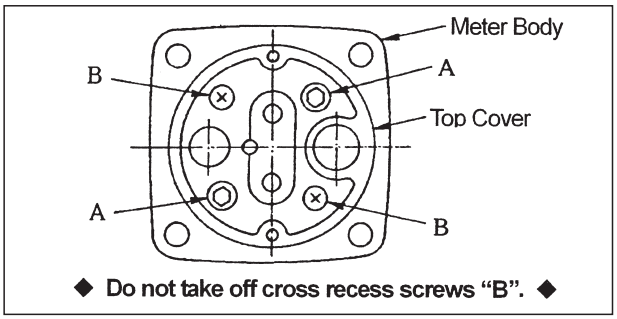
(3) Clean the filter by directing a compressed air from the coarse side or immersing in a suitable solvent.

(4) While you clean the filter, clean also the O-ring for nozzle, gasket, O-ring for rear cover. Be careful not to miss any of them.

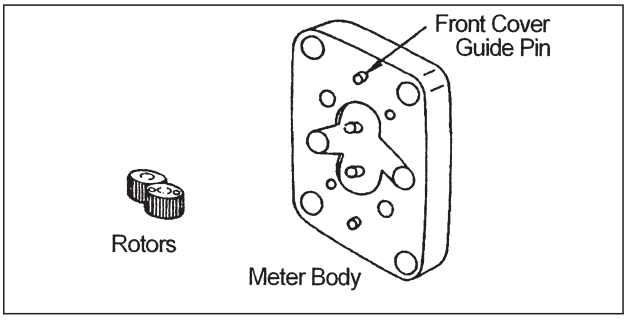
11.1.2 Meter Body Disassembly and Inspection



(1) Take off two hex socket head bolts using hexagonal wrench key and separate the rear cover from the meter body and register assembly. The rear of the meter body is now accessible.



(2) Take off two socket head bolts A using hexagonal wrench key and separate the meter body from the front cover. As a precaution against dropping the rotors, be sure to remove the front cover upwards. Without taking off cross recess screws "B", clean complete with the meter body.



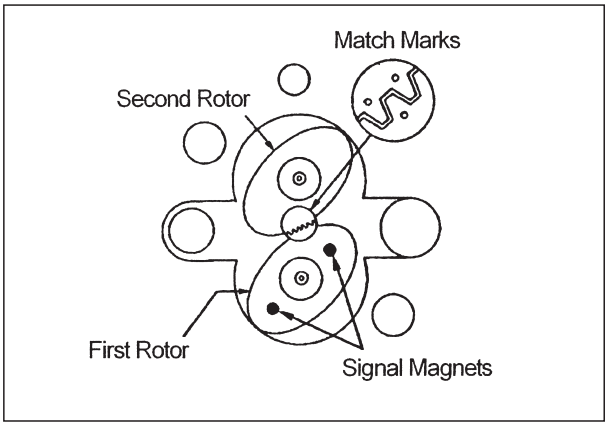
(3) With the front cover removed, oval rotors are now accessible.

(4) Remove the oval rotors.
Examine rotors for foreign matter lodged in the teeth and bearings for wear.

Individual members are precision machined and adjusted in the factory. Clean them thoroughly in suitable detergent.

11.1.3 Precautions at Meter Body Assembly

Following meter body disassembly, inspection and cleaning, assemble in the reverse order of disassembly. Be careful not to drop rotors.

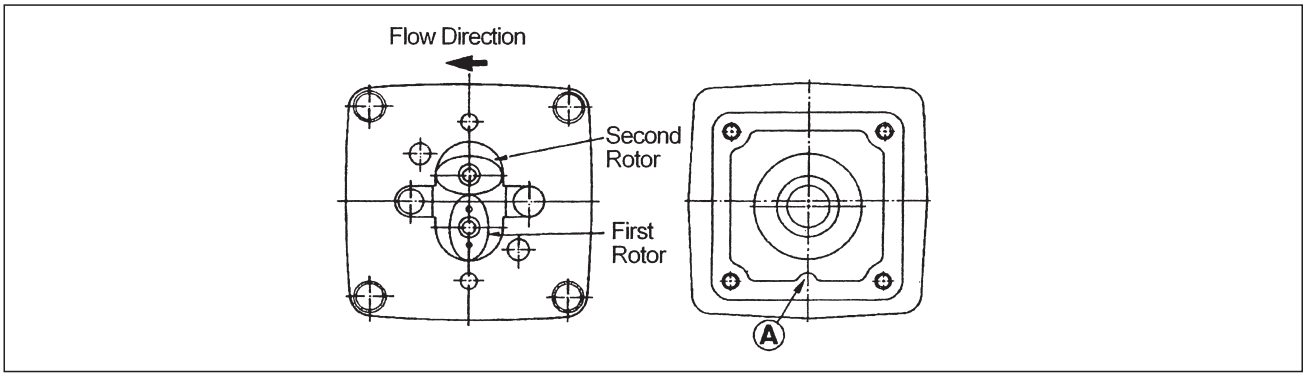


⚠ CAUTION

(1) Align match marks on the rotors as shown at right and then turn them for more than one complete revolution to ensure freely rotation.

(2) Exercise care not to install the rotors in wrong position in the measuring chamber (see diagrams below). Be sure to install the front cover in the original physical orientation.
Frame protrusion Ⓐ indicates the side facing the 1 st rotor.

(3) Do not attempt to spin the rotors abruptly at high r.p.m. by directing an air gun, or similar tool.

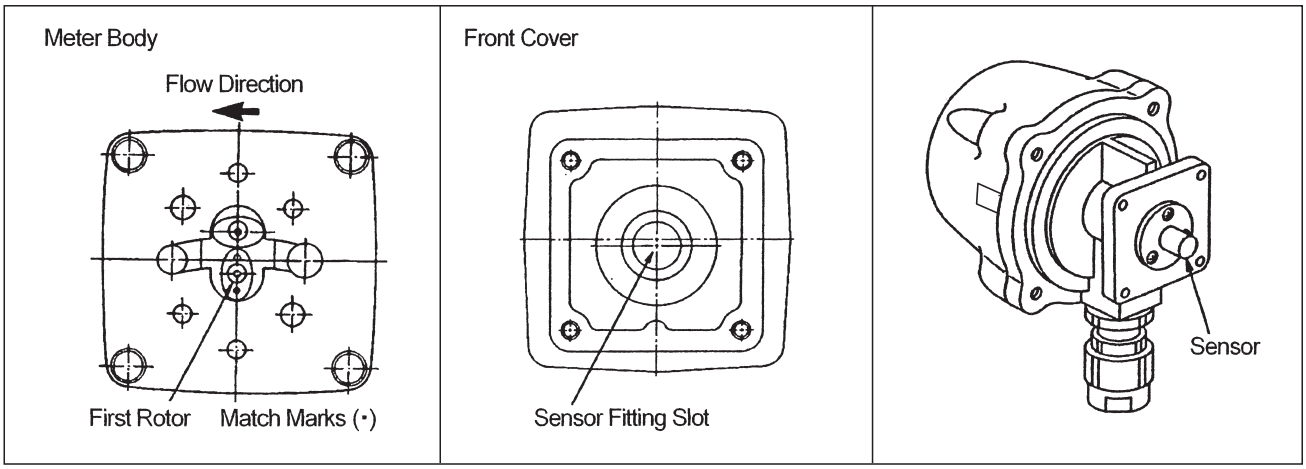


11.1.4 Rotor Installation

Do not attempt to remove the rotors unless it is absolutely necessary. If it has been removed for some reason, reinstall it by the following procedure:

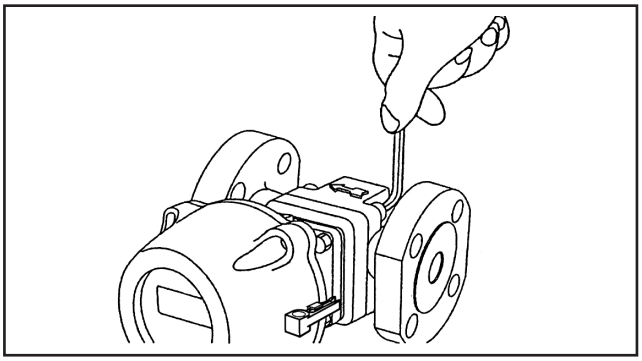
(1) If the flow direction is from right to left as shown in the figure, install the first rotor (magnet embedded rotor) under the second as viewed from the front side (register-face side).

(2) Install the front cover with the sensor fitting slot down (on the first rotor side).

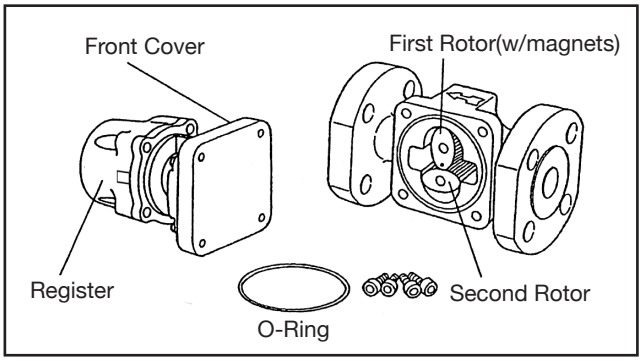


11.2 Meter Sizes 49 and 50 (meter body ID code: L)

11.2.1 Meter Sizes 49 and 50 Disassembly and Inspection



(1) Take off four hex bolts from the meter to separate the register from the meter.



(2) Holding the register and front cover in your hand, separate horizontally. Inspect the measuring chamber and remove scale adhering to components. Exercise care to avoid dropping the rotors or may result in damaging them.

11.2.2 Meter Sizes 49 and 50 Considerations in Assembly

Assembly is the reverse of the removal procedure, but please be well advised the following instructions.

(1) Assemble the rotors as shown in the sketch at right and ensure that they turn smoothly by hand at least one rotation completely.

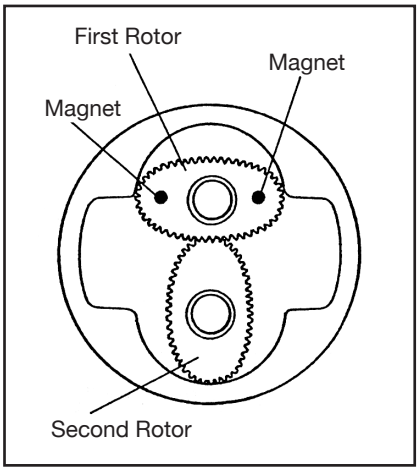
(2) Signal magnets are embedded in the first rotor. If it is desired to replace rotors, replace them as a matched pair.

➡ **NOTE: Installing the first and second rotors the other way round by no means present problems in their performance and function.**

(3) If O-ring replacement is necessary, make certain that it is free from any defects, such as flaws, before you replace it. Equally important is to use care against getting it caught in the front cover.

(4) At assembly, exercise care to preclude grit and dust from entering the measuring chamber, which may cause immovable rotors and other trouble.

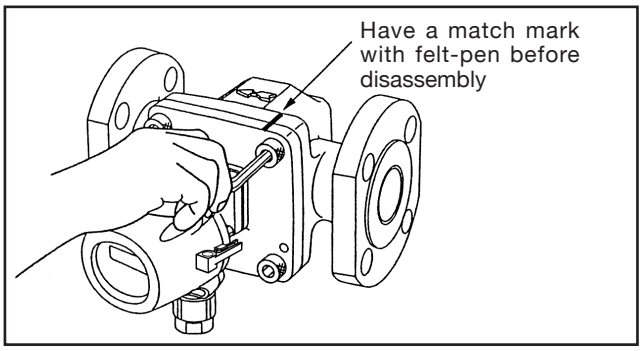
(5) Avoid spinning the rotors at high speed abruptly by flowing air with an air gun or similar tool.

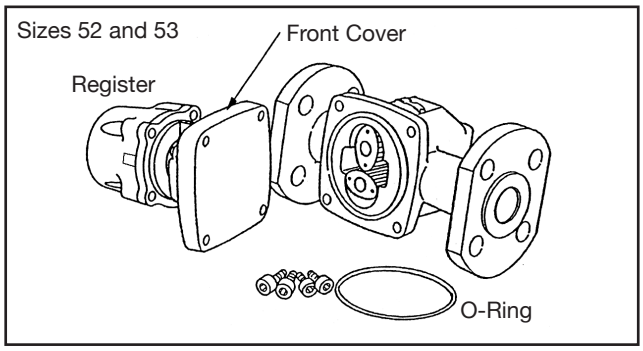


⚠**WARNING: The meter is not compatible with other registers. Never attempt to replace.**

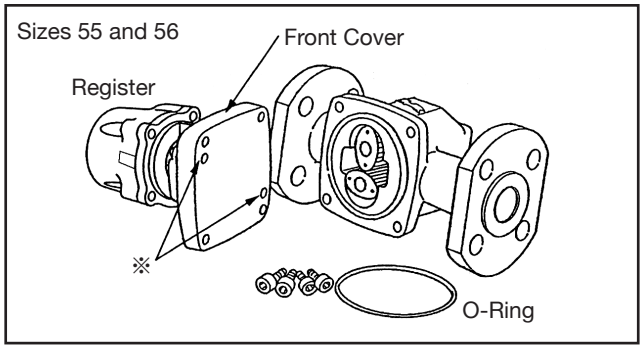
11.3 Meter Sizes 52, 53, 55 and 56 (meter body ID code: L, W, D)

11.3.1 Meter Sizes 52, 53, 55 and 56 Disassembly and Inspection



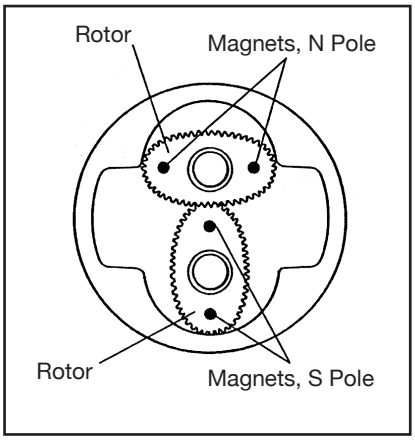


(1) Take off four bolts of the meter to separate the register from the meter.
(2) Holding the register and front cover with your hand, separate horizontally. (Screwing in the two threaded jackscrews marked ※ in the front cover will facilitate removal.) Inspect the measuring chamber and wash clean components to remove scale. Be careful to avoid dropping the rotors, which may damage them.



➡ **NOTE: Installing the front cover with screws protruding will break the front cover. Back off the jackscrews before installation.**

11.3.2 Considerations on Assembly of Meter Sizes 52, 53, 55 and 56



Assembly is the reverse of the removal procedure, but please be well advised the following instructions.
(1) Assemble the rotors as shown in the sketch at right and ensure that they turn smoothly by hand at least one rotation completely.
(2) The first rotor is identical with the second rotor except for magnet polarities. Do not confuse them with those of other products. If it is desired to replace rotors, replace them as a matched pair.

➡ **NOTE: Installing the first and second rotors the other way round by no means present problems in their performance and function.**

(3) If O-ring replacement is desired, make certain that it is free from any flaws before you replace it. Equally important is to use care against getting it caught in the front cover.
(4) At assembly, exercise care to preclude grit and dust from entering the measuring chamber, which may cause immovable rotors and other trouble.
(5) Avoid spinning the rotors at high speed abruptly by flowing air with an air gun or similar tool.

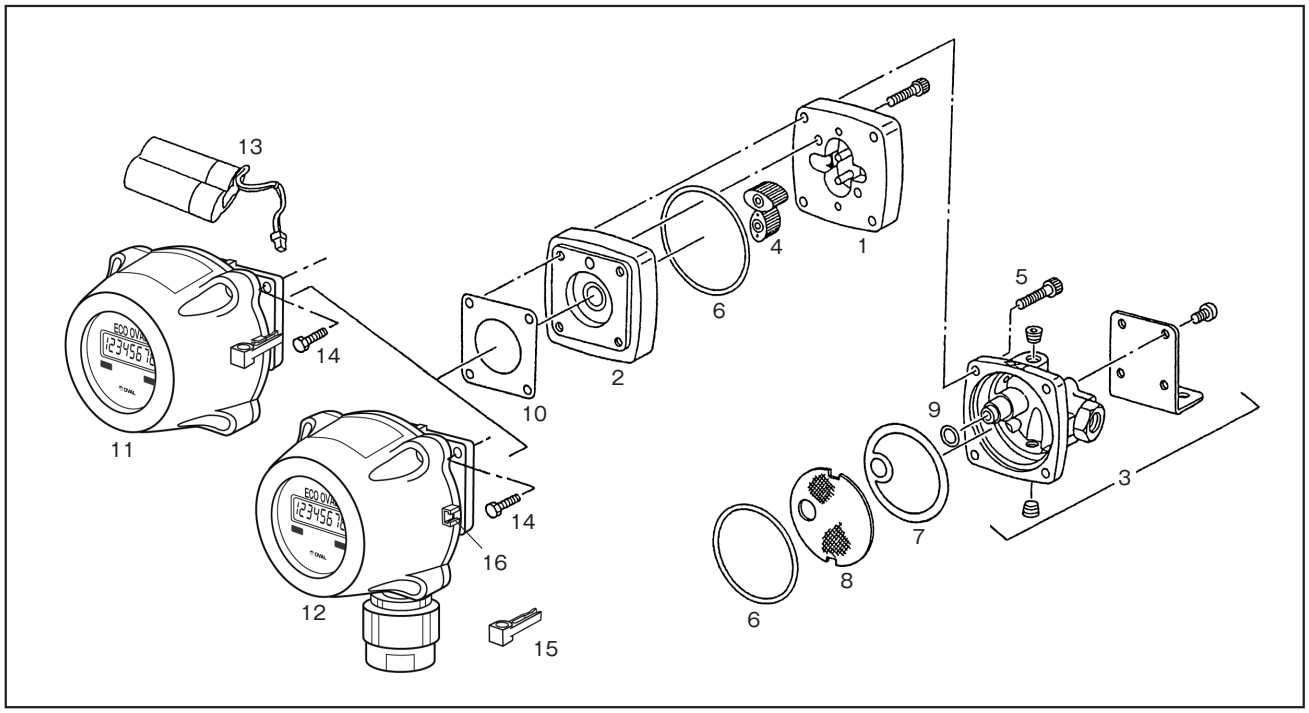
⚠ **CAUTION: (1) Score marks, scratches, bumps or dents due to impressions, or other flaws should be reconditioned flat with oilstone or similar tool.**
(2) Areas which have been in contact with front cover jack bolts are found distorted outwardly should be reconditioned flat with oilstone.

⚠ **WARNING: This meter is not compatible with other type register. Never attempt to replace.**

12. EXPLODED VIEW AND PARTS LIST

12.1 Meter Sizes 41 and 45 (meter body ID code: V)

Exploded view



Parts list

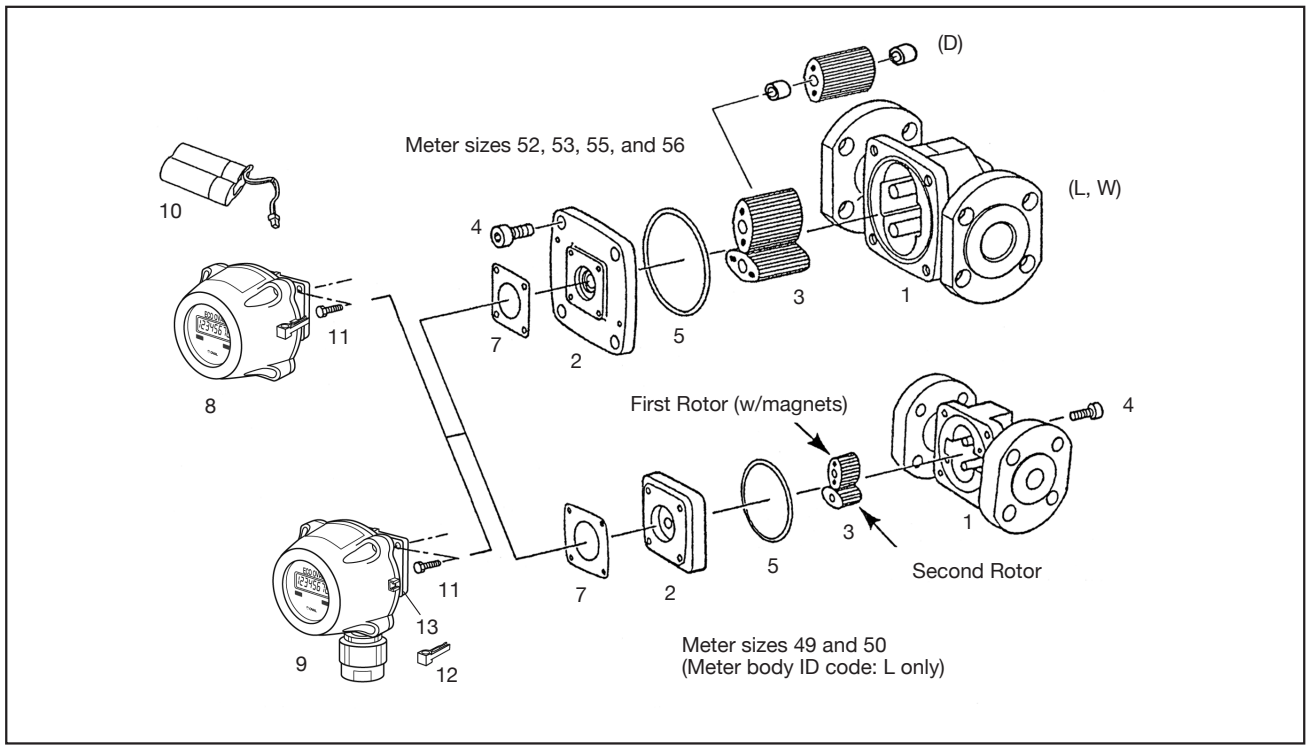
Symbol No.	Assembly Category	Part Name	Q'ty	Remarks
1	Basic Meter	Meter Body	1 set	
		Top Cover		
		Rotor Shaft		
		Dowel Pin A		
		Dowel Pin B		
		Top Cover Fitting Screw		
		Fittings and Bolts		
2	Front Cover Assembly	Front Cover	1 set	
		Front Cover Fitting Bolt		
3	Rear Cover Assembly	Rear Cover	1 set	
		Outflow Nozzle		
		Plug		Rc1/8
4	Rotor Assembly	First Rotor	1 set	
		Second Rotor (w/signal magnet)		
		Bearings		
5	Bolt	Hex Soc. Head Bolt, Rear Cover	4	
6	O-Ring		2	JIS G65
7	Gasket		1	
8	Filter		1	
9	O-Ring		1	JIS P10
10	Register Gasket		1	
11	Register		1 set	Battery pack built in
12	Register with generator		1 set	Battery pack built in
13	Battery Pack		1 set	
14	Register Fitting Bolt		4	M5×18
15	Selector Magnet		1	
16	Magnet Holder		1	w/ M3×5 flat head screw

● Parts Ordering

1. Specify by assembly unit. Supply us with the model name, instruction manual No., unit name, and the quantity required. Product code is shown on the nameplate.
2. If a replacement register is required, supply us also with the specifications of the register.

12.2 Meter Sizes 49, 50, 52, 53, 55 and 56 (meter body ID code: L, W and D)

Exploded view



Parts list

Symbol No.	Unit Name	Part Name	Q'ty	Remarks
1	Basic Meter	Meter Body Rotor Shaft	1set	
2	Front Cover	Front Cover	1	
3	Rotors	First Rotor Second Rotor Rotor Bearing (Meter body ID code: D only)	1set	Signal magnets embedded ※
4	Bolts	Hex Bolt, Front Cover	4	
5	O-Ring	O-Ring	1	
7	Register Gasket		1	
8	Register		1set	w/battery pack A
9	Register w/Generator		1set	w/battery pack B
10	Battery Pack A		1set	2 parallel batteries
11	Register Fitting Bolt		4	M5×18
12	Selector Magnet		1	
13	Magnet Holder		1	w/M3×5 flat head screw

➡ NOTES □ :(1) In meter sizes 49 and 50, magnets are embedded only in the first rotor.
(2) Signal magnet polarities differ between the first and second rotor. Do not confuse with other products.

● Parts Ordering

1. Specify by assembly unit. Supply us with the model name, instruction manual No., unit name, and the quantity required. Product code is shown on the nameplate of the product or on the periphery of the inlet flange of the flowmeter.
2. If a replacement register is required, supply us also with the specifications of the register.

13. BATTERY PACK REPLACEMENT

(1) Take off four bolts (M6) and detach the register cover (Fig. A).

⚠CAUTION:

The register body is coupled to its cover with a chain. Avoid to damage the internal wiring by pulling strongly when removing the cover.

(2) Disconnect wire leads from the register body (Fig. B).
Disconnect two wire leads from their connectors on the register substrate. Lightly holding the connector with long-nose pliers, or similar tool, uncouple perpendicularly in this process. (Do not give them a strong pull.)

⚠CAUTION:

Do not remove the black cable from the gum band. The gum band is attached to prevent the cable from being tucked. If it is removed, twist it around the gum band again referencing Fig. B after the step ④ shown in the section (5) to be described.

(3) Separate the metal cover (Fig. C).
Loosen three setscrews (M3) holding the metal cover over the battery pack and separate the cover.

(4) Remove the battery pack (Fig. D).
Holding and uncoupling the battery pack connector on the register substrate, remove the battery pack.

(5) Installing a new battery pack:
Install a new battery pack in place on the register substrate and couple the connector.
① The connector is polarized to prevent installation in incorrect orientation. Do not force into position.
② Connector installation with wrong electrodes result in no current drain and no display. Try to install into correct position.
③ Register substrate has four rectangular slots to secure the battery pack. Install the battery in line with these slots.
④ Lay the lead wires on center of the battery pack exactly the way they were installed and retain with the metal cover.(Only battery powered model)

⚠CAUTION:

1. When you remove the register housing, exercise care to preclude moisture and dust into the housing. Keep your fingers, etc. off electronic components.
2. When you install the housing cover, make sure of proper cable accommodation. (See register cover installation procedure outlined on page 7.)
3. Ensure that there is no explosive fumes around the housing before you open the cover.

Battery Pack Specification	
Manufacturer	: TOSHIBA Co.,LTD
Type	: ER17500V-2CY
Nominal voltage	: 3.7VDC
Rated capacity	: 2700mAh

● **Contact our sales representatives for replacement battery.**

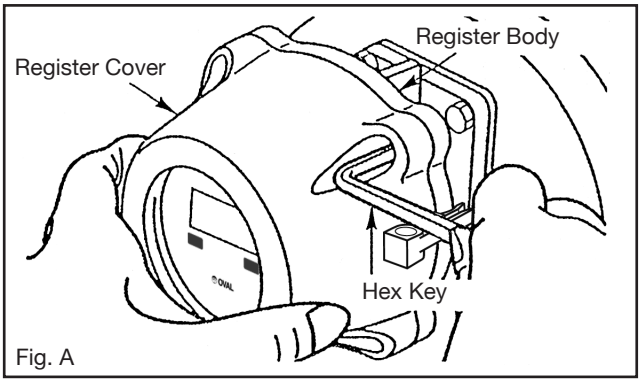


Fig. A

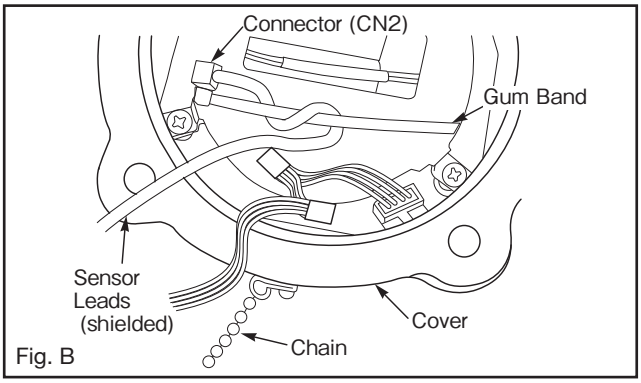


Fig. B

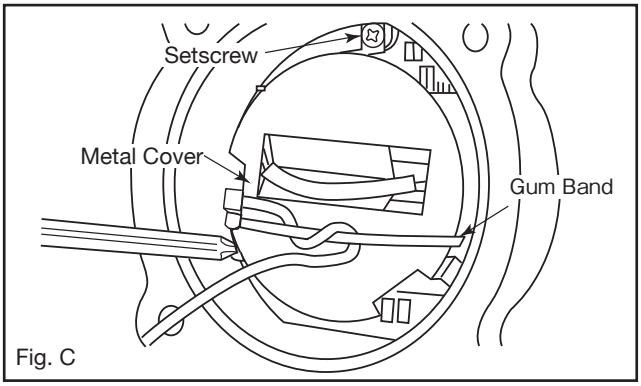


Fig. C

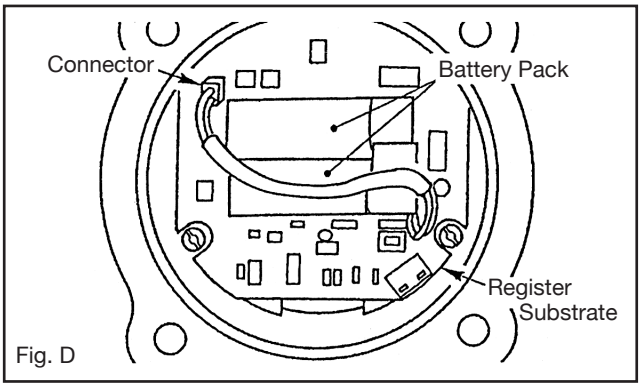
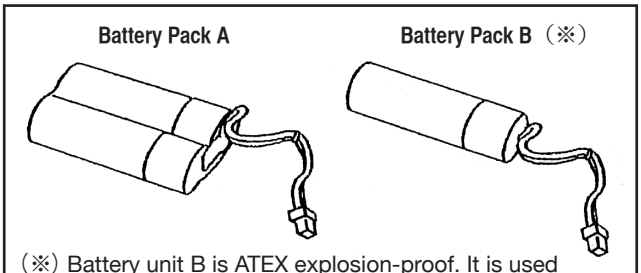


Fig. D



(※) Battery unit B is ATEX explosion-proof. It is used for an external power model.
Battery Pack

14. GENERAL SPECIFICATIONS

14.1 Meter Body specifications

Item		Description							
Meter size		41	45	49	50	52	53	55	56
Flange rating		Rc 1/4	Rc 3/8	JIS 10K RF, ASME 150 RF					
Operating temp. range		0 to 120℃, Explosionproof model : 0 to 100℃ (L, V, D), 0 to 120℃ (W)							
Max. operating press.		1.96MPa		1.18MPa (L, W), 1.19MPa (D)					
Linearity		±0.35% RD (L, V, D) (※ 1), ±1% RD (W)							
Material	Body	SCS14 (V)		FC250 (L), SCS13 or equiv. (W, D)					
	Rotors	SUS316L Sintered metal (V)		Special resin (L, W), SUS316L Sintered metal (D)					
	O-rings	Viton (V)		Viton (L, W), Front Cover : Teflon, Rotor Shaft : Perfluoro (D)					
Flow directions		Right to left (standard), left to right, bottom to top, top to bottom							
Finish		Non (V)		Munsell 2.5YR6/13 (L), Non (W, D)					

※ 1 : Model LGD operating on water 80 to 120℃ has an accuracy of ± 1% of reading.

➡ NOTE : L, W, and S in brackets ( ) show meter body ID code by material in the major categories table.

14.2 Major Categories

Meter size	Nominal size mm	Meter body ID code / Material / Flange rating	L	W	V	D
			FC250/ Special resin	SCS13 or equiv./ Special resin	SCS14/ SUS316L Sintered metal	SCS13 or equiv./ SUS316L Sintered metal
41	8 (1/4")	Rc1/4	–	–	○	–
45	10 (3/8")	Rc3/8	–	–	○	–
49	20 (3/4")	JIS10K, ASME150	○	–	–	–
50	20 (3/4")	JIS10K, ASME150	○	–	–	–
52	20 (3/4")	JIS10K, ASME150	–	○	–	○
	25 (1")	JIS10K, ASME150	○	–	–	–
53	25 (1")	JIS10K, ASME150	–	○	–	○
	40 (1・1/2")	JIS10K, ASME150	○	–	–	–
55	40 (1・1/2")	JIS10K, ASME150	○	○ (JIS only)	–	○
56	50 (2")	JIS10K, ASME150	○	○ (JIS only)	–	○

14.3 Flow Ranges

● Oil Service (Kerosene, Gas Oil, Heavy oil) (L) Material: Body: FC250/Rotors: Special resin

Unit in L/h

Meter Size	Nom. size mm / Viscosity	Kerosene	Gas Oil (heavy oil A)	Heavy oil
		Above 0.8mPa•s to 2mPa•s	Above 2mPa•s to 5mPa•s	Above 5mPa•s to 200mPa•s
49	20 (3/4")	10 to 800	7 to 800	5 to 800
50	20 (3/4")	150 to 1600	80 to 2000	50 to 2000
52	25 (1")	300 to 3000	150 to 3800	80 to 3800
53	40 (1・1/2")	600 to 5000	300 to 6400	150 to 6400
55	40 (1・1/2")	1200 to 11000	600 to 14000	400 to 14000
56	50 (2")	2000 to 20000	1400 to 24000	900 to 24000

● Water Service (W) Material:
Body: SCS13 equivalent/Rotors: Special resin

Unit in L/h

Meter Size	Nom. size mm	Water
52	20 (3/4")	200 to 1200
53	25 (1")	600 to 3600
55	40 (1・1/2")	1200 to 7200
56	50 (2")	2000 to 12000

● General chemical liquids service (V,D)
Material: Body: SCS14/Rotors: SUS316 Sintered metal

Unit in m³/h

Meter Size		Nom. size / Viscosity	80℃ to 120℃ Watter	Less than 0.3mPa・s	0.3mPa・s to 0.8mPa・s	0.8mPa・s to 2mPa・s	2mPa・s to 5mPa・s	5mPa・s to 1000mPa・s
V	41	8 (Rc1/4)	0.018 to 0.1		0.012 to 0.1	0.004 to 0.1	0.0025 to 0.1	0.001 to 0.1(※ 1)
	45	10 (Rc3/8)	0.035 to 0.5		0.035 to 0.5	0.015 to 0.5	0.010 to 0.5	0.005 to 0.5(※ 1)
D	52	20 (3/4")	0.7 to 3		0.4 to 3	0.3 to 3	0.15 to 3.8	0.08 to 3.8
	53	25 (1")	1.1 to 5		0.7 to 5	0.55 to 5	0.28 to 6.4	0.15 to 6.4
	55	40 (1・1/2")	1.8 to 11		1.2 to 11	1 to 11	0.4 to 14	0.26 to 14
	56	50 (2")	3.5 to 20		2.5 to 20	2 to 20	0.9 to 24	0.6 to 24

※ 1 : 5mPa•s to 200mPa•s to flow.

14.4 Electronic Register Specifications

Item		Description		
Functions		1. Grand total (8-digit) 2. Instantaneous flowrate (mode b1: hourly/mode 2: per-minute, selectable) 3. Resettable total (zero start/zero resettable, mode C) 7-digit 4. Low battery alarm (battery mark " " comes on below battery voltage 3.0V.) 5. Factored pulse and unfactored pulse output (externally powered model)		
Display		7-segment LCD 8-digit Characters height 10mm LCD display reads in L (standard), kL, m^3, g, kg, none (normal).		
Reading accuracy		Total:±1 count or better Instantaneous: ±1% of full scale		
Display orientation		Rotatable in 90 deg. steps		
Output signal		Type	Open collector	
		Capacity	Permissible current: 20mA DC Max. voltage application: 30V DC	
		Kind	Factored	Unfactored
		Pulse width	1ms (std.), 50ms, 100ms, 250ms	2ms (fixed)
Transmission length		1 kilometer max. (applicable to externally powered model) (※ 1) Vinyl-insulated, vinyl-sheathed control cable (CVV-S): 1.25mm^2 or equiv. Finished cable O.D.: Acceptable up to 12.0mm		
Power source		Battery powered	Powered from external source	
		3.6V DC dedicated battery pack built in Life expectancy: 8 years (Low battery alarm comes on below 3V approx.)	12 to 50V DC ±10% Current capacity 10mA min. Memory backup battery built in	
Ambient temperature range		-20 to +60℃ (Explosionproof model: -20 to +50℃) (※) Display operating range: -10 to +60℃ (Non condensing)		
Material		Housing: AC2A-T6		
Finish		Body: Munsell 10B8/4 Cover: Munsell 2.5PB4/10		
Explosionproof configuration	TIIS	No external wiring (battery powered): Intrinsically safe Externally wired: Flameproof (※ 2)		
	ATEX	No external wiring (battery powered): Intrinsically safe Externally wired: Flameproof (※ 2)		
Cable entry		Furnished with TIIS G1/2 compatible cable gland. ATEX NPT 1/2 or M20×1.5 In case used in hazardous area, make sure to use cable gland which satisfies the following requirments. Protection requirments: Exd ⅡB IP Protection requirments: IP66		
Enclosure protection rating		IP66		

※ 1: For field wiring, use cables 0.1 μF max. in capacitance and 1mH in inductance.

※ 2: The externally powered models operate on the internal battery when the external power is not supplied.

※ : This flowmeter is not provided with subtracting counter; both reverse flows and pulsations cause counts on the total flow and pulse output.

14.5 Applicable Standards

Applicable EU directive	RoHS Directive: 2011/65/EU+(EU)2015/863 EMC Directive: 2014/30/EU ATEX Directive: 94/9/EC
Applicable EN standards, etc.	RoHS Directive: EN IEC 63000 EMC Directive: EN61326-1 Class A ATEX Directive: EN60079-0, EN60079-1, EN60079-11

14.6 Factored Pulse Width Selector Tables

● Meter body ID code:L

※ : Option

Meter Size	Capacity	Factored pulse		Factored pulse selectable range				Unfactored pulse	
		Unit pulse	Output freq., Hz	1ms	50ms	100ms	250ms	Nom. meter factor	Output freq.
49	※ 999999.99×L	10mL/P	22.2	○	–	–	–	5.928mL/P	37.5Hz
	※ 9999999.9×L	100mL/P	2.22	○	○	○	○		
	99999999×L	1L/P	0.22	○	○	○	○		
50	※ 999999.99×L	10mL/P	55.6	○	–	–	–	9.912mL/P	56.0Hz
	※ 9999999.9×L	100mL/P	5.56	○	○	○	–		
	99999999×L	1L/P	0.56	○	○	○	○		
52	※ 999999.99×L	10mL/P	106	○	–	–	–	9.639mL/P	109.5Hz
	※ 9999999.9×L	100mL/P	10.6	○	○	–	–		
	99999999×L	1L/P	1.06	○	○	○	○		
53	※ 9999999.9×L	100mL/P	17.7	○	–	–	–	17.470mL/P	101.8Hz
	99999999×L	1L/P	1.77	○	○	○	○		
	※ 999999.99×m³	10L/P	0.18	○	○	○	○		
55	※ 9999999.9×L	100mL/P	38.9	○	–	–	–	34.526mL/P	112.6Hz
	※ 99999999×L	1L/P	3.89	○	○	○	–		
	999999.99×m³	10L/P	0.39	○	○	○	○		
56	※ 9999999.9×L	100mL/P	66.7	○	–	–	–	74.483mL/P	89.5Hz
	※ 99999999×L	1L/P	6.67	○	○	○	–		
	999999.99×m³	10L/P	0.67	○	○	○	○		

● Meter body ID code:W

※ : Option

Meter Size	Capacity	Factored pulse		Factored pulse selectable range				Unfactored pulse	
		Unit pulse	Output freq., Hz	1ms	50ms	100ms	250ms	Nom. meter factor	Output freq.
52	※ 999999.99×L	10mL/P	33.3	○	–	–	–	9.918mL/P	33.6Hz
	※ 9999999.9×L	100mL/P	3.33	○	○	○	–		
	99999999×L	1L/P	0.33	○	○	○	○		
53	※ 9999999.9×L	100mL/P	10.0	○	○	–	–	17.955mL/P	55.7Hz
	99999999×L	1L/P	1.0	○	○	○	○		
	※ 999999.99×m³	10L/P	0.1	○	○	○	○		
55	※ 9999999.9×L	100mL/P	20.0	○	–	–	–	35.496mL/P	56.3Hz
	※ 99999999×L	1L/P	2.0	○	○	○	○		
	999999.99×m³	10L/P	0.2	○	○	○	○		
56	※ 9999999.9×L	100mL/P	33.3	○	–	–	–	76.455mL/P	43.6Hz
	※ 99999999×L	1L/P	3.33	○	○	○	–		
	999999.99×m³	10L/P	0.33	○	○	○	○		

● Meter body ID code:V, D

※ : Option

Meter Size		Capacity	Factored pulse		Factored pulse selectable range				Unfactored pulse	
			Unit pulse	Output freq., Hz	1ms	50ms	100ms	250ms	Nom. meter factor	Output freq.
V	41	※ 99999.999×L	1mL/P	27.8	○	–	–	–	0.4896mL/P	56.7Hz
		※ 999999.99×L	10mL/P	2.78	○	○	○	–		
		9999999.9×L	100mL/P	0.28	○	○	○	○		
	45	※ 999999.99×L	10mL/P	13.9	○	–	–	–	2.468mL/P	56.3Hz
		※ 9999999.9×L	100mL/P	1.39	○	○	○	○		
		99999999×L	1L/P	0.14	○	○	○	○		
D	52	※ 999999.99×L	10mL/P	106	○	–	–	–	9.664mL/P	109.2Hz
		※ 9999999.9×L	100mL/P	10.6	○	○	–	–		
		99999999×L	1L/P	1.06	○	○	○	○		
	53	※ 9999999.9×L	100mL/P	17.7	○	–	–	–	17.513mL/P	101.5Hz
		99999999×L	1L/P	1.77	○	○	○	○		
		※ 999999.99×L	10L/P	0.17	○	○	○	○		
	55	※ 9999999.9×L	100mL/P	38.9	○	–	–	–	34.605mL/P	112.4Hz
		※ 99999999×L	1L/P	3.89	○	○	○	–		
		999999.99×m³	10L/P	0.39	○	○	○	○		
	56	※ 9999999.9×L	100mL/P	66.7	○	–	–	–	74.66mL/P	89.3Hz
		※ 99999999×L	1L/P	6.67	○	○	○	–		
		999999.99×m³	10L/P	0.67	○	○	○	○		

➡ NOTES: 1. Output frequencies are at max. frowrate.

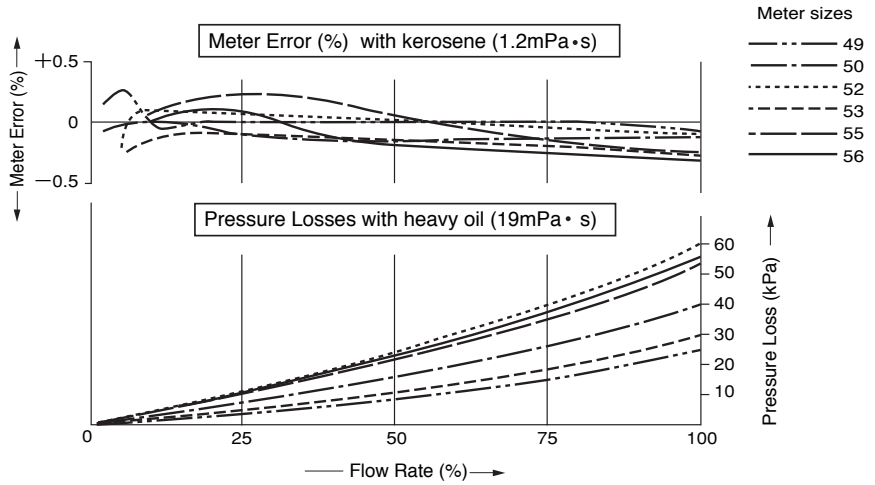
2. Shadowed figures in box are of option. If change to them is required, consult the factory.

3. Factored pulse width can be set up with front-panel switch in 1 msec.

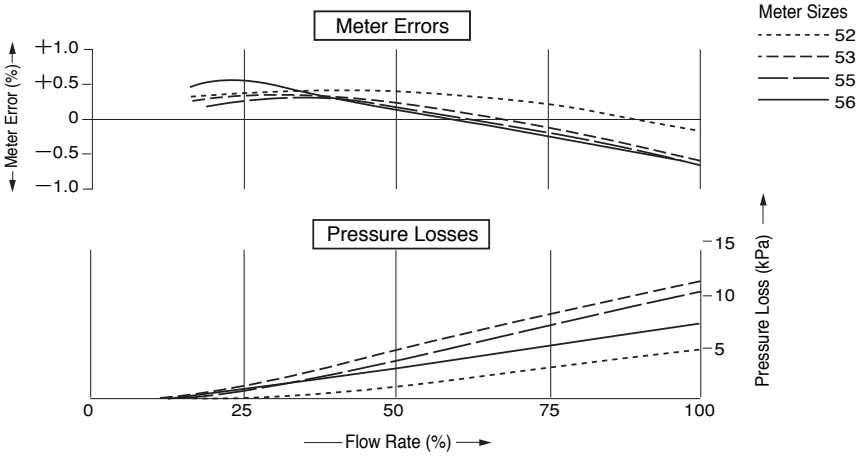
4. When altering pulse width, make sure not to bridge pulses at max. flowrate.

14.7 Meter Errors and Pressure Losses

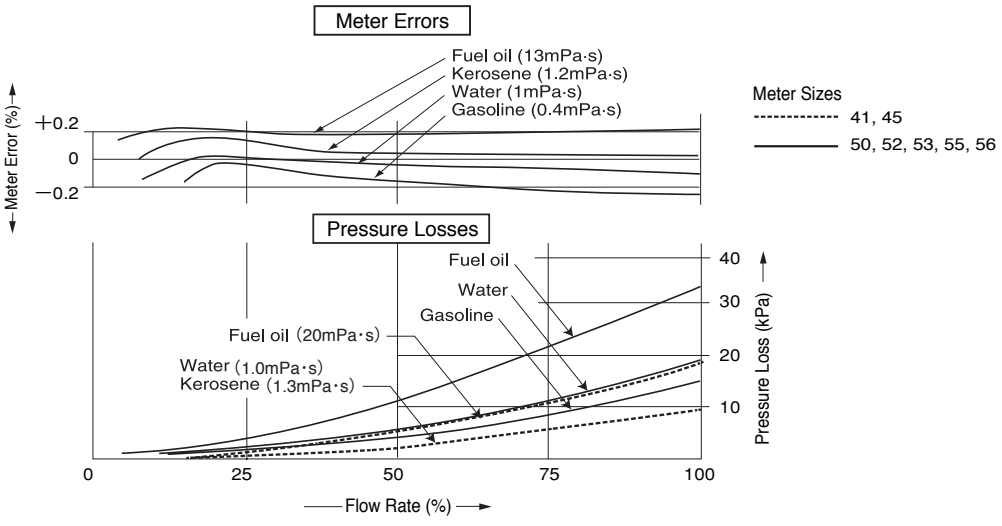
● **for Oil Service**



● **for Water Service**



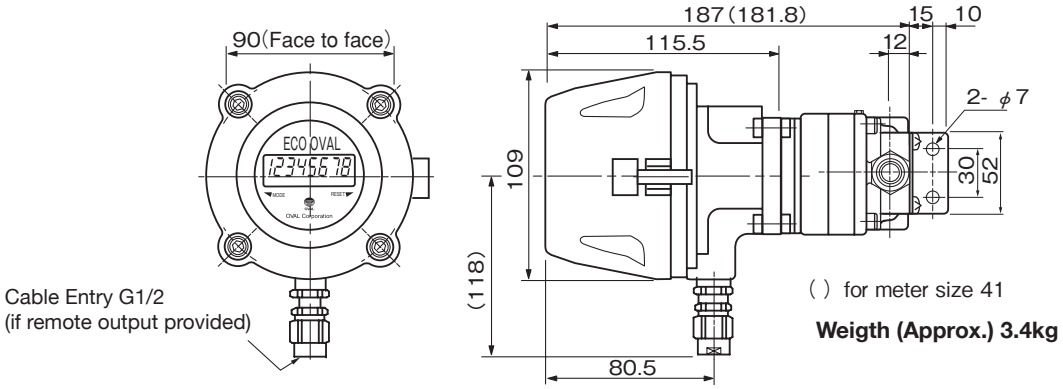
● **General chemical liquids service**



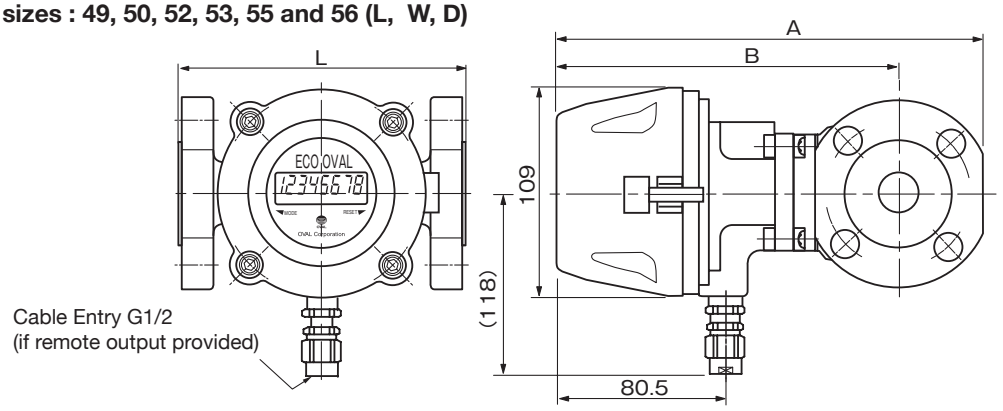
15. OUTLINE DIMENSIONS

15.1 ECO OVAL

● **Meter sizes : 41 and 45 (V)**



● **Meter sizes : 49, 50, 52, 53, 55 and 56 (L, W, D)**



Meter size	Material	Nom. size (mm)	L (mm) ※	A (mm)	B (mm)	Approx. Weight (kg)
49	L	20	150	200.5	155.5	4.2
50	L	20	150	205.5	160.5	4.2
52	L	25	225	218.5	163.5	7.2
	W・D	20	225	204.5	158.5	7.5
53	L	40	225	232.5	174.5	8.7
	W・D	25	225	229.5	172.5	9.1
55	L	40	230	236.5	178.5	10.7
	W・D	40	245	237.5	179.5	11.2
56	L	50	250	255.5	183.5	15.5
	W・D	50	280	255.5	183.5	16.9

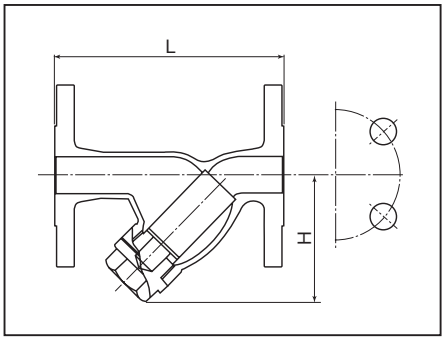
※ : JIS 10K RF dimensions are shown here. For ASME 150 RF, consult the factory.

15.2 Strainers

⚠ CAUTION : 41, 45 models (Meter body ID cord V) are of 200 mesh strainer built-in.

● General chemical liquids service (LGD) Visocsity : Max. 5mPa・s

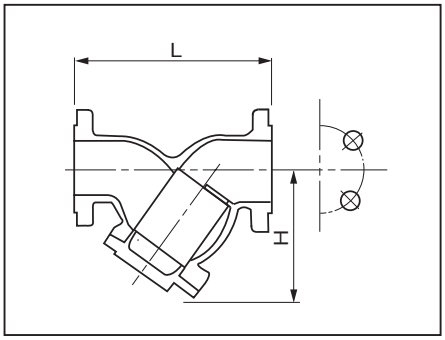
Item		Description
Operating Temp. Range (fluid temp.)		0 to 120℃
Max. Operating Pressure		0.98MPa
Materials	Body	SCS13A
	Net	SUS316/SUS304
Finish		Unpainted
Allowable diff. press. on net		0.1MPa



Model number	Nominal size (mm)	Net Mesh	L (mm)	H (mm)	Flange rating	Weight (kg)	Applicable meters
YKL13F-20J	20	100	140	75	JIS 10K RF	2.5	52
YKL13F-25J	25	100	160	85		4	53
YKL13F-40J	40	60	190	110		6	55
YKL13F-50J	50	60	220	130		8	56

● Oil and water service (LGL, LGW)

Item		Description
Operating Temp. Range		0 to 120℃
Max. Operating Pressure		1.18MPa
Materials	Body	FC250
	Net	SUS304
Finish		Orange (Munsell 2.5YR6/13)



Model number	Nominal size (mm)	Net Mesh	L (mm)	H (mm)	Flange rating	Weight (kg)	Applicable meters	
							LGL	LGW
SS5278A	20	80	125	82	JIS 10K RF	3.4	49, 50	52
SS5378A	25	60	140	104		5.3	52	53
SS5578A	40	60	170	129		7.7	53, 55	55
SS5678A	50	60	190	153		9.6	56	56

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