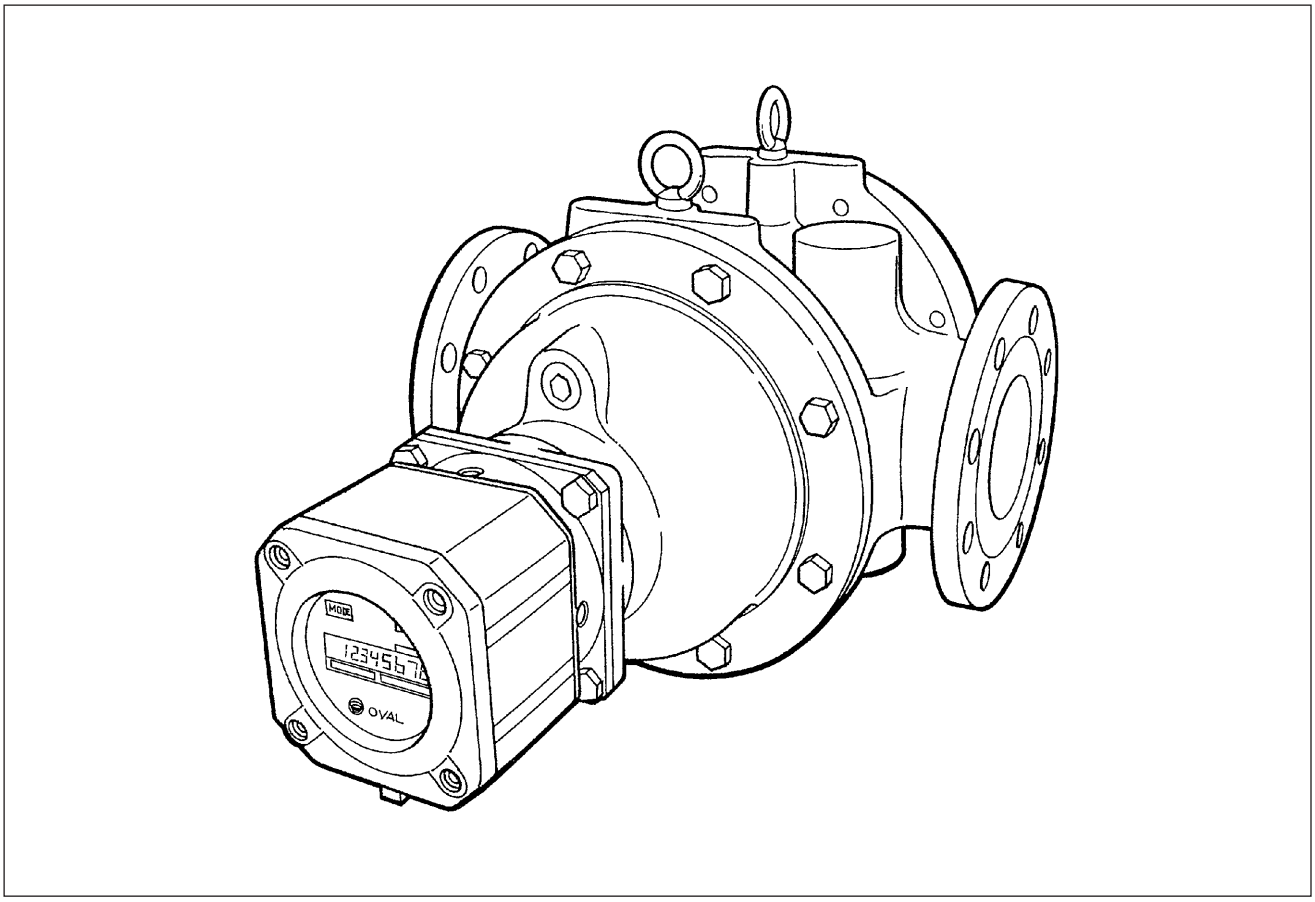
OVAL INSTRUCTIONS

Ins. No. B-525-8-E

ULTRA UF-II

Meter Sizes : 80 and 81
Register Model : A (Standard type)
H (Smart type)



Every **ULTRA UF-II** (electronic register equipped flowmeter) is fabricated and shipped from our factory under stringent quality control. In order to maintain its design performance throughout its life, this manual offers the operator the necessary installation, operation and maintenance information.
Be well familiar with these instructions before you place the meter in service and retain this manual at the field location for ready reference.

◆ About Meter Size Designation ◆

The size of OVAL positive-displacement flowmeters is basically identified by a two-digit code. For details, see Section 19 Product Code Explanation.

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⚠ **CAUTION: ● marked sections apply to Smart type**

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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.

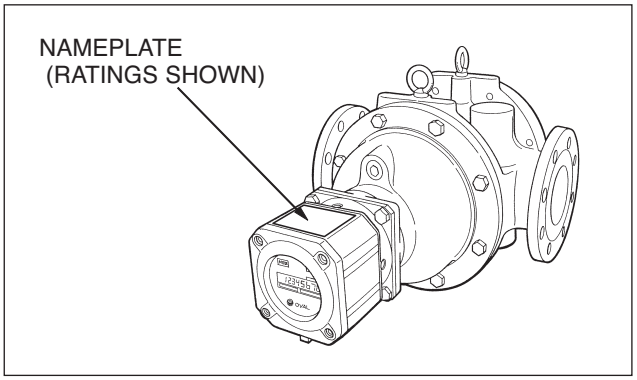
1. BEFORE YOU BEGIN

Every ULTRA UF-II is thoroughly tested before it leaves the factory. When received, it should be thoroughly inspected for indication of rough handling during transit. Necessary handling precautions are described in this section; read the instructions carefully.
As for other information, find the respective sections from "CONTENTS" on pages 2 and 3.
For any inquiries, contact your nearest OVAL designated sales office.

⚠ CAUTION: When you make inquiries, include the product name, model number, serial number, ratings and other necessary information.

1.1 Confirming the Nameplate

Every ULTRA UF-II is assembled and adjusted according to individual specifications. Product code and ratings are stated on the register nameplate (page 5). Make sure that, by referring to the GENERAL SPECIFICATIONS on page 40 and PRODUCT CODE EXPLANATION page 42, the ratings shown conform to your particular specification.



1.2 Transportation Considerations

(1) To safeguard against damage during transit, transport the ULTRA UF-II to the installation site in the same container used for transportation from the factory if circumstances permit.
(2) ULTRA UF-II is adjusted and inspected as an assembly consisting of the meter body, sensor and register. It should therefore be handled as an integral assembly.
(3) The register is accurately set up and adjusted. Do not attempt to remove the front cover to gain access to its internal assembly.

1.3 Storage Considerations

If an ULTRA UF-II 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 your ULTRA UF-II in store in the same shipping container used for transportation from OVAL if possible.
(2) Place of storage should conform to the following requirements:
  ★ 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°C and 65%).
(3) Purge the ULTRA UF-II 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 of storage for extended periods of time, good practice is to keep in store in the same containers used for shipment from the factory.

1.4 Structural Considerations

(1) The register is of weathertight construction for outdoor service.

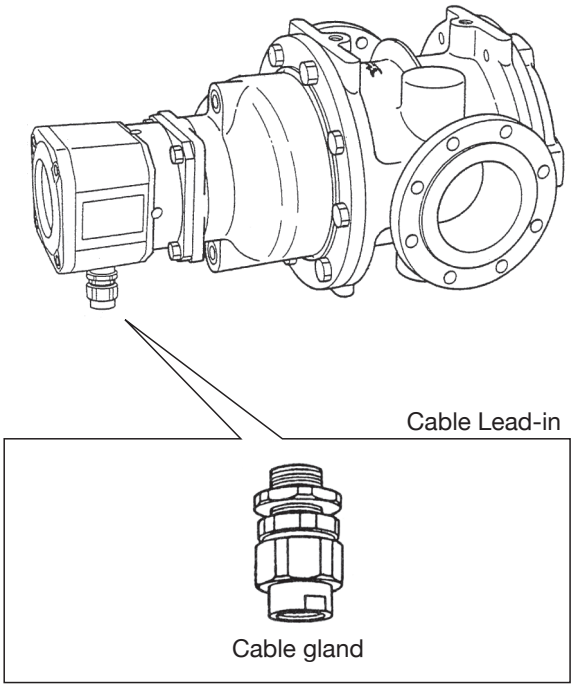
(2) Do not attempt to replace component parts with substitutes or perform unauthorized circuit modifications.

(3) The cable lead-in supplied with the explosionproof type forms part of the flameproof enclosure. Do not attempt to use any substitute lead-in other than those supplied. The pressuretight packing union should be tightened securely upon completion of connections.
- Output provided: For other than 00 in the last two digits of product code, pressuretight packing is supplied.
- Output not provided: For other 00 in the last two digits of product code, close-up plug is supplied.

(4) Of the four different pressuretight packings (ϕ9, ϕ10, ϕ11 and ϕ12) furnished as standard accessories, a ϕ11 packing is tentatively installed in place. Select from these and install the one that best fits the finished outside diameter of your particular cable.

Table 1.1 Applicable Cable Outside Dia. Unit 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

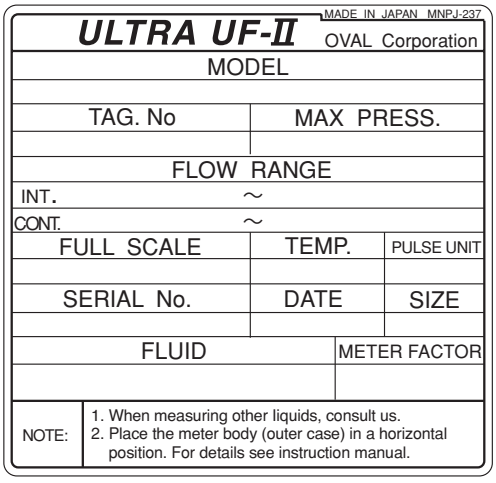


➡ NOTE: Cable gland is not supplied with non-explosionproof type models. The customer is to prepare a watertight gland (thread size: G1/2). In such a case, provide means to preclude moisture from the register.

⚠ **CAUTION: Moisture intrusion into the register may make the display cloudy and cause problem.**

2. OPERATING CONDITIONS

To maintain the stated high accuracy and long service life of OVAL UF-II flowmeter, make sure that flowrate, pressure, temperature and viscosity are held within the ratings shown in the nameplate attached to the top of the register. Do not fail to confirm these ratings before placing it in service.



⚠ **CAUTION:**

(1) Although allowable ambient temperature is up to +60 °C for explosionproof units, it is desirable that the meter be used at room temperature and humidity.

(2) In cases where the register is exposed to elevated temperatures due to exposure to direct rays of the sun or to radiant heat, ensure, by providing a sunshade or similar protection, that the meter is used within the operating temperature range.

(3) Standard ULTRA register is not provided with subtract function. If pulsation in the flow (where the fluid moves back and forth in the pipeline under the influence of pressure) or reversal of flow exists, the total counter may show erratic reading, accumulating all incoming pulses irrespective of flow direction.

2.1 Operating Conditions for Explosionproof Model

This product is approved as explosionproof. Failure to comply with the following conditions will automatically nullify this rating.

(1) Do not perform any unauthorized modification to this product.
(2) Before opening the enclosure, if necessary for some reason, ensure safety against hazards associated with flammable gases present in the atmosphere.
(3) Standard ULTRA register; In case of TIIS explosionproof type used under the ambient temperature of 45°C or higher, use a cable resistant to the temperature of 75°C or higher.
Smart Type ULTRA register; In case of TIIS explosionproof type used under the ambient temperature of 50° C or higher, use a cable resistant to the temperature of 70°C or higher.
(4) Intrinsically safe rating remains valid only when no external circuit is connected to this equipment. To use it rated intrinsically safe, do not connect it to any external circuitry.
(5) Use under ambient temperature conditions below 60°C.
(6) Metered fluid temperature must be held below 120°C.

Specification (1): Output provided (Product code ends with a code other than 00.)

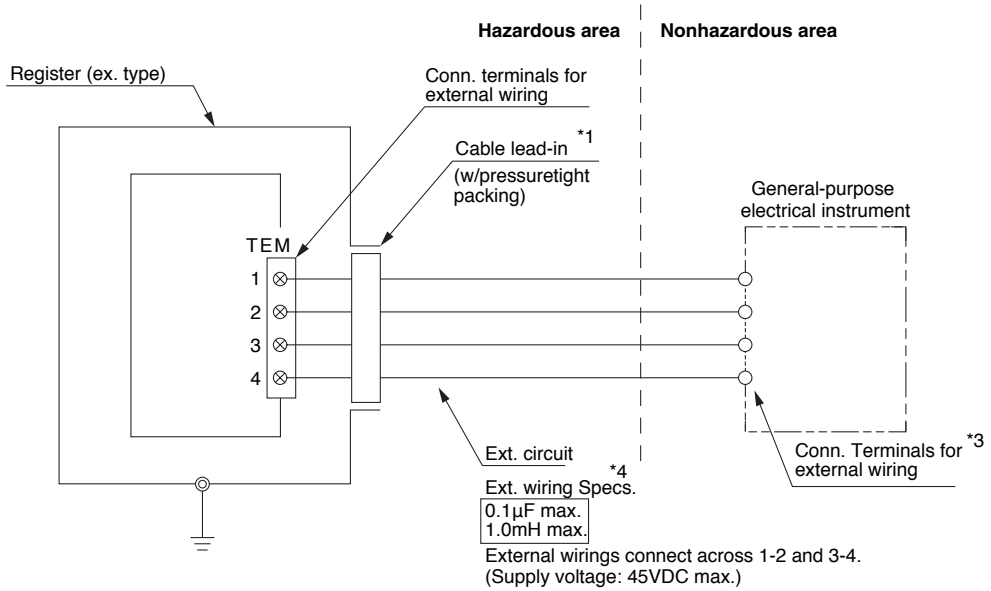


Fig. 2.1

Specification (2): Output not provided (Product code ends in 00.)

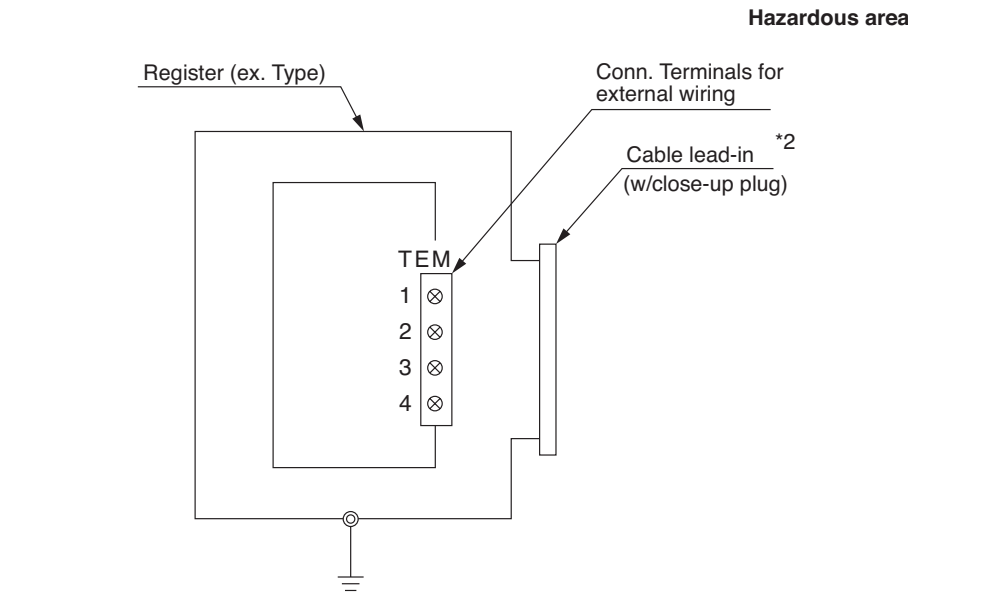


Fig. 2.2

➡ NOTE : Detailed explanation of asterisks *1 through *4 in Figs. 2.1 and 2.2.

*1 *3 *4	Explosionproof enclosure of the ex type equipment is represented by a code Exd II BT4/Exia II BT4. For models with the provision of output (product code ends with a code other than 00), a pressuretight packing *1 for cable entry is supplied as standard accessory. Flameproof rating (Exd II BT4) remains valid as long as it is used in place. However, because of a built-in battery pack, if supply power is removed from this state and an external circuit *4 is disconnected at the external circuit wiring connection terminals end *3, then intrinsic safety rating (Exia II BT4) applies.
*2	For models with no provision of output (product code ends in 00), close-up plugs *2 (manufactured by Shimada Electric, Model SBP-16) for cable entry are supplied as standard accessories. Intrinsically safe rating (Exia II BT4) remains valid as long as these are used in place.
*4	In working with models with provision of output (product code ends with a code other than 00), use cables that link this product with a general-purpose electrical instrument, (receiving instrument, etc.) which meet the following requirements: • Temperature rating : Register Model UA; In case of TIIS explosionproof type used under the ambient temperature of 45°C or higher, use a cable resistant to the temperature of 75°C or higher. Register Model U8; In case of TIIS explosionproof type used under the ambient temperature of 50°C or higher, use a cable resistant to the temperature of 70°C or higher. • Electrical ratings : Allowable cable capacitance 0.1, μF max. Allowable cable inductance 1.0mH max.

3. GENERAL

This flowmeter has been developed to meet the needs of precise flowrate measurement. The local direct-reading total counter is an all-electronic register built around a single-chip CPU. With latest electronic technologies used throughout, this versatile register displays accumulated total flow, instantaneous flowrate (digital readout) and provides, by option, a pulse and analog output proportional to the rate of flow.
In this meter, fluid flow is detected by sensing with an amorphous sensor the magnetic fields of permanent magnets embedded in the oval rotors. As a result, high reliability is achieved.

Features

(1) Uniform-speed revolution, uniform flowrate, and uniform torque.
(2) Exceptionally quiet with no noise and low vibration.
(3) You can monitor accumulated total flow and instantaneous flowrate locally on the digital display.
(4) When coupled with a remotely located receiving instrument, output signals can readily and simply be used for applications including control, adjustment and recording.
(5) IEC explosionproof construction offers increased safety. A compactly built body.
(6) A low battery alarm is among its alarm indicator functions.
(7) Both in the local totalizer model and externally powered model, a nonvolatile memory retains variables in cases of power cycling and power failure.

➡ NOTE : For battery life, see Section 9.4 on page 18.

<NOTE>

With the use over an extended period of time, meter error will deviate more or less from the factory calibration's. Upon request, we may conduct an instrumental error testing once again and establish a "new meter factor" in the scaler when your UF-II flowmeter is returned to the factory for periodic inspection or for other reasons.

4. PART NAMES

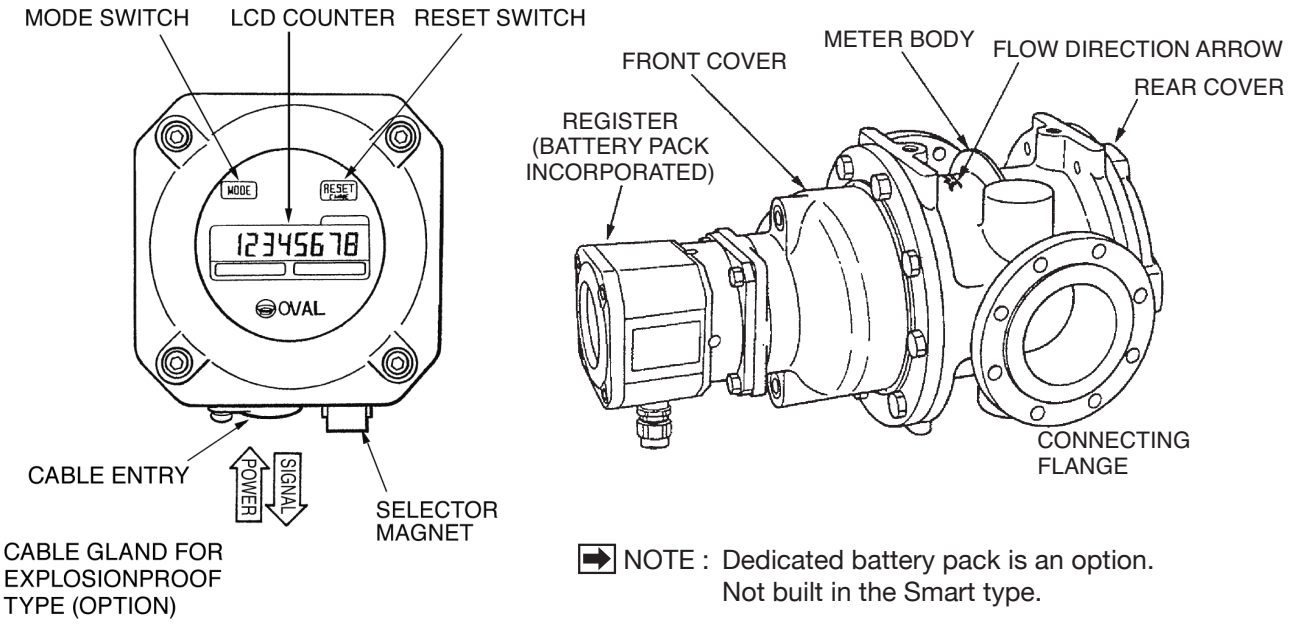


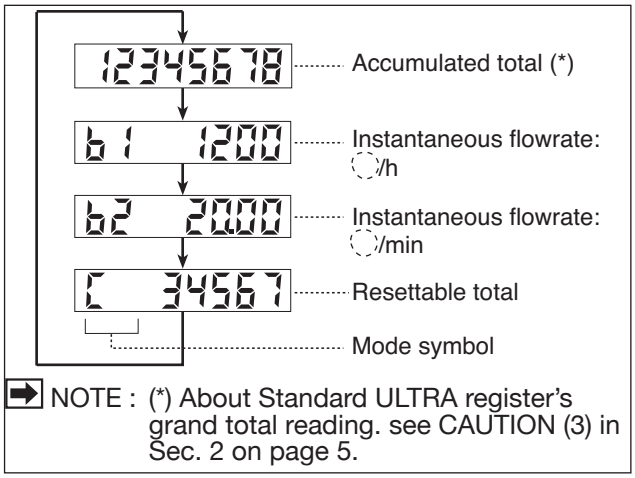
Fig. 4.1

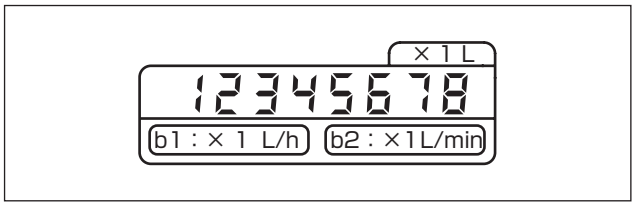
5. LCD COUNTER DISPLAY

5.1 Standard ULTRA register

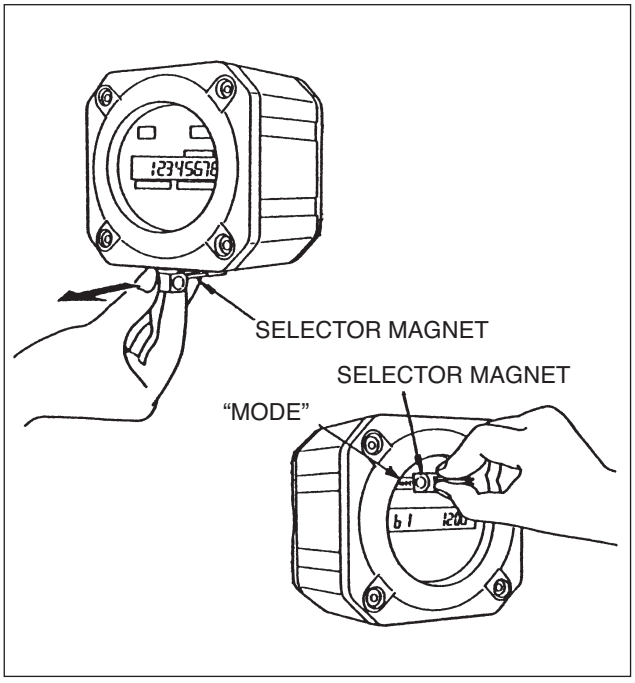
5.1.1 About "MODE" Switch

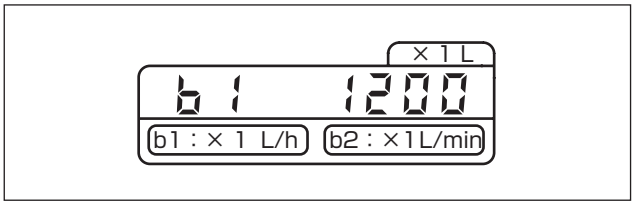
Take out the selector magnet inserted at the bottom of the register, apply it to the labels "MODE" and "RESET" on the LCD counter face and the display will scroll through the available readings as shown.



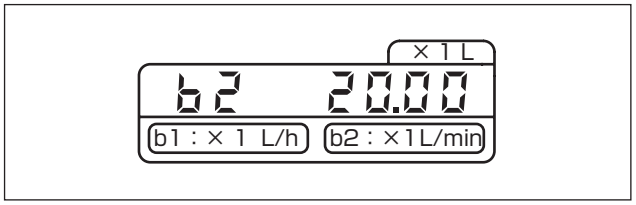


(1) Accumulated Total Flow
An accumulated total of 12345678 L is shown here.

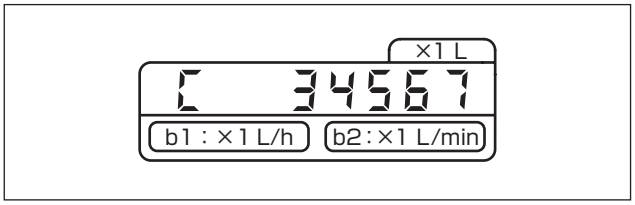




(2) Instantaneous Flowrate (b1)
An instantaneous flowrate of 1200 L/h is shown here.



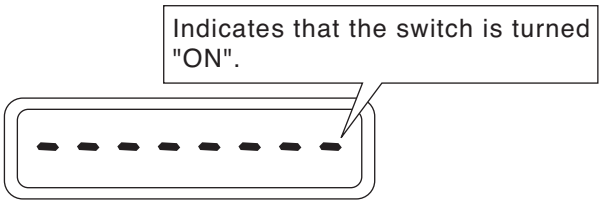
(3) Instantaneous Flowrate (b2)
An instantaneous flowrate of 20.00 L/min. is shown here.



(4) Resettable Total Flow
A resettable accumulated total of 34567 L is shown here.

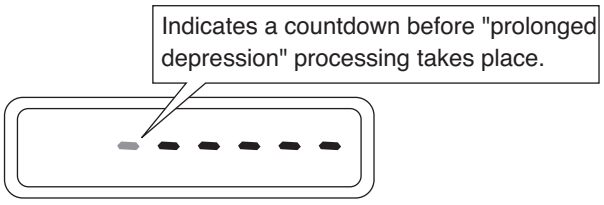
5.1.2 About the Displayed Messages during Operation

(1) Ordinary operation
"MODE" switch is turned "ON"
(selector magnet held close to it.)
⇒ 8 bars appear.



⇒ Immediately turning "OFF"
(selector magnet the window to the next one.

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



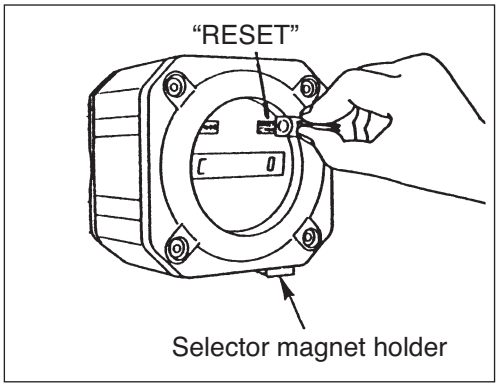
⇒ Holding turned "ON" until the last bar disappears results in "prolonged depression" processing (*) to takes place.
(Turning "OFF" before the last bar disappears results in the same behavior as in (1) to take place.
* Prolonged operation: An operation required for Normal mode ⇔ Parameter review mode 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.)

5.1.3 About "RESET" Switch

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

⚠ CAUTION
Do not fail to install the selector magnet in its holder after use lest you will not lose it. It uses an intensive magnet; never hold it close to floppy disks or other magnetic storage items.

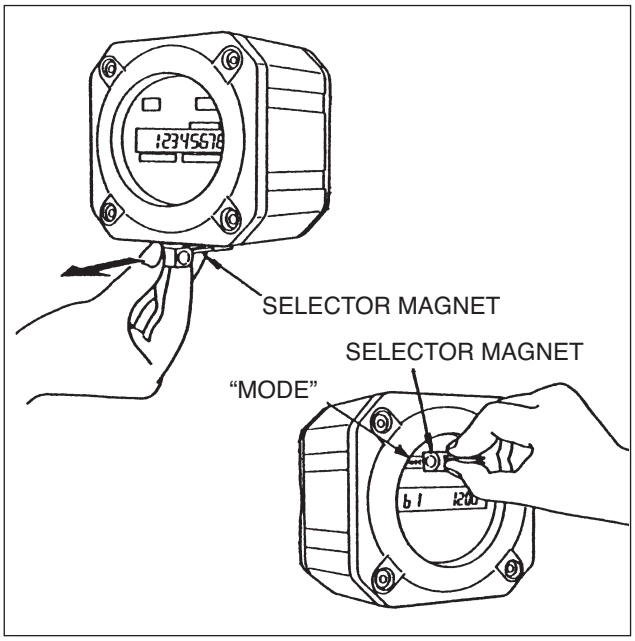


5.2 Smart Type ULTRA register

5.2.1 About "MODE" Switch

Take out the selector magnet inserted at the bottom of the register, apply it to the label "MODE" on the LCD counter face and the display will scroll forward through the available readings as shown.

⚠ CAUTION
Do not fail to install the selector magnet in its holder after use lest you will not lose it. It uses an intensive magnet; never hold it close to floppy disks or other magnetic storage media.



5.2.2 Display Functions

The display can show four different kinds of flow information - total flow, instantaneous actual flowrate, percent instantaneous flowrate, and 8-division percent bar graph.
It also shows the following error messages:

Full scale exceeded: **ErrorFS**
Upper-limit flowrate exceeded: **ErrorOF**

➡ NOTE : Multiple errors will be indicated in priority order below:
ErrorOF > ErrorFS

5.2.3 Display Selection

Two ways are available to select displays - with a display select switch inside the register, or through communications with the Smart Communication Unit Model EL2310.
If your option is through communications, follow the instructions outlined in the Smart Communication Unit EL2310 instruction manual.

➡ NOTE : Show "Transmitter Info." window at "Configure" menu on the PC screen.

Selection with display select switch requires access to the display select switch SW1 by opening the register cover facing its internal assembly and pressing this switch (see page 33). The display scrolls forward through available information each time you press this switch as shown in Fig. 5.1.

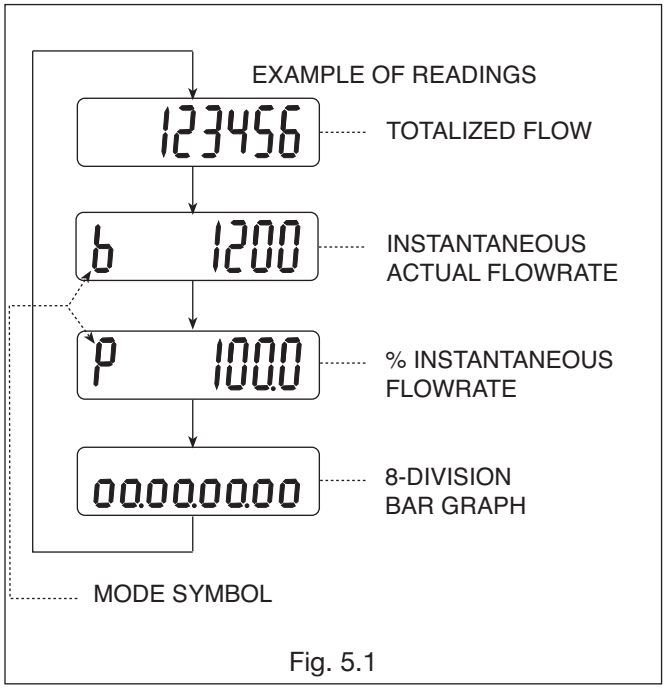


Fig. 5.1

5.2.4 Total Flow Reset

Displayed total flow can be reset either by the display select switch SW1 (see Fig. 12.1 on page 33) or through communications with the Smart Communication Unit. If your option is through communications, follow the instructions outlined in the instruction manual of Smart Communication Unit EL2310.

➡ NOTE : NOTE: Show "Measure" window at "View" menu on the PC screen.

With the display select switch, you can reset the totalizer by holding the display select switch SW1 depressed for more than 3 seconds while the total flow is shown.

5.2.5 Precautions for Pulse Output Type

(1) If your model is of pulse output type, the pulse output and total counter remain inoperative for 15 seconds approx. after power on while communicating with the Smart Communication Unit. For 15 seconds approx. after termination of communications, the pulse output and total counter also remain inoperative.

(2) Requirements for validating communications
Communication is valid only when the following requirements are met:
- Flowrate at zero (There is no pulse output.)
- Within 15 seconds after powered on

➡ NOTE : The period of 15 seconds immediately after power on is called "Communication standby mode." (The built-in indicator, if so equipped, will display as shown in (1) in the figure below.)
If communications are started during this time period, a switchover to "Communication mode" takes place, permitting you to communicate until power is turned off (The built-in indicator will display as shown in (2) in the figure below).
To start flow measurement routine, power on again. (After power cycling, the pulse output and total counter will also remain inoperative for 15 seconds.)

(3) While communications continue, the receiving instrument (total counter, etc.) may overcount under certain

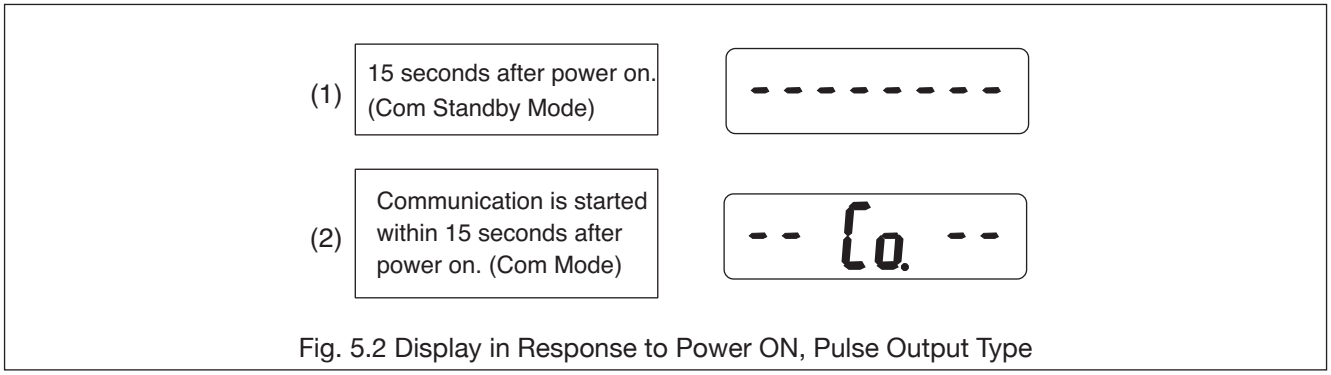


Fig. 5.2 Display in Response to Power ON, Pulse Output Type

circumstances. To eliminate the possibility of such erratic extra counting, precautions should be taken by either disconnecting the receiving instrument before starting communications, or keeping track of the most recent total reading and other important data.

(4) Except for the purpose of communications, do not attempt to connect the probe of Smart Communication Unit with the signal lines. If the probe remains connected, the pulse output signal may be distorted due to the influence of capacitive impedance the interface has, resulting in the receiving instrument could fail to receive the pulse signal accurately.

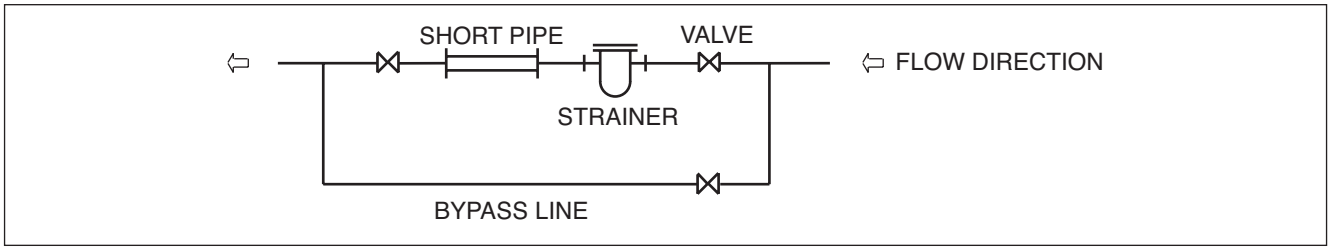
⚠ PRECAUTIONS with ANALOG OUTLINES

The analog type permits communications with the Smart Communication Unit at any time. However, in parameter change according to the specification, considering a possibility of erroneous setting which could disturb the operation of the receiving instrument by a surge of power output, you are recommended to change the parameters while stopping the fluid flow.

6. INSTALLATION

6.1 Considerations on Installation

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

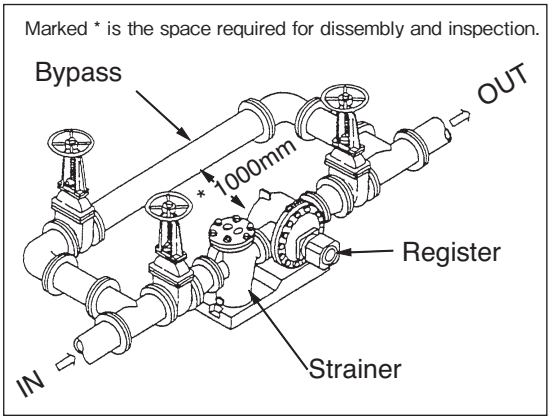


(2) Install the meter free from pipe strains.
(3) The meter must be installed on the discharge side of the pump.
(4) If the meter is to be used under tank head, give a head greater than the pressure losses of the piping system, strainer, meter, etc.
⇨NOTE: Pressure losses of ULTRA UF-II and strainers are stated on the GENERAL SPECIFICATIONS.
(5) The meter installation is correct if the flow direction conforms to the arrow mark on the meter body.
(6) The strainer should be located upstream of, and as close to the meter as possible.
(7) Since the sensor in ULTRA UF-II operates on the principle of sensing changes in magnetic flux density, it must be isolated from the influence of any external magnetic flux. In order to minimize the influence of external magnetic flux, select an installation location 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 OVAL.
(9) Lagging material, if used, must not cover the register and its adapter.

● **Typical OVAL Flowmeter Installations**

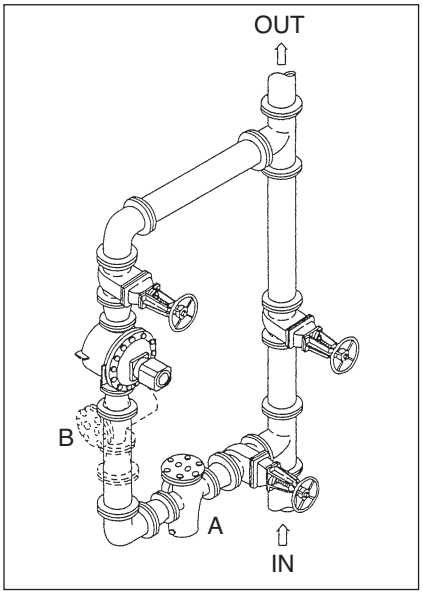
6.2 Standard Installation, Horizontal Line

(1) In case flow direction is from Right to Left, change places of meter and strainer.
(2) Arrange piping so as to facilitate drainage.
(3) Strainer should be inspected on a regular basis.



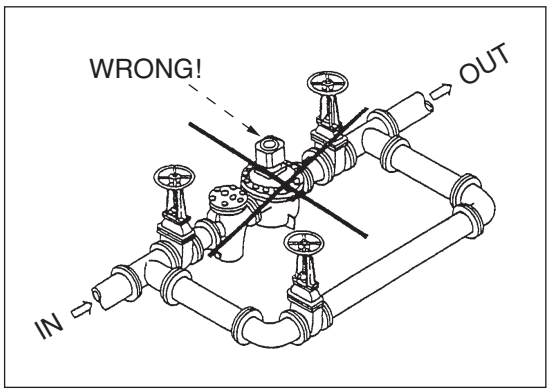
6.3 Standard Installation, Vertical Line

(1) If the flow direction is from top to bottom, change places of meter and strainer.
(2) Installing the strainer at "B" will make net reinstallation difficult at cleaning; we recommend to install the strainer at "A".



6.4 Example of Faulty Piping

Do not install the meter in a position like this.

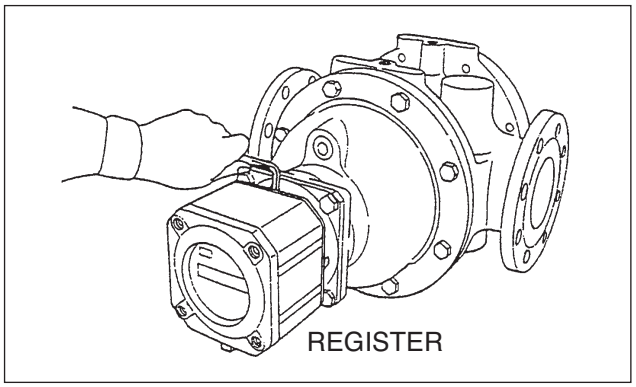


<<NOTE>> For outline dimensions and pipe connection dims., see the approval drawing.

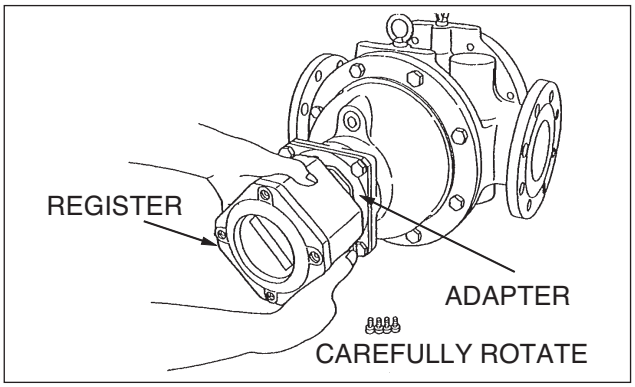
7. HOW TO CHANGE FLOW DIRECTIONS

⚠ CAUTION: Do not fail to remove power to the meter if the meter is of the type to provide remote output.

To change flow directions, change the orientation of both the register and the flowmeter body to the new flow direction

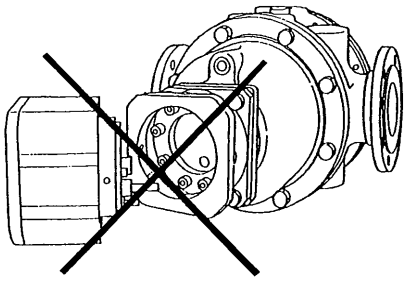


(1) Take four hex socket head bolts (M6) with hex wrench.



(2) Holding the register assembly in both hands, carefully rotate it and then secure it with hex socket head bolts in line with the new direction of flow.

DON'T DO THIS!



Do not attempt to separate the register like this to change flow directions.

⚠ CAUTION:
- **Rotate the register without separating from the adapter.**
- **Do not attempt to rotate the register more than one complete revolution.**

➡ NOTE : If the register has been separated, restore the register to its original condition before the change of flow direction, retry the step (2) above (without separating the register).

8. WIRING INSTRUCTIONS

(⇨Refer also to the wiring instructions of respective receiving instrument instruction manual.)

8.1 Wiring Connections at Terminals

(1) Cables for field wiring

The following cables should be used unless otherwise specified:
Cables 1.25mm^2 in conductor area and 8.5 to 12 mm in finished O.D. As to the number of conductors, select 2 to 4 according to your particular application. It is recommended that their shield be grounded at the receiving instrument.

⚠ CAUTION: Standard ULTRA register; In case of TIIS explosionproof type used under the ambient temperature of 45°C or higher, use a cable resistant to the temperature of 75°C or higher.
Smart Type ULTRA register; In case of TIIS explosionproof type used under the ambient temperature of 50°C or higher, use a cable resistant to the temperature of 70°C or higher.

(2) Transmission length

The maximum transmission length is typically one kilometer.

➡ NOTE : If it exceeds one kilometer, consult the factory.

(3) Inductive interference prevention

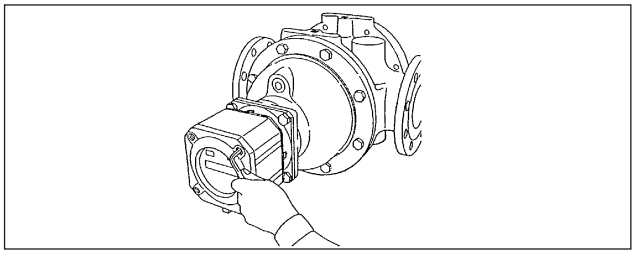
To minimize the possibility of stray current pickup, the field wiring should be routed sufficiently away from existing power cables or power circuits.

⚠(4) Considerations on connections

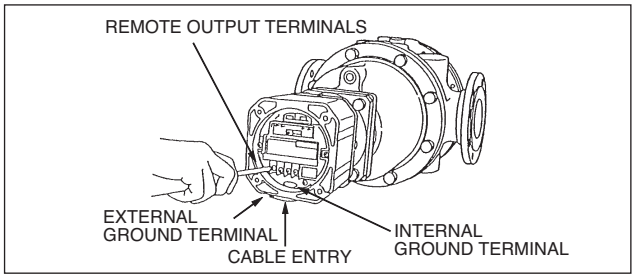
1) M3.5 terminal posts are used on the terminal block. Use crimp-style terminals that fit the conductors at the cable end.
2) Be sure to earth ground the preamplifier's ground terminal.
3) Pitch down the cable from the cable entry so that rainwater will not have a chance to enter the equipment through the cable.
4) In areas where lightning strokes are expected, provide a lightning arrestor for protection.

⚠ CAUTION
Make sure of the validity of meter (transmitter) and companion receiving instrument combination by referring to their model numbers, serial numbers, etc. before you make electrical connections.

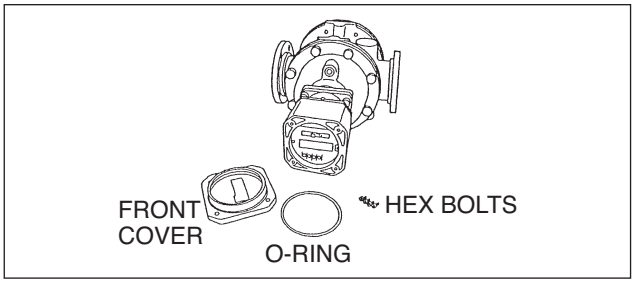
8.2 Terminal Connections



(1) Take off four hex socket head bolts (402) on the front face of register assembly and remove the cover (401).



(3) Using crimp-style terminals, make good electrical connections.



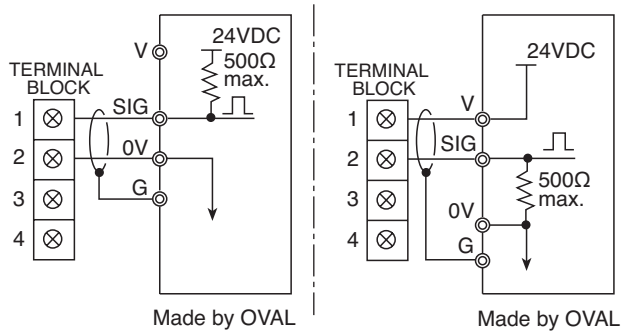
(2) Remove the front cover to gain access to the 4-post terminal block. Terminal identification label is found on the back of front cover.

➡ NOTE : Connect the external earth ground terminal to instrumentation earth ground before use.

➡ NOTE : Pressuretight packings are not furnished with non-explosionproof models and models remote output is not available (see page 5).

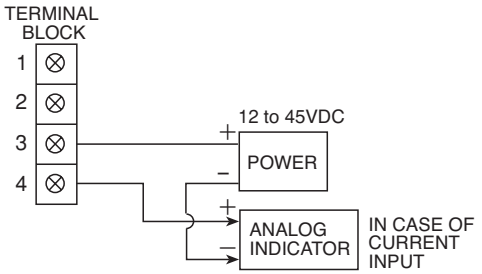
8.3 Wiring Connections, Standard ULTRA register

(1) Current Pulse Output (2-wire system)



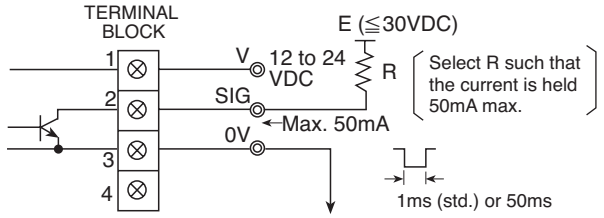
➡ NOTE : The circuit with OVAL products to accept current pulses comes in two configurations as shown above. Refer to the receiving instrument instruction manual before making connections.

(2) Analog Output (2-wire system)



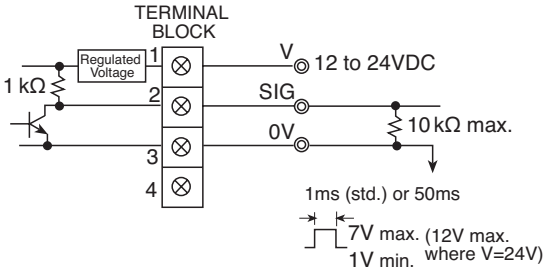
➡ NOTE : In case of voltage input, couple an external load resistance (see the load resistance range in Section 8.4).

(3) Open Collector Output (3-wire system)

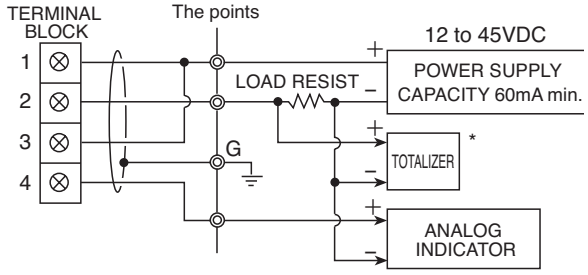


➡ NOTE : Select load resistance R such that the current flowing into the transistor held within 50mA in relation with source voltage E.

(4) Voltage Pulse Output (3-wire system)



(5) Current Pulse + Analog Output (4-wire system)



* Select the voltage input for the totalizer.
Make sure of the trigger level of voltage input and determine the supply voltage and load resistance value.

➡ NOTE :

(1) In OVAL receiving instruments, signal conversion is performed with an internal load resistance. If you build a system like the one shown here with a commercially available totalizer, make sure of the signal levels to the totalizer since signal is converted from current pulses into voltage pulses according to the formula of 4/20mA × load resistance.

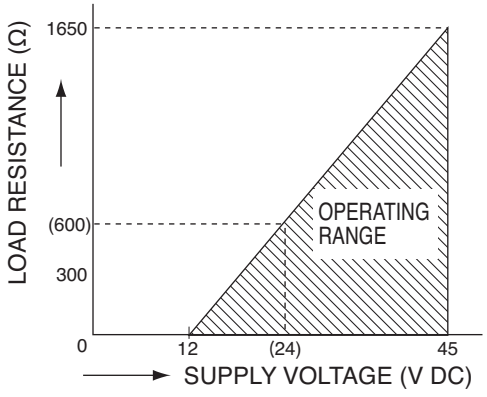
(2) If you use an OVAL receiving instrument in the configuration shown here, make sure of the current carrying capacity of receiving instrument's power supply. If it has a problem in current carrying capacity, a separate power supply should be provided for the analog indicator.

8.4 About Acceptable Load Resistance Range, Standard ULTRA register

In the specification of two-wire transmission system for analog and pulse signals, the power lines also serve as signal lines.

The transmission loop requires a DC power supply. If it is desired to connect an instrument in a loop, the load resistance of both the instrument and conductors must fall within the operating range as shown in the graph at right.

Standard: Power supply voltage = 24 VDC
Load resistance = 250Ω



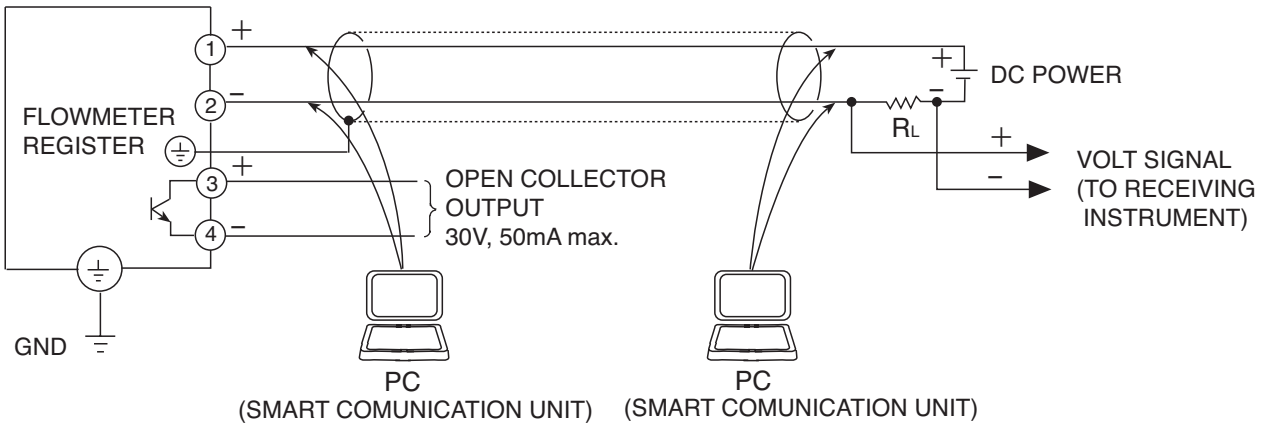
8.5 Preamp-to-Receiving Instrument Hookup with Smart Type ULTRA register

The 2-wire signal transmission system used in this flowmeter furnishes DC power to the meter. It serves as the power line and signal line as well with pulse or analog current output.

An OVAL receiving instrument can be coupled directly, but instruments in general which are designed to accept a voltage signal input require a load resistor RL connected in series for voltage conversion. Since the voltage signal level varies with the load resistance value, determine the load resistance value by referring to the receiving instrument specifications and the acceptable load resistance range shown below.

Communications with a PC (Smart Communication Unit) requires a 250 to 1000Ω load.

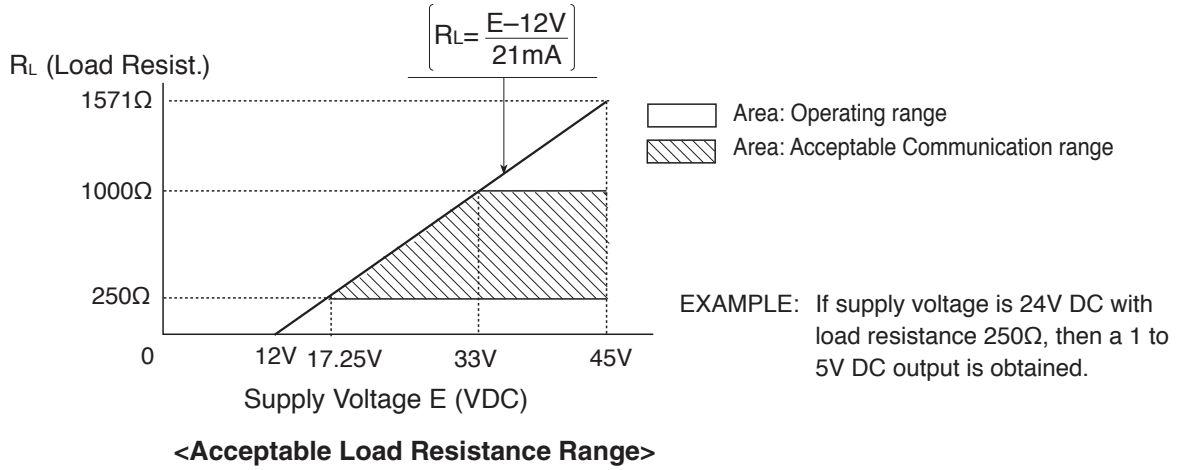
● **In case a voltage input is fed to the receiving instrument**



Output	Voltage Signal (V)
Pulse Output	ON / OFF (20mA×RL) / (4mA×RL)
Analog Output	(4mA×RL)–(20mA×RL) at 0 to FS

➡ NOTE : With the relationship with supply voltage E, select the load resistance value RL such that the current flowing into the transistor is held below 50mA.

Fig. 8.1



<Acceptable Load Resistance Range>

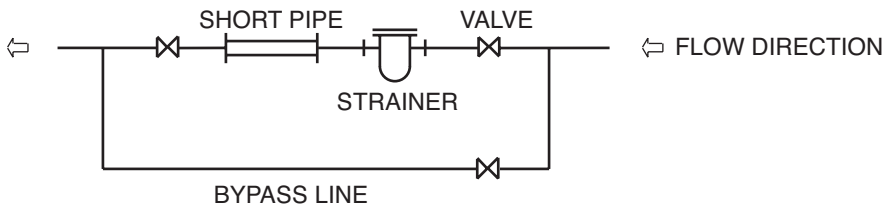
Fig. 8.2

9. OPERATING INSTRUCTIONS

9.1 Flushing the Piping Assembly

Do not fail to remove the meter from the piping assembly and install a short pipe section in place of the meter. Costly damage to the meter could result if you attempt to flush away construction debris and other foreign matter with the meter installed.

⚠ **CAUTION: Do not allow water to run across the meter, or it will cause internal components to gather rust and in time, hinder smooth rotation of the rotors.**

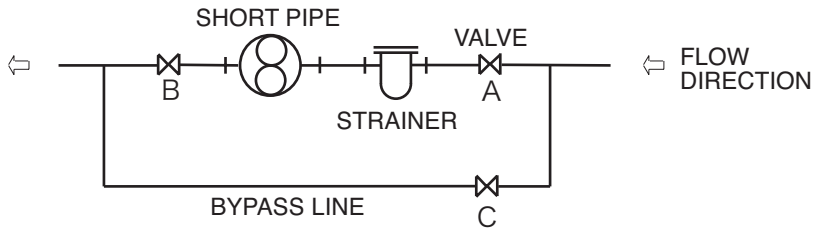


⚠ 9.2 Operating Considerations

(1) Read well the information stated on the nameplate before commencing operation and make sure the operating conditions conform to the specification.

(2) Carefully follow the valve operations sequence given below (refer to the piping diagram below):
   1) Shut off the valves (A) and (B).
   2) Progressively open the valve (C) to allow the fluid in the bypass line.
   3) Slightly open the valves (A) and (B). If necessary, slightly close the valve (C). The flowrate at this point is correct if the register pointer moves slightly.
   4) In applications where temperature exceeds 80°C, run the meter at least for 10 minutes in the conditions (3) to ensure uniform heat distribution in the measuring chamber.
   5) Following the preheating period above, progressively close the valve (C) in the bypass line and progressively open the valves (A) and (B) until reaching the rated flow.
   6) Flowrate should be regulated with the valve (B) downstream of the meter and should be held within the rating.

(3) The strainer net should be inspected for condition and cleaned on a regular basis. On a new installation, in particular, inspect daily first and, according to the clogged condition of the net being observed, inspection intervals may be reduced progressively to, say, once in two or three days.



⚠ CAUTIONS

9.3 Precautions for Models without Battery Pack

(1) Totalized data is written for storage in a non volatile memory several seconds after the flow of a process fluid is stopped. Accordingly, a precaution to remember is not to attempt to turn off power while flowing the process fluid, or turn off power simultaneously with process fluid shutoff.

(2) If you shut off power after stopping the process fluid, good practice is to turn it off 10 seconds or more after process fluid shutoff. In applications where a sudden power shutdown or instantaneous power interruptions is expected during metering, it is desirable to provide an optional battery pack.

(3) If the meter is to be used in the accounting field, we recommend you to provide the battery pack.

⚠ CAUTIONS

9.4 About the Register Life

(1) Because of the life expectancy of internal components, such as the LCD and non-volatile memory, the internal electronics is designed to be replaced in about 10 years. The electronics life depends on the environment in which it is used; if any of the following operating conditions applies, we recommend you to replace it as an assembly in five to six years:

- **High temperature environment.**
- **High temperature process fluid measurement.**
- **Field installation with widely varying temperatures.**
- **LCD counter display is exposed to the direct rays of the sun.**
- **Frequent process fluid flows and interruptions.**

(2) Models with optional battery pack have a storage life of 10 years approx. after shipment, whether the battery is consumed or not. In other words, even in applications where the register is powered from an external source for most of the time and the battery current drain is considered negligibly small, battery replacement is yet required due to its storage life.

Storage life may be reduced even more under such adverse environmental conditions as:

- **High temperature environment**
- **High temperature process material measurement**
- **Cold region**

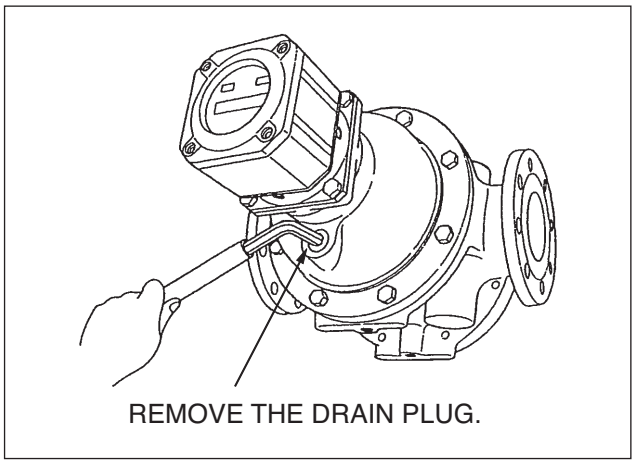
10. DISASSEMBLY AND INSPECTION

◎ **Although it depends on individual operating conditions, periodic disassembly and inspection should be performed at least once a year.**

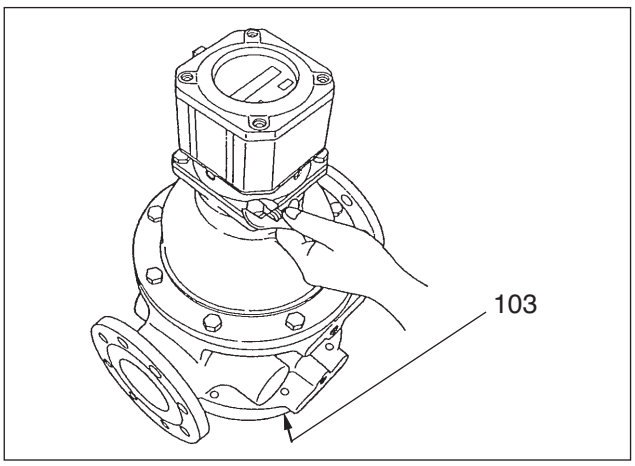
⚠ CAUTION

1. **Because the UF-II Flowmeter 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, an important precaution to remember is to reduce the internal pressure of the piping assembly 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 the meter. Exercise care to keep individual members disassembled free from grit and dust.**
2. **If the meter is of externally powered type, be sure to turn off power before you disassemble.**

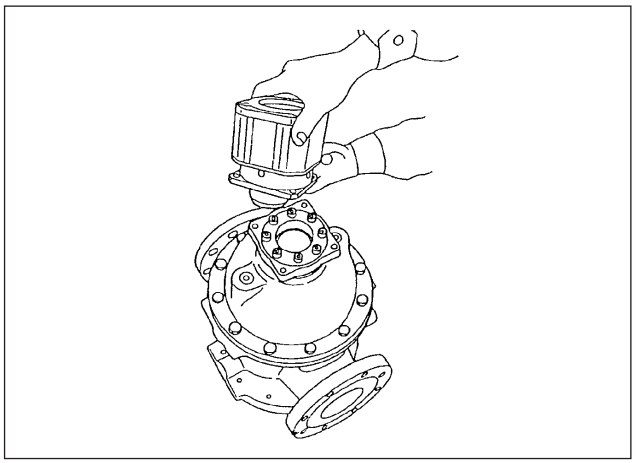
10.1 Disassembly and Inspection Procedures



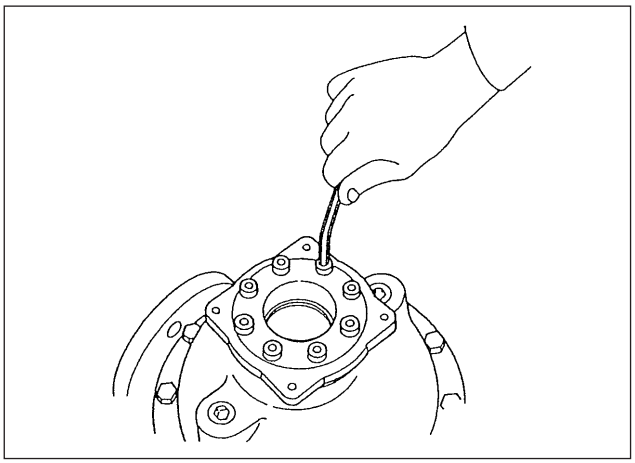
(1) Remove the flowmeter from the piping assembly, drain the meter, and start working in the following procedure.



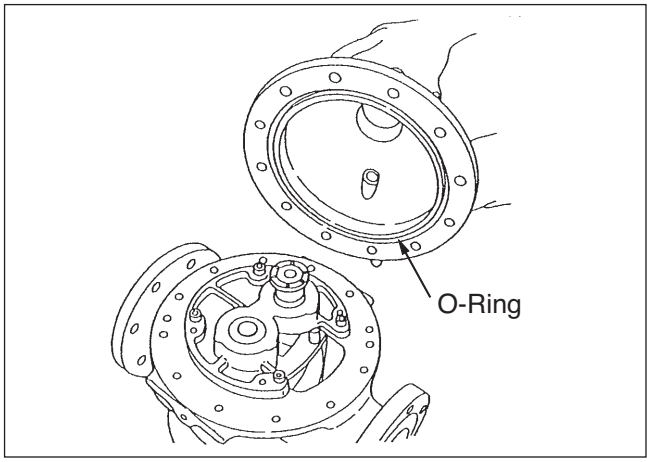
(2) 1) Place the meter upright with the rear cover (103) down (register faces up).
2) Unbolt four hex bolts holding the register, using hex key.



(3) Holding the register with both hands, carefully separate it.

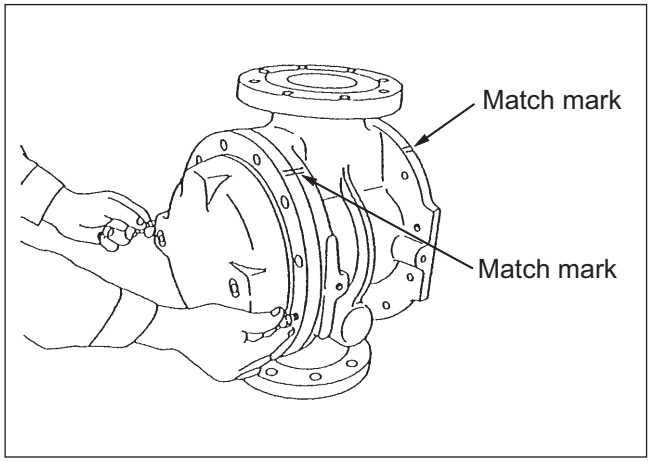


(4) Take off eight fitting bolts (117) with hex key and remove the sealing flange (116). Then, separate the signal generating magnet assembly.

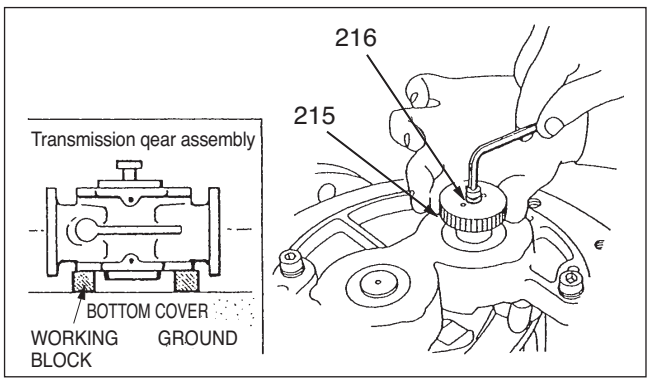


(5) Take off twelve fitting bolts (114) securing the front cover, carefully lift and remove the front cover vertically.

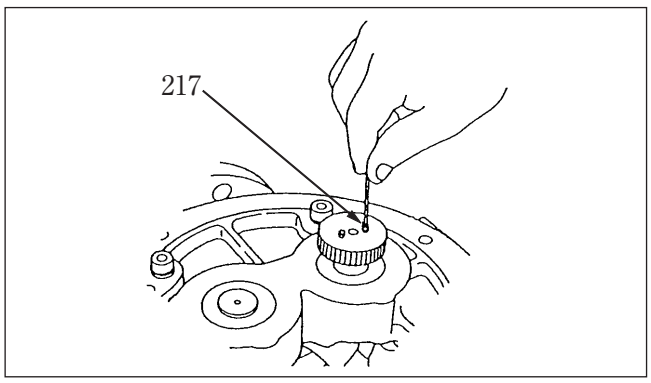
➡ NOTE : Make sure of the presence of O-ring (105). This precaution also applies at assembly. Good practice is to attach it to the cover with grease before installation.



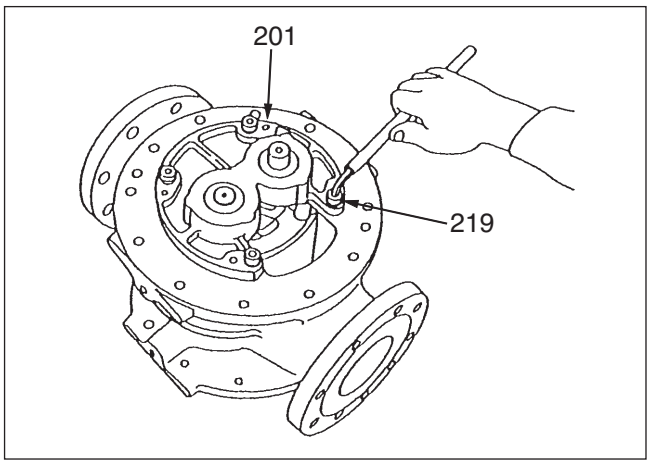
(6) 1) Place the meter body with the flange face down.
2) Take off twelve rear cover fitting bolts (114) and remove the rear cover.



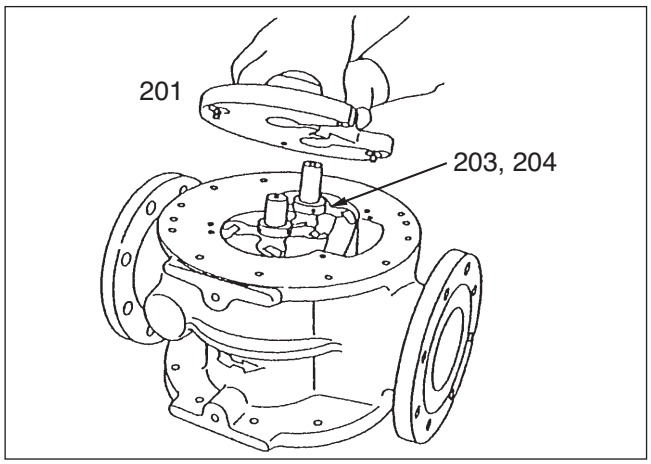
(7) 1) With the bottom cover (202) down, place the meter body upright so that the transmission gear assembly is accessible from top. Place working blocks under the meter body as shown to hold the bottom cover off the ground at this time.
2) Take off hex socket head bolts (216) and remove the transmission gear (215).

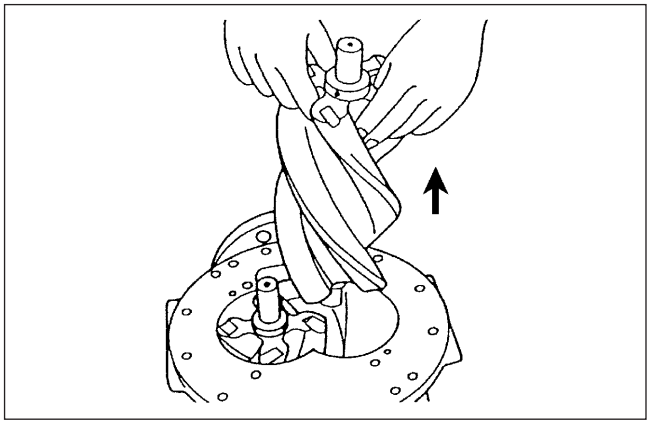


➡ NOTE : 1) Before loosening hex socket head bolts, tuck a piece of waste between rotors to prevent their turning.
2) The transmission gear is provided with a socket head setscrew (217) as a non-turn means. At assembly, tighten this non-turn arrangement upon completion of tightening hex socket head bolts.

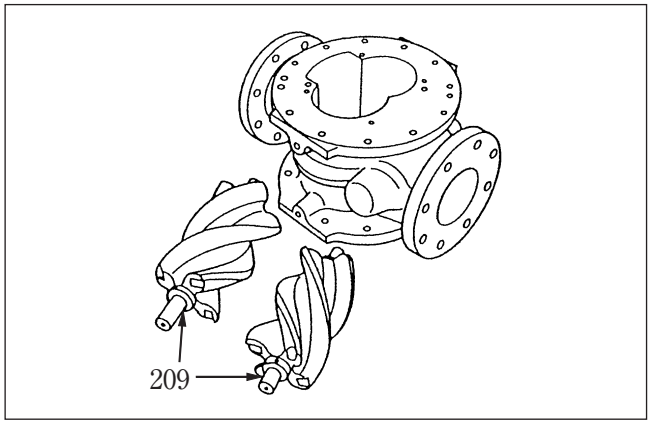


(8) Take off hex socket head bolts (219) and remove the top cover (201).





(9) Remove the rotors (203) and (204). Since each rotor is integral with its shaft, hold the rotor to be removed first with both hands and carefully slide it vertically out of the chamber while rotating it in the direction of twist. Use care, while doing this, so as the thrust rings (209) on the lower cover side not to come off the shafts.



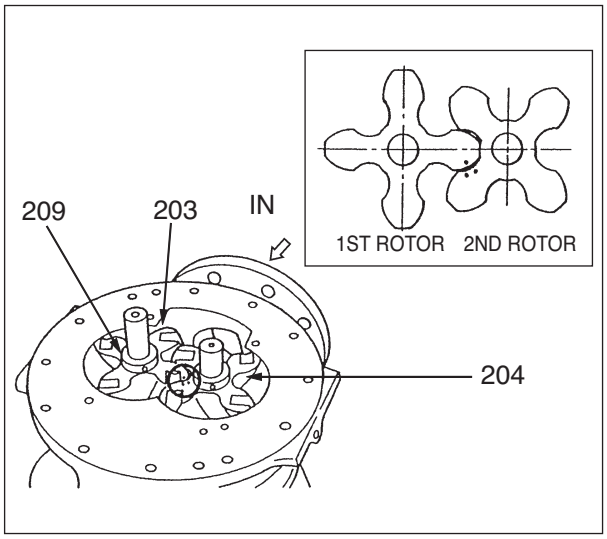
➡ NOTE : Mark individual thrust rings (209) with identification marks to ensure their correct installation with respect to respective rotors at assembly.

Individual components are accessible for inspection as described above.

(10) Proceed to disassemble the bottom cover side. For thorough inspection, follow the procedure given below:
   1) Place the meter body with the flange face down.
   2) Take off hex socket head bolts (219) and separate the bottom cover (202). The bottom cover and bearings are now accessible for inspection.

10.2 Assembly

(1) Clean thoroughly the rotors, measuring chamber, top cover, signal generating magnet assembly, and other components with suitable solvent. Exercise care to keep dust and grime out before installation.
(2) Thrust rings (209) must be installed in their original positions of respective rotors (203 and 204). Ensure at this time that the pin (210) for the thrust ring fits exactly in the slot on the rotor side.
(3) When installing the rotors, the 1st rotor is identified as the one provided with the transmission gear according to the flow direction specified. The flow direction is from left to right in the sketch shown at right.
(4) Match marks are stamped on the rotors as shown in the inset of the sketch. Install the rotors with these match marks aligned. When they are in engagement, allow them to make several revolutions to ensure their smooth rotation.



10.3 Disassembly and Inspection as Installed in the Piping Assembly

After having confirmed of the internal pressure of the piping assembly reduced to zero, remove the drain plug (107) to drain the meter, disassemble and inspect in the same manner as described in steps (2) through (9) in the previous "Disassembly and Inspection Procedures".

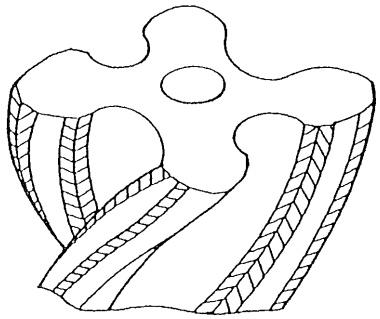
Approximate Internal Capacity of Meters

Meter Size	Approx. Capacity
80	8.5 liters
81	10 liters

10.4 Reconditioning the Rotor Gear Teeth

The hatched areas of one rotor shown in the sketch at right indicate the areas in contact with the other rotor while they revolve. Do not attempt to recondition these areas unless it is absolutely necessary due to undue wear found during disassembly and inspection. If the rotors have score marks or deep scratches, indicative of having jammed with foreign solids between them, correct with an oil stone or similar abrasive tool only the protrusions until the affected areas are equalized with other hatched areas in height.

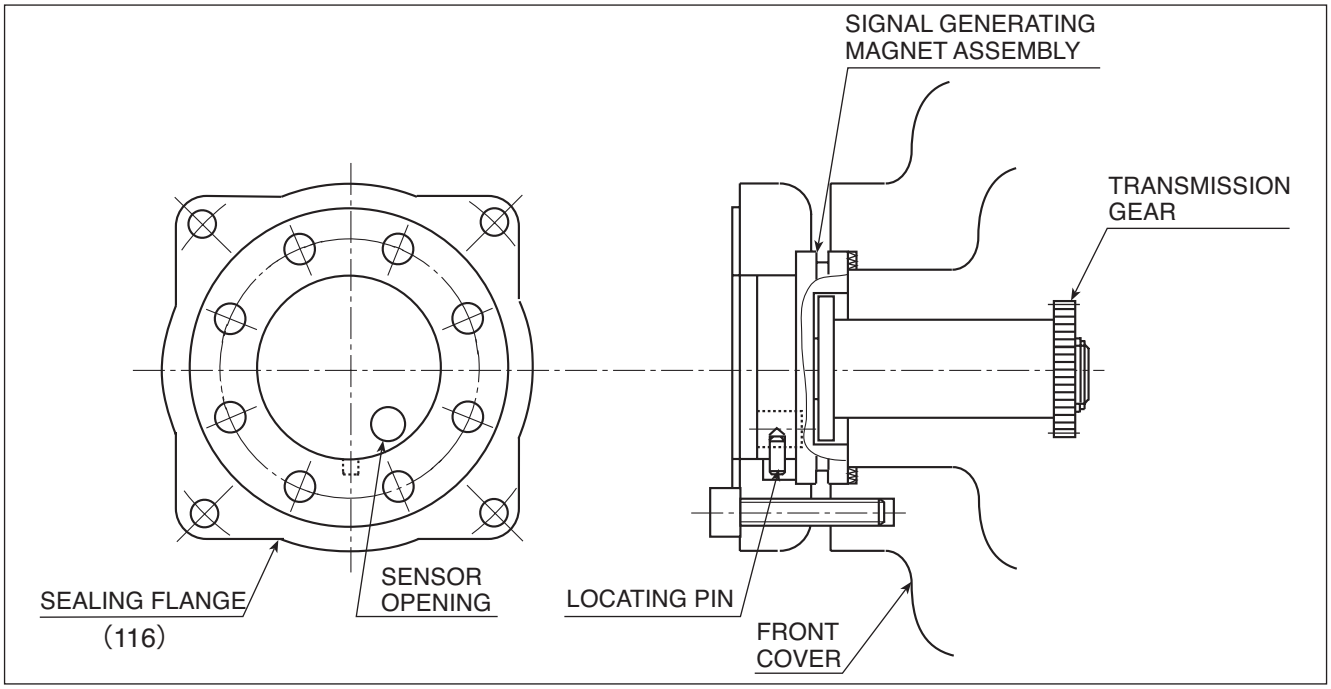
UF-II Flowmeter Rotor



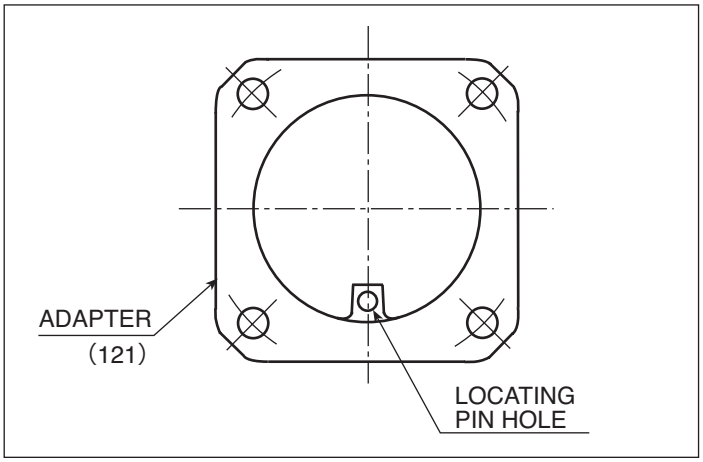
Other areas indicative of jamming with foreign solids, if any, may be reconditioned according to ordinary shop practice.

⚠ 10.5 Signal Generating Magnet Disassembly and Reassembly Notes

Phase observation is required for the signal generating magnet assembly. If installed out of phase at assembly, the total counter will not count. Install the generating magnet assembly such that the locating pin always points in a downward direction.

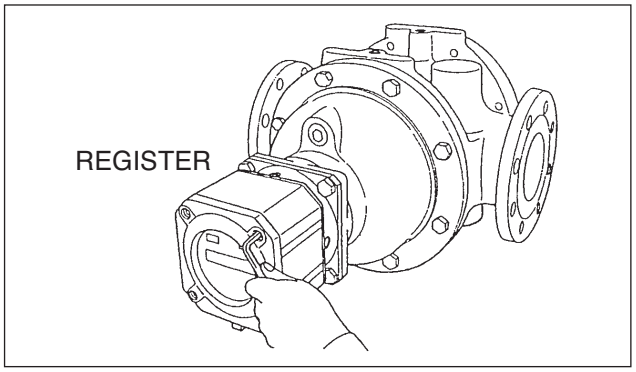


➡ NOTE : The adapter is installed correctly as shown at right (pin hole is right under).

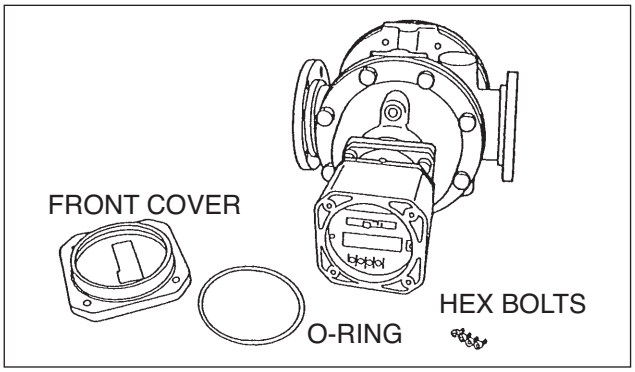


11. STANDARD ULTRA REGISTER SWITCH FUNCTIONS AND PARAMETER SETUP

11.1 Switch Names and Functions



(1) Using hex key, remove four hex socket head bolts securing the front cover.



(2) Removing the front cover provides access to the electronics unit.

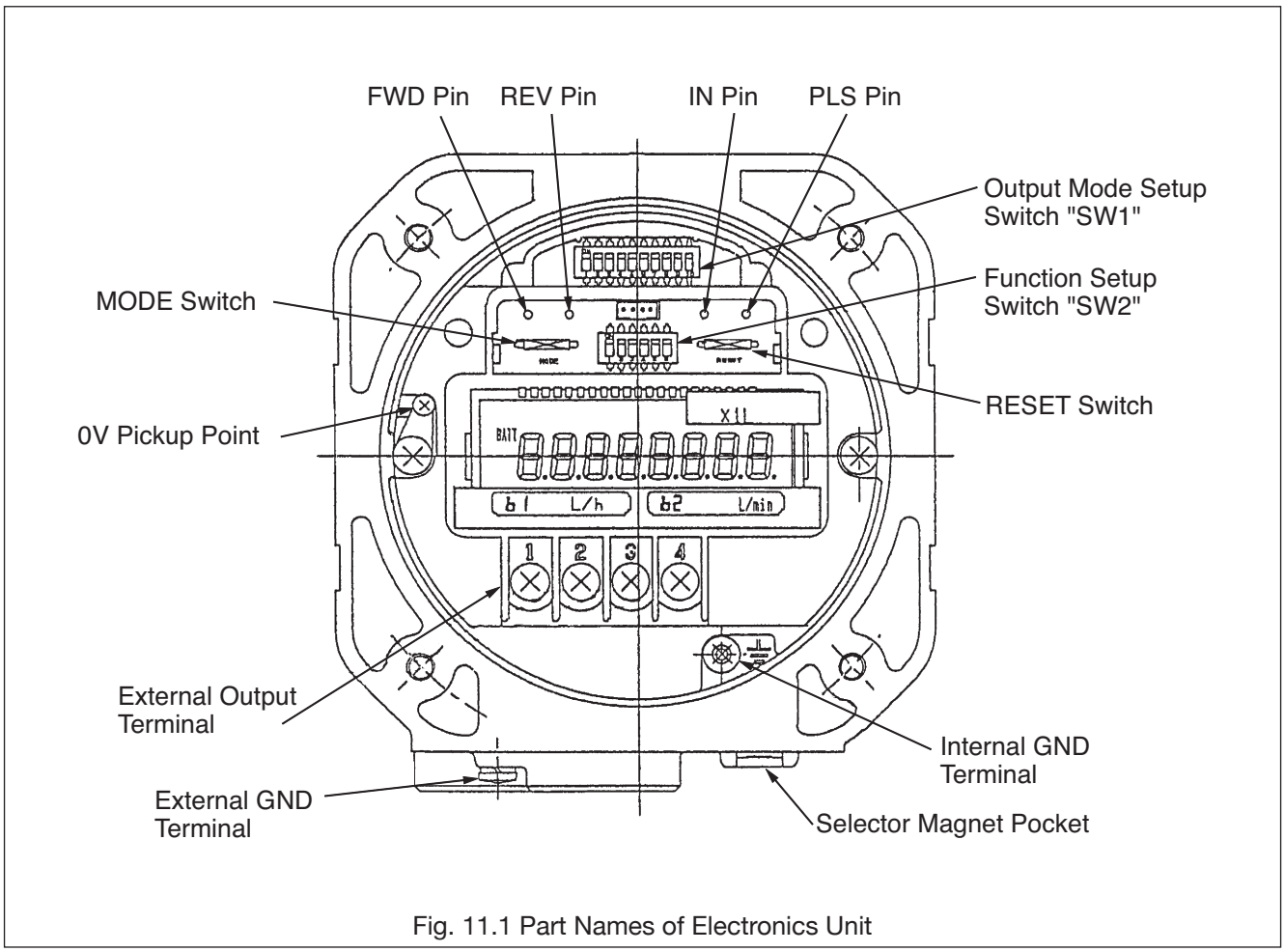


Fig. 11.1 Part Names of Electronics Unit

➡ NOTE : A seal plate and certification seal are provided for master oilmeters, special measuring instruments and flowmeters to be certified for products subject to tariffs and duties on spirits and alcohol (see figure at right).

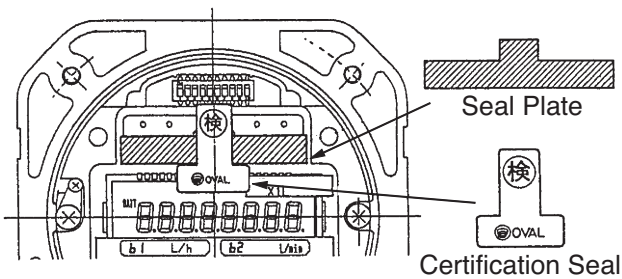


Fig. 11.2

11.1.1 Function Setup Switch "SW2"

DIP Switch No.	Description of Functions
SW2–1	Parameter write-protect OFF: Rewritable "Default" ON: Write protect * To seal, set to ON before pasting the seal.
SW2-2	Factored/unfactored pulse select OFF: Factored pulse ON: Unfactored pulse
SW2-3	Inhibit to reset the resettable total OFF: Resettable "Default" ON: Nonresettable
SW2-4	Accumulated total reset ON : OFF resets the accumulated total. * Set to OFF in normal use.
SW2-5	Unused * Always OFF
SW2-6	Battery power switch OFF: Battery power OFF ON: Battery power ON "Default"

➡ NOTE : [ ] shows default setting.

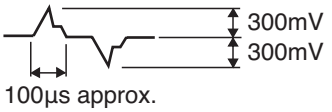
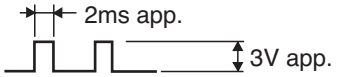
11.1.2 Output Mode Setup Switch "SW1"

Output Mode / DIP Switch No.	Power pulse/ analog	Open collector pulse	Voltage pulse	Remarks
SW1-1	OFF	OFF	ON	ON for voltage pulse only. All else OFF.
SW1-2	OFF	OFF	ON	
SW1-3	ON	OFF	OFF	ON for voltagepulse/analog output only. All else OFF.
SW1-4	ON	OFF	OFF	
SW1-5	ON	OFF	OFF	
SW1-6	ON	OFF	OFF	
SW1-7	OFF	ON	ON	ON for open collector output and voltage pulse output only. All else OFF.
SW1-8	OFF	ON	ON	
SW1-9	OFF	ON	ON	
SW1-10	OFF	ON	ON	

⚠ **CAUTION: To change SW1 settings, place all switches in OFF and then place only the required switch in ON.**

11.2 Individual Test Pin Functions

➡ NOTE : Connect the 0V end to the L.H. side fitting screw in the electronics unit (see Fig. 11.1).

Pin Name	Function	Waveform
FWD	Monitors the amplified output waveform from magnetic sensor for flow metering.	
REV	Monitors the amplified output waveform from magnetic sensor for discriminating between FWD and REV flow. (Only when the double sensor is used.)	Same as above
PLS	Monitors the rectangular waveform after FWD pulsee waveshaping. Timing remains the same as that of FWD and its waveform is one before unfactored output amplification.	
IN	Accepts a simulated pulse train from OVAL pulse checker Model PC2201, or other signal source. Input mode is PG30 mode of Model PC2201. It also accepts pulses with levels "0": 1V max. and "1": 7 to 12V min. or open collector.	

11.3 Accumulated Total and Instantaneous Flowrate Calculations

(1) Total flow
... Both accumulated total and resettable total

$$Q=P\times F\times H$$

where
P: Number of incoming pulses
F: Meter factor
H: Conversion factor

(2) Instantaneous Flowrate
... Valid only for input pulses of small periodic variation
The period of incoming pulses for the sample cycle number is measured in units of 30 µsec and substituted in the following formulas for readout:

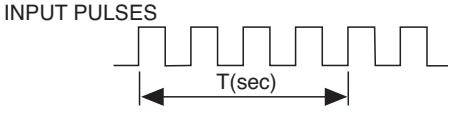
$$\text{Hourly Flowrate}=b1=\frac{3600\times F\times H\times A}{T\ (\text{sec})}$$

$$\text{Per-min. Flowrate}=b2=\frac{b1}{60}$$

where
A: Sample cycle number
F: Meter factor
H: Conversion factor

(3) Sample Cycle Number
It shows the number of sampling pulses in instantaneous flowrate computation.
If indicated reading on the display fluctuates, an average reading may be obtained by selecting a larger number.
If the fluctuation of indicated reading is excessive, pulsation of the flow is suspected among possible causes and the pipeline should be inspected.

➡ NOTE : Sample Cycle Number



If a setting A = 4 is chosen, the time is measured for 4 cycles of incoming pulses and, based on the formulas above, calculation is made. Resolution of measurement is 30 µsec.

If the number of incoming pulses falls below the sample cycle number (A: Default 4) in the sampling time (At: Default 5 sec), the instantaneous flowrate reads 0.
Accordingly, if it is desired to read the instantaneous flowrate in small flows, select a smaller sample cycle number.

11.4 Parameter List

Parameter	Code	Default Setting	Initial Value	Description	Remarks
Meter factor	F	Depends on the customer specification. (Indicated on the parameter label.)	1.0000-2	・ 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	1.0000E0	1.0000E0	・ Unit conversion factor (Unit: [Δ/L]) Δ: Unit after conversion (without conversion Δ: = □) ・ Setting range: 0.9999-9 to 9.9999E7	Change units of total flow and instant. flowrate to any units desired. (Without conversion, H1.0000E0) Ex.: At 1.5kg per 1 L, change the flowrate to read in kg. →Conversion factor is 1.5[kg/L] (=1.5000×10^{-0}[kg/L]) Therefore set to "H1.5000E0" (kg/L). (Note 1)
Pulse weight	Pu	Depends on the customer specification. (Indicated on the parameter label.)	1.00E0	・ Weight of factored pulse output (Unit: [Δ/Pulse]) ・ Setting range: 0.99-9 to 9.99E7	Ex.: To change the weight of factored pulse from 1 L/P → 10L/P (=1.00×10^{+2}[L/P]) → Set to "Pu 1.00E1" (L/P). (Note2)
Indicated unit of registration	Un	———	——	———	This parameter is unused. (Do not set it up.)
Decimal point location in instantaneous flowrate	bP	Depends on the customer specification.	0	・ Decimal point location in instantaneous flowrate b1 ・ Setting range: 0, 1, 2	Ex.: To change the indicated min. rdg. in inst. flowrate from 1 L/h to 0.1 L/h (= one place below decimal point) → Set to "bP .1".
Decimal point location in total flow	SP	Depends on the customer specification.	0	・ Decimal point location in accumulated and resettable total ・ Setting range: 0, 1, 2, 3	Ex.: To change the indicated min. rdg. in total flow from 1L to 0.01 L (= 2 places below decimal point) → Set to "SP .2".
Sampling time	At	5	5	・ Upper limit in instant. flowrate sampling (Unit: [sec]) ・ Setting range: 1 to 999	If flow pulses fail to arrive for a duration At [sec], the instantaneous flowrate shows 0.
Sample cycle number	A	Depends on the customer specification. (Indicated on the parameter label.)	4	・ Sampling frequency ・ Setting range: 1 to 999	Instantaneous flowrate is determined by measuring the time for incoming flow pulses A times. If the spread of instant. flowrate indicated is too great, choosing a larger A eases the problem.
Analog full scale (Note 3)	AF	Depends on the customer specification. (Indicated on the parameter label.)	3800	・ Analog full scale flowrate (Unit: [Δ/h]) ・ Setting range: 0.01 to 99999	Ex.: To change the analog output full scale flowrate (flowrate to produce a 20mA output) from 3600L/h to 1800L/h → Set to "AF 1800" (L/h).
Analog damping (Note 3)	AdAn	2.5	0.0	・ Analog time constant (soft) (Unit: [sec]) ・ Setting range: 0.01 to 99999	If ripples in analog output are too great, choosing a greater AdAn stabilizes the fluctuation of indicated reading. Ex.: To change the analog output time const. from 2.5 [sec] to [5 sec] → Set to "AdAn 5.0."
4mA trim (Note 3)	A04	———	(4.000)	Analog output 4mA trim	See "Parameter Setup Procedure" for detail.
20mA trim (Note 3)	A20	———	(20.00)	Analog output 20mA trim	See "Parameter Setup Procedure" for detail.
Pulse width	Pon	1 or 50 "An item shown on parameter label"	1	Factored pulse output "ON" width (Unit: [msec])	Ex.: To change pulse width from 1ms to 50ms → Set to "Pon 50" (msec). (Note 4)

⇨ to next page

Parameter	Code	Default Setting	Initial Value	Description	Remarks
Pulse dummy output 1	Pd1	Not a parameter to be set up	——	Furnishes a 1Hz simulated factored pulse output irrespective of flowmetering.	・ This function is useful in loop check, etc. ・ For operation in practice, see "About Dummy Output Functions (special features)."
Pulse dummy output 2	Pd2	Not a parameter to be set up	——	Furnishes a 10Hz simulated factored pulse output irrespective of flowmetering.	

NOTES 1. When conversion factor (H) has been set, change pulse weight (Pu), indicated unit (Un), etc. relative to the units after conversion.

2. Be sure to set up a value such that $\frac{F \times H}{2} \leqq Pu \leqq F \times H \times 10000$

3. Not shown on the LCD if the meter operates on the battery alone.
4. Be sure to set a value such that factored pulse "OFF" width > 1 ms.

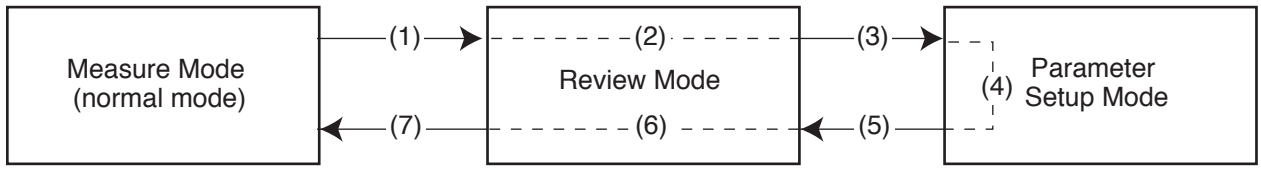
11.5 Parameter Setup Procedure

11.5.1 Reconfiguration Procedure

Given below is the parameter sequence:

(1) In "Measure Mode (normal mode)," turn MODE switch ON for 5 seconds to go into "Review Mode".
↓
(2) Using MODE and RESET switches, show the parameter you want to modify.
↓
(3) Turn MODE switch ON for 2 seconds to go into "Parameter Setup Mode".
↓
(4) Using MODE and RESET switches, set up a new parameter. (See Para. 11.5.2 below for the procedure.
↓
(5) Following the parameter entry, turn MODE switch ON for 2 seconds to go back to "Review Mode".
↓
(6) Using MODE and RESET switches, show the title (= one from bdAtA, AnA, PuLSE, or CorrEctCo).
↓
(7) Turn MODE switch ON for 5 seconds to go back to "Measure Mode".

A diagram to show parameter setup flow



➡ NOTE : For complete detail of MODE and RESET switch operations in steps (1), (2), (6) and (7), see “Table 11.2 Menu Trees and Switch Operation" on page 32.

11.5.2 Entering New Parameters

The procedure to enter a parameter (switch operations sequence in "Parameter Setup Mode") comes in three ways (numerical setup, decimal point location setup, and analog 4/20mA trim) that follows:

[Kind 1] Numerical setup parameters (F, H, Pu, At, A, AF, dAn, Pon, C1P to C4P, Cid to C4d)

The blinking digit in the parameter setup mode is the place of interest.

MODE ..... Each time the switch is turned on, the place of interest moves one place to the left.

RESET ..... Each time the switch is turned on, the figure in the blinking place increases by one. Or exponential sign toggles ("E", "-", etc.).

→ Following the parameter setup, hold the MODE switch turned ON for 2 seconds (the new setting is established and the screen returns to the review mode).

Example: Parameter "F" (meter factor)

Exponential sign (E: 10^{+n}, –: 10^{-n})
(The screen above reads F=1.2345×10^{+2}L)

Digit of interest (blinking)
- Turning MODE "ON" moves the blinking digit one place to the left ("E").
- Turning RESET "ON" increases the figure by one ("2" → "3").

[Kind 2] Decimal point setup parameters (bP, SP, and CP)

In the parameter setup mode, a figure representing the decimal places of interest flickers.

MODE ..... Not used in the setup process.

RESET ..... Each time the switch is turned ON, the decimal point moves one place to the left and the figure increases by one.

→ When the decimal point appears at the desired location, hold MODE turned ON for 2 seconds.
(This establishes the setting and the window returns to review mode.)

Example: Parameter "bP" (decimal place in instantaneous flowrate)

Relative to the figure at right of decimal point, this point moves.
If a setting above (bP=2) is chosen, the instantaneous flowrate reads [b1 □□□.□□].

A figure representing the decimal places of interest (flickers)
- Relative to the figure at right of decimal point, this point moves ("0"→"1"→"2").

[Kind 3] Analog output 4/20mA trim

<u>- During the analog trim, keep on monitoring the analog output with a milliammeter or voltmeter.</u>

Given below is the 4mA trim procedure (the same holds true with 20mA trim).

(1) At "A04 4.000," hold "MODE" turned ON for 2 seconds to go into the parameter setup mode; the least significant "0" at rightmost digit blinks on and off and a 4mA simulated output from the register appears.

(2) Set the milliammeter reading in the procedure below. (If it reads 3.988mA, for example, set to "A04 3.988.")

Example: Parameter "A04" (4mA trim)

MODE - Each time the switch is turned ON, the digit of interest moves one place to the left.

RESET - Each time the switch is turned ON, the figure of interest increases by one.

Digit of interest (blinking)
- Turning MODE "ON," the blinking digit moves to the left.
- Turning RESET "ON," the figure increases by one ("O" → "1").

Following entering parameters, hold MODE turned ON for 2 seconds to establish the setting.

(3) Analog output is trimmed: make sure of the milliammeter reading once again.
(The indicated reading returns to "A04 4.000" (the mostright digit blinking) now.)

- If the reading is within the tolerance with respect to 4mA, by holding MODE turned ON for 2 seconds the second time, you can exit the setup mode. → Adjustment is complete. Returns to the review mode.
- If the reading is still outside the tolerance, repeat step (2) above.

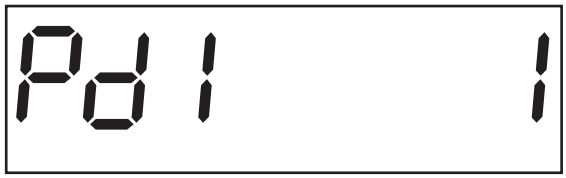
11.5.3 About Dummy Output Features (special functions)

By the following steps, a 1 Hz or 10Hz simulated factored pulse train can be furnished irrespective of flowmeter measurement.

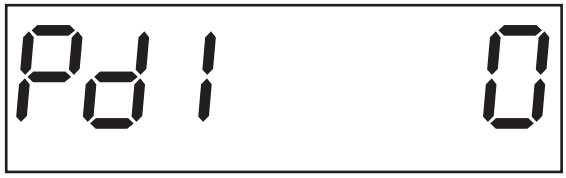
➡ NOTE : This feature is not available with the unfactored pulse output specification.

- 1Hz simulated output mode (dummy output 1 mode Code: Pd1)

(1) According to the Table 8.4 "Menu Trees and Switch Operation" (page 15), show dummy output 1 ("Pd1 1") on the LCD.

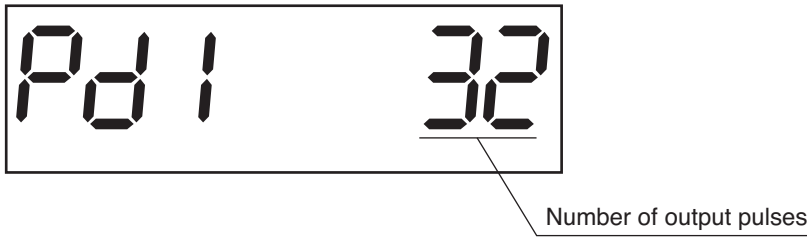


(2) Turn MODE button ON for 2 seconds to go to the dummy output run mode.
(The display shows "Pd1 0").



(3) Operation within the dummy output run mode

- Turn RESET button ON → Dummy output appears and the counter counts in sync with the pulse output produced.
- Turn MODE button ON → Dummy output stops.
- Hold MODE button turned ON for 2 seconds → Dummy output run mode is terminated, returning to the state (1).



➡ NOTE : (1) The procedure above also applies to the 10Hz simulated output mode (dummy output 2 mode Code: Pd2).
(2) Pulse width is set by parameter Pon.

11.5.4 Parameter Initialization

(1) Remove the external power source.
(2) Holding the selector magnet close to the MODE switch, turn the battery switch (SW2-6) from OFF to ON.
(3) The LCD lights up in all figure places. (The selector magnet is held in proximity.)
(4) When the screen shows "PA. rESEt", remove the selector magnet to turn "OFF" → Initialization is complete.
(Holding the magnet in proximity while "PA. rESEt" is being shown causes the modes to go to the measure mode without initialization.)

➡ NOTE : Parameter initialization is the step to be taken upon detection of a parameter error "PA.Err 1" or other erratic condition. Do not take this step unless absolutely necessary.

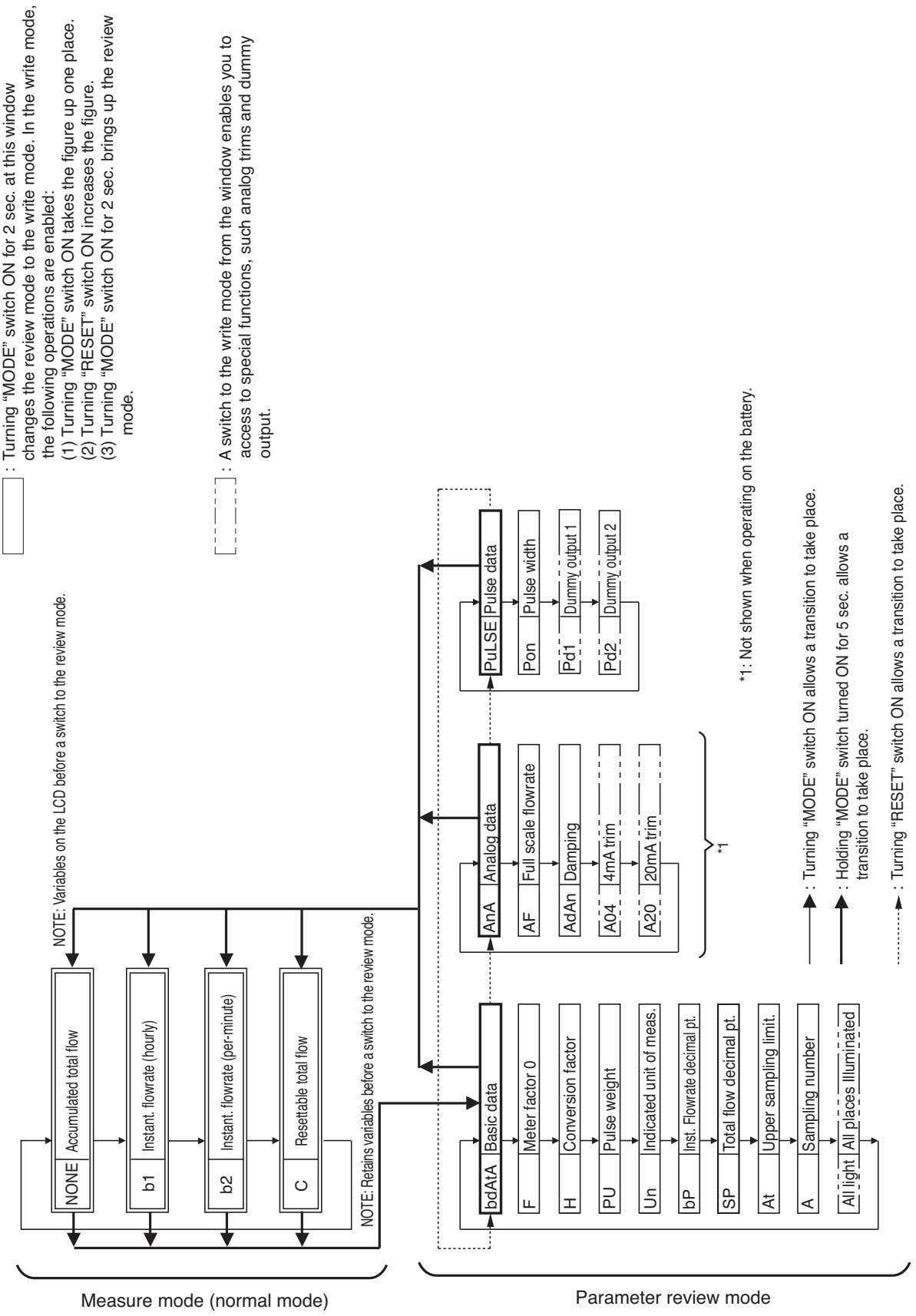
11.5.5 About Error Messages

The electronics unit can be reconfigured for new parameters at your option.
However, if some parameters you set up conflict, or when an erratic condition arises, the LCD display will tell you with an error message from Table 11.1 below.

Table 11.1

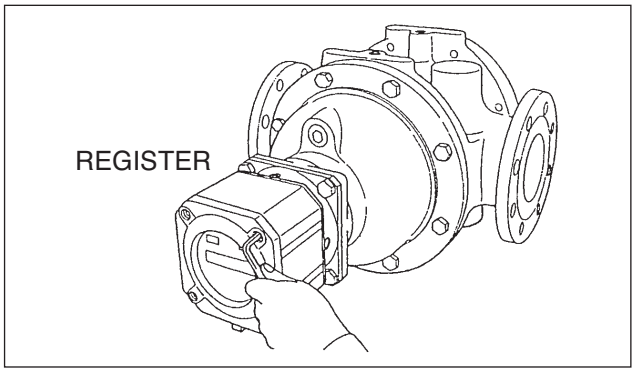
Message	Name	Description	Coping action
PA. Err	Parameter setup error	An attempt is made to rewrite a parameter while parameters are write-protected. (In the standard model, write-protect feature is set in OFF and will not appear.)	Can be reset by placing No. 1 of display board SW2 in OFF. (This enables you to change parameters.)
PA. Err. 1	Parameter error 1	Backup data retained for parameters has been damaged.	CPU initialization and then reconfiguration of parameters are required.
PA. Err. 2	Parameter error 2	Some of the backup data retained for the display mode, accumulate total flow reading, or resettable total flow reading have been damaged.	Can be restored with MODE switch, but the accumulated total flow and resettable total reading will be reset to 0.
PA. Err. Pu	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: $F \times H/2 \leqq Pu \leqq F \times H \times 10000$
AnA. Err	Analog output error	Analog output level is exceeding 120% of full scale for either reason: (1) Flowrate excessive (2) Analog full scale setting too small	(1): Reduce flowrate. (2): Select an appropriate analog full scale setting relative to the flowmeter specification.
Out. Err	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	Battery life	Supply voltage has dropped.	Replace the battery with a new one.

Table 11.2 Menu Trees and Switch Operation

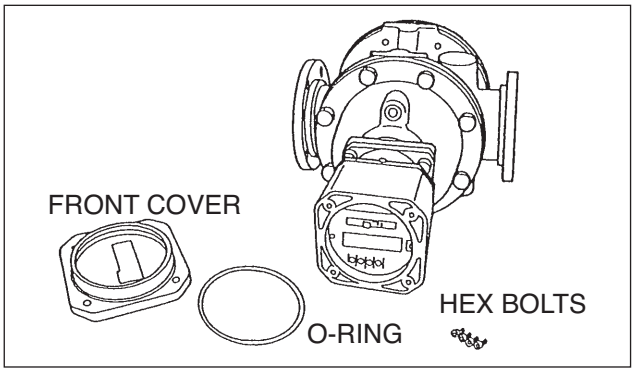


12. SWITCH FUNCTIONS AND PARAMETER SETUP, OF SMART TYPE ULTRA REGISTER

12.1 Switch Names and Functions



(1) Using a hex key, take off four hex socket head bolts securing the front cover.



(2) Removing the front cover provides access to the electronics unit.

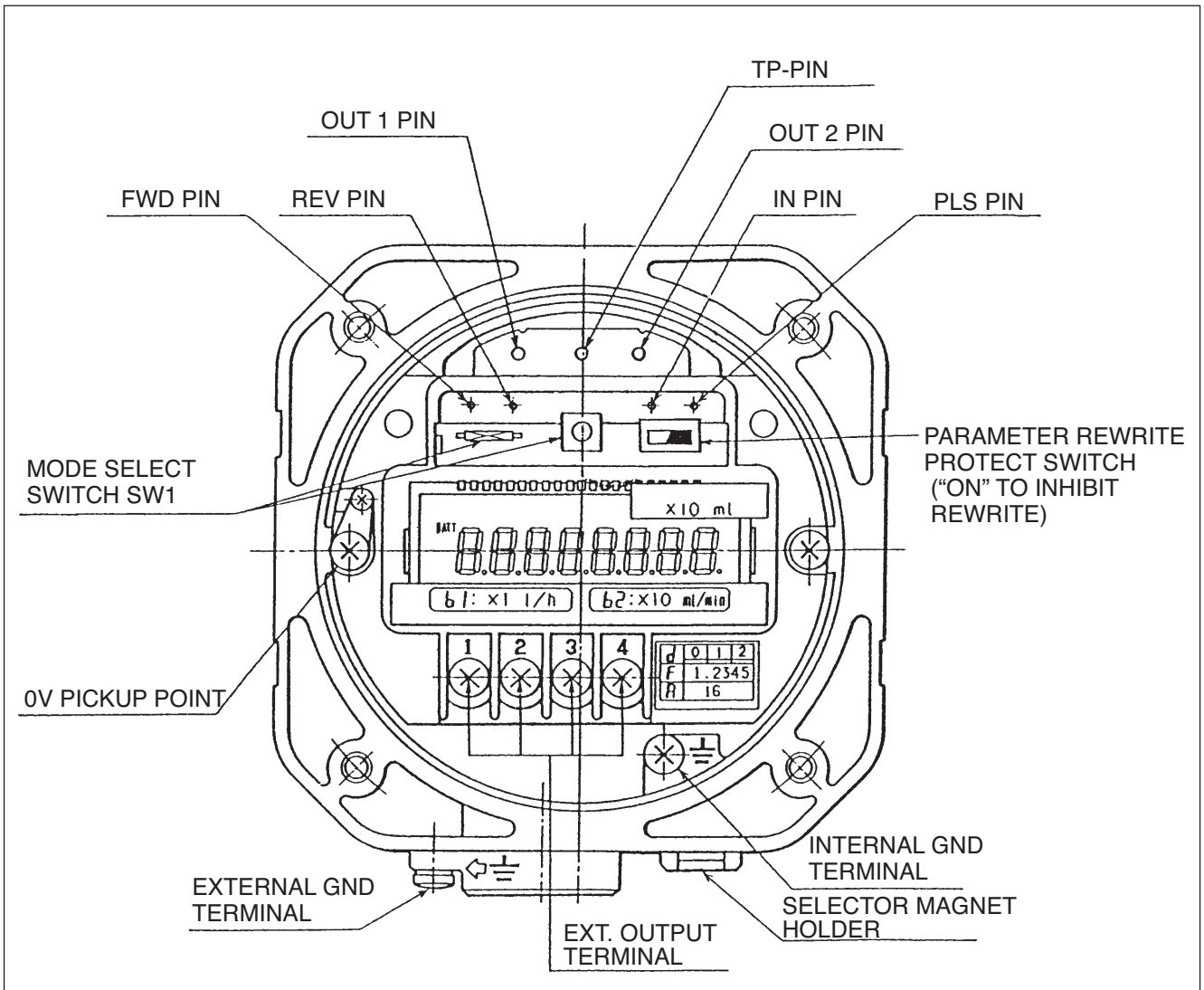
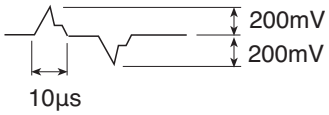
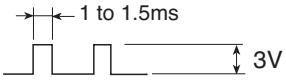
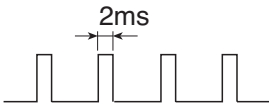
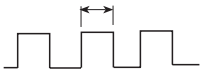
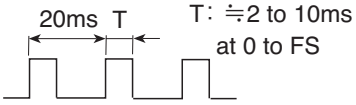


Fig. 12.1 Part Names of Electronics Unit

12.2 Individual Test Pin Functions

➡ NOTE : NOTE: Connect the 0V side to the TP-PIN.

PIN NAME	FUNCTION	WAVEFORM
FWD	An output of No. 1 amorphous sensor waveform appears.	
REV	An output of No. 2 amorphous sensor waveform appears. While the flowmeter is making forward revolutions, pulses are produced slightly behind the FWD pulses.	Same as above.
PLS	A rectangular waveform after FWD pulse waveshaping appears. Timing remains the same as that of FWD and its waveform is one before unfactored output amplification.	
IN	Accepts a square-wave pulse train from the pulse checker (OVAL Model PC2201, for example). Used for analog full scale adjustment, loop check, or other servicing. Input mode is Model PC2201's PG30 mode. Also accepts pulses with levels "0": 1V max. and "1": 7 to 12V min., or open collector.	
OUT1	Provides a waveform corresponding to the power signal which appears across remote output signal terminals 1 and 2.	(1) Unfactored pulse  (2) Factored pulse Depends on "Pulse width" setting.  (3) Analog output 
OUT2	Produces a waveform corresponding to the open collector output which appears across external output terminals 3 and 4.	

12.3 About the Meter Factor

If it is desired to change meter factors in an instrumental error testing, for example, you may establish a new meter factor by the following procedure.

Instrumental error testing must be conducted with proper facilities and procedures specified in the Measurement Act, Japan Measuring Instruments Federation, JIS standards, or other established standards.

• How to Determine a New Meter Factor

E: Instrumental error determined by the test (%)

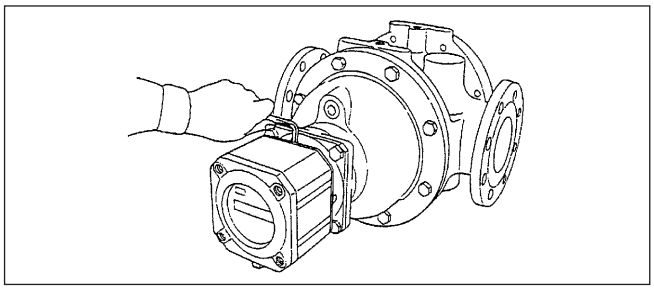
$$\text{New Meter Factor} = (\text{Current meter factor}) \times \left(1 - \frac{E}{100}\right) \text{ (mL/P)}$$

where current meter factor : Stated in the test report or on the tag of the product.

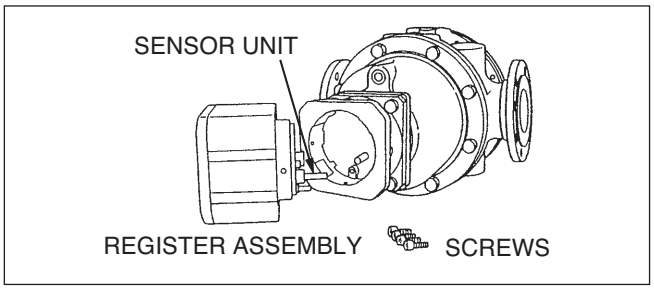
E : Instrumental error determined by the test (%)

⚠ CAUTION: It is recommended to keep track of the new meter factor for later reference.

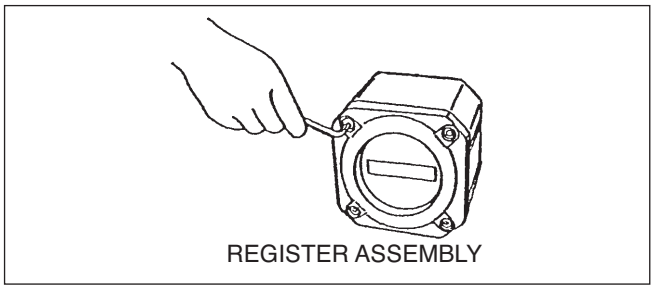
13. SENSOR REPLACEMENT PROCEDURE



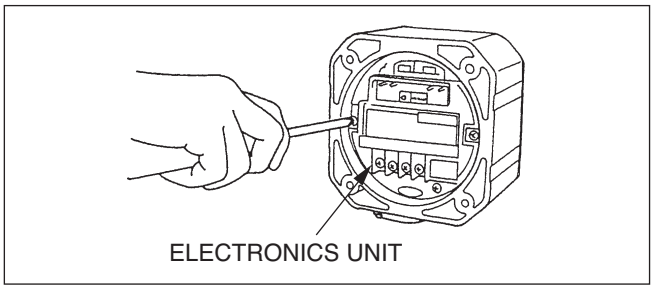
(1) Take off four hex socket head screws on the side of the register.



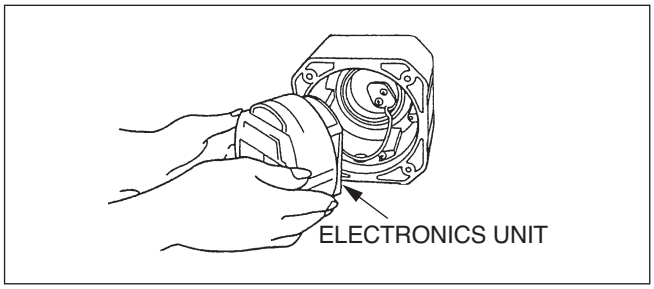
(2) Carefully draw the register assembly out. Exercising care not to bump the sensor against adjacent components, draw it out in the horizontal direction.



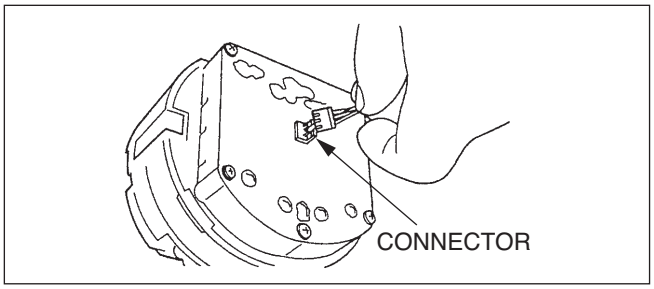
(3) Take off four hex socket head bolts and separate the cover.



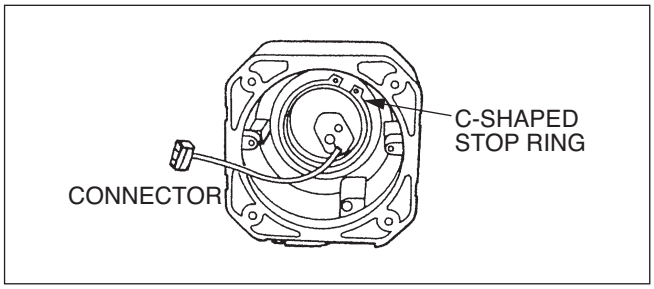
(4) With screwdriver, take off two fitting screws holding the electronics unit.



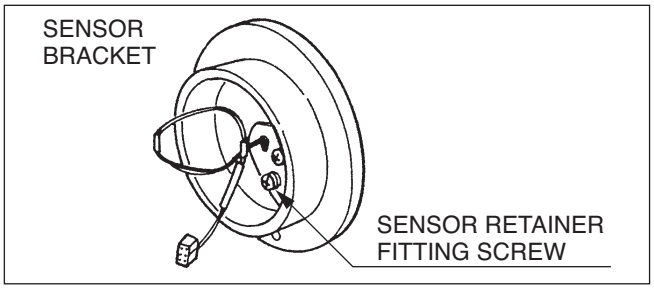
(5) Holding the electronics unit with both hands, carefully draw it out.



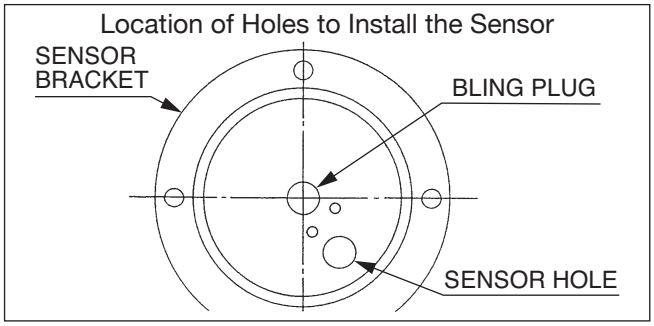
(6) Uncouple the connector from the sensor unit at back of the electronics unit.

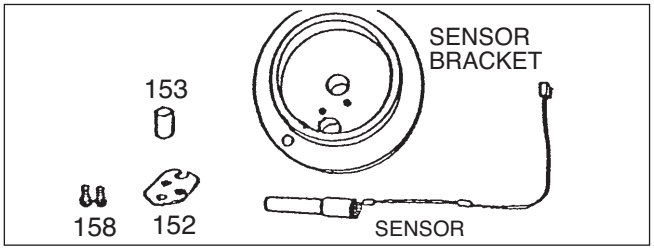


(7) Using C-shaped stop ring pliers, remove the C-shaped stop ring for the shat. The sensor unit is now separable from the register housing.



(8) Loosen the sensor retainer fitting screws (M4) with screwdriver, remove the sensor retainer and draw out the sensor unit.





(9) Install a new sensor unit through the opening through which the old sensor unit was removed and assemble in the reverse order of disassembly.

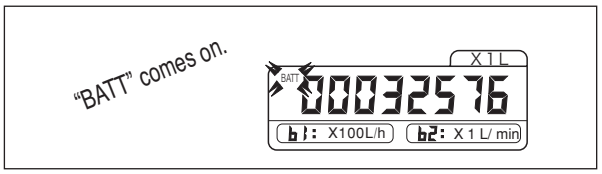
14. BATTERY REPLACEMENT PROCEDURE (Standard ULTRA register with battery pack)

14.1 About the Battery

(1) When the batteries have weakened to nearly their end of life, a low battery warning message "BATT" appears on the register display. At this point, your are urged to replace the battery pack within a week.

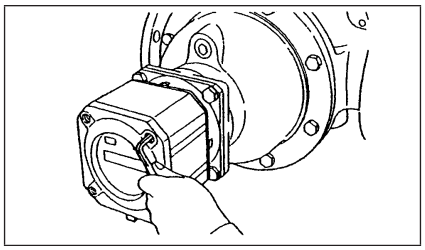
(2) This dedicated battery pack is provided with a connector. Other commercially available batteries cannot be used. Be sure to use the battery pack dedicated to this register.

➡ NOTE : (*) Without external power, the battery is good for approximately 8 years, continuous operation. (It may vary with operating and environmental conditions.)

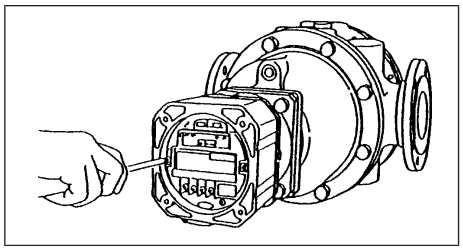


14.2 Battery Pack Replacement

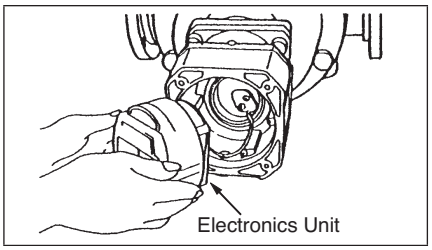
⚠ CAUTION: If your meter is of externally powered type, turn off power first.



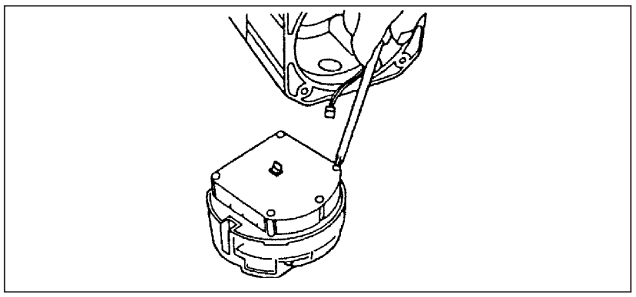
(1) Take off four hex socket head bolts on the front face of the register and remove the cover.



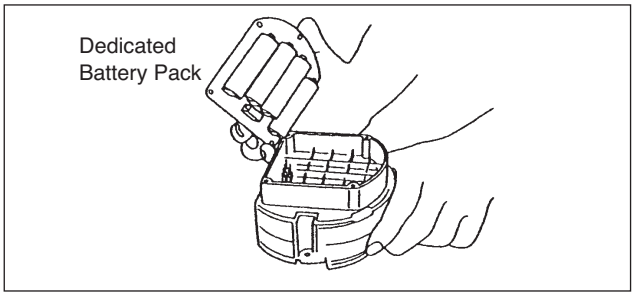
(2) Using screwdriver, take off two fitting screws on electronics unit.



(3) Holding the electronics unit with both hands, carefully draw it out. Be careful not to damage the sensor leads connected.



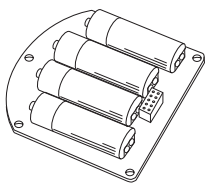
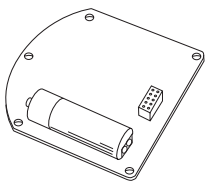
(4) Uncouple the connector from the sensor unit at back of the electronics unit and take off five screws as shown.



(5) Carefully draw the dedicated battery pack out.

(6) Install a new battery pack. Make sure of the connector location. Forcible installation may damage the connector or cause poor electrical contact.

◎ Two types of dedicated battery packs are available.

	Battery pack without external output (4 batteries)	Battery pack without external output (1 battery)
Appearance		
Life (when operating on battery)	Approx. 8 years	Approx. 2 years
Applicable range	Applicable to the battery pack without external output (Usable for the battery pack with external output)	Applicable to the battery pack with external output (Not usable for the battery pack without external output)

IMPORTANT

When you replace batteries, contact your nearest OVAL service station and use dedicated battery packs.

⚠ WARNING

This dedicated battery pack is of an intrinsic safety explosionproof configuration. Never attempt to disassemble it.

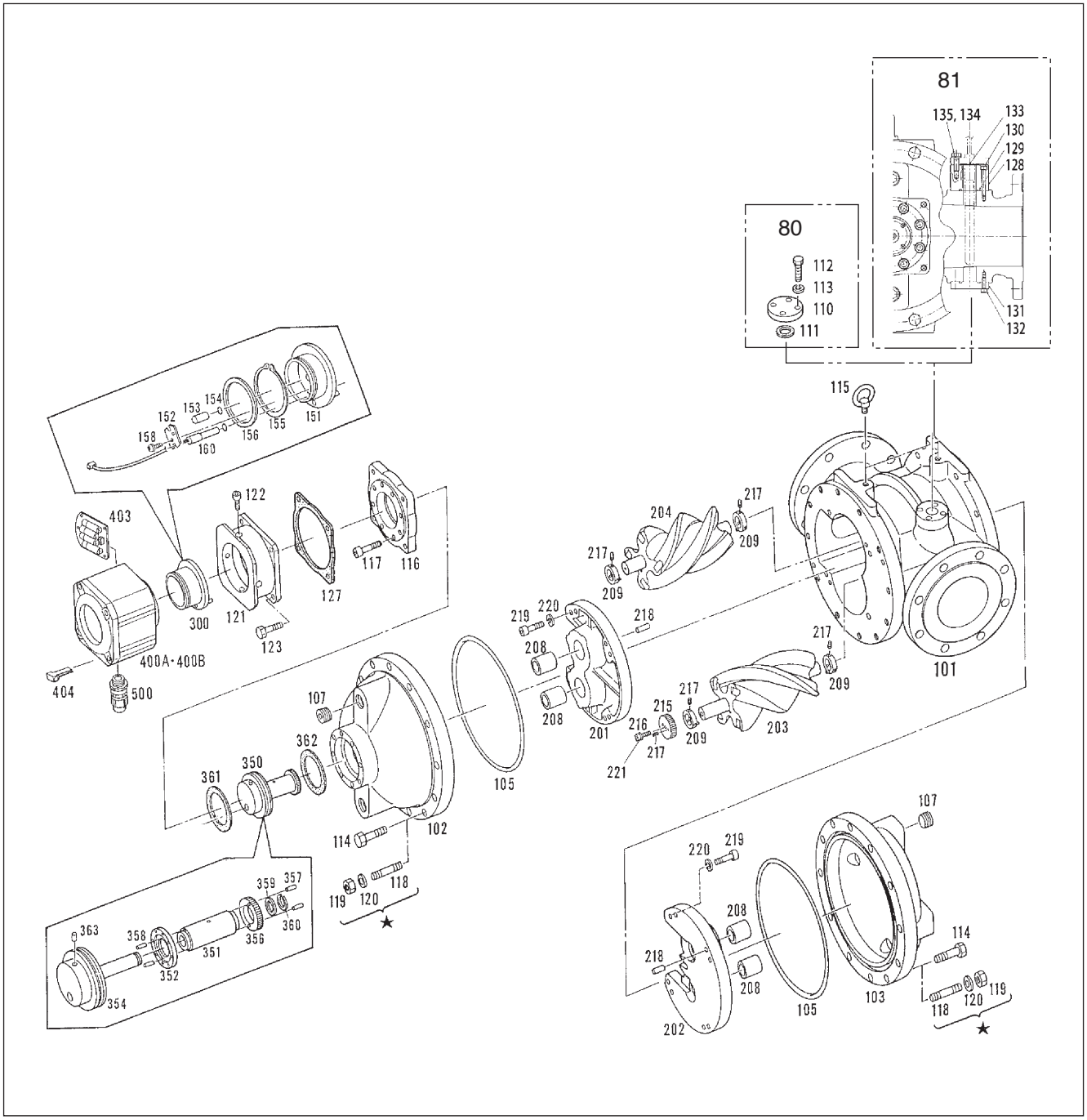
15. TROUBLESHOOTING

SYMPTOM	POSSIBLE CAUSE	COPING ACTION
1. Totalizer does not 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 carrying capacity of power source is inadequate.	3. Provide a 14 to 45VDC power to the register. (12 to 24VDC for open collector or voltage pulse output.) Current carrying capacity 30mA min. is required for power. (With analog output equipped register, 24VDC, 60mA min. is required.)
	4. Battery has run down.	4. Referring to Section 14, replace batteries.
	5. Rotors jammed with foreign matter; rotors locked: metered liquid fails to run.	5. Referring to Disassembly and Inspection Procedure (Sec. 10), disassemble meter body and clean the rotors thoroughly.
	6. Sensor installed out of position.	6. Refer to "How to Change Flow Directions" (Sec. 7) and reinstall the sensor.
2. Unusual noise.	1. Air is entrapped.	1. Decrease flowrate and eliminate air in the piping assembly.
	2. Vaporized metered liquid in the piping assembly.	2. Decrease flowrate and control metered fluid temperature and pressure to prevent vaporization.
	3. Rotors revolving in contact with measuring chamber.	3. Refer to Disassembly and Inspection Procedure (Sec. 10) and disassemble and inspect for condition.
3. "BATT" flickers.	1. Battery voltage is low.	1. Refer to Sec. 14 and replace batteries.
4. Liquid leaks.	1. Incomplete seal of the pipeline.	1. Inspect rear cover fitting bolts 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 valves remain 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. Analog output unusual.	1. Load resistance too great.	1. Referring to "Load Resistance Range" on page 15 check load resistance to power supply voltage relationship and keep them within the specified range.
7. Accumulated total too high.	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.
8. Accumulated total too low.	1. Influenced by external magnetic fields.	1. Keep out external magnetic fields.

16. EXPLODED VIEWS AND PARTS LIST

- **When you order replacement parts, specify the stock No., flowmeter model, instruction manual No., symbol No., part name and the quantity desired.**

<Exploded View>



<Parts List>

Sym. No.	Part Name	Q'ty	Remarks
101	Meter Body	1	
102	Front Cover	1	
103	Rear Cover	1	
▲105	O-Ring	2	*
107	Plug	4	
110	Thermometer Blind Lid	1	Size 80
111	Gasket	1	Size 80
112	Hex Bolt	8	Size 80
113	Washer	8	Size 80
114	Lid Fitting Bolt	16	Size 80,M12×35
		24	Size 80,M12×40
115	Eyebolt	2	
116	Sealing Flange	1	
117	Hex Socket Head Bolt	8	M10×45
121	Adapter	1	
122	Hex Socket Head bolt	4	
123	Hex Bolt	4	
127	Gasket	1	
128	Thermometer Boss	1	Size 81
129	O-Ring	2	Size 81
130	Hex Socket Head Bolt	4	Size 81
131	Thermometer Lid	1	Size 81
132	Hex Socket Head Bolt	4	Size 81
133	Gasket	1	Size 81
134	Hex Bolt	4	Size 81
135	Spring Washer	4	Size 81
201	Top Cover	1	
202	Bottom Cover	1	
203	First Rotor	1	w/rotor shaft
204	Second Rotor	1	w/rotor shaft
208	Bearing	4	
209	Thrust Ring	4	
215	Transmission Gear	1	
216	Hex Socket Head Bolt	1	
217	Hex Socket Head Screw	5	
218	Cover Locating Pin	4	
219	Hex Socket Head Bolt	8	
220	Spring Washer	8	
221	Spring Washer	1	

Sym. No.	Part Name	Q'ty	Remarks
300	Sensor Assembly	1 set	(151 to 160)
151	Sensor Bracket	1	
152	Sensor Retainer	1	
153	Blind Plug	1	
154	O-Ring B	2	S10
155	O-Ring C	1	S63
156	C-Ring	1	
158	Pan Head Screw	2	M4×8
160	Sensor	1	
350	Signal Magnet Ass'y	1 set	(351 to 363)
351	Bearing Holder	1	Bearing inclusive
352	Magnet Retainer	1	Magnet embedded
354	Bulkhead	1	
356	Transmission Gear	1	
357	Pin	2	ϕ2×12
358	Pin	2	ϕ2×8
359	Thrust Spacer	1	
360	C-Ring	1	
▲361	Gasket	1	t 0.4×ϕ84×ϕ68
▲362	Gasket	1	t 1.5×ϕ84×ϕ68
363	Pin	1	ϕ4×10
400A	Register Assembly	1 set	Model A
400B	Register Assembly	1 set	Model H
401	Register Lid	1	
402	Register Lid Fitting Bolt	4	M6
403	Battery Pack	1	
404	Selector Magnet Unit	1	
405A	Internal Assembly	1 set	Standard ULTRA register
405B	Internal Assembly	1 set	Smart Type ULTRA register
500	Pressuretight Packing	1 set	Std. accessory for ext. powered type

▲: Recommended spare parts

★: 30k type

* O-ring size Meter Size 80: JIS G-200
Size 81: JIS G-250

17. GENERAL SPECIFICATIONS

17.1 Standard ULTRA register Specifications

Item \ Meter Size			80 and 81
Local Indicator (LCD) (Note 1)	Grand total (8-digits)		0.01m³ (standard), 0.01m³, 0.1m³
	Resettable counter (7-digits)	C mode	The unit of total flow is the same as that of grand total.
	Instantaneous flowrate (4-digit)	b1 mode	0.1 m³/h (standard)
		b2 mode	0.001 m³/min (standard)
Output —	None		Local display only.
Output Current	Analog		4 to 20mA DC See acceptable load resistance range on page 15.
	Pulse (Note 2)	Category	Factored or unfactored: 0/1 = 4/20mA DC
		Pulse width	Factored: 1 ms (standard), 50 ms Unfactored: 2 ms
		Voltage pulse units	Same as the indicated unit.
Output Open collector	Pulse (Note 2)	Category	Factored or unfactored: Max. voltage impression 30V DC Allowable current 50mA
		Pulse width	Factored: I ms (standard), 50 ms Unfactored: 2 ms
		Voltage pulse units	Same as the indicated unit.
Output Voltage	Pulse (Note 2)	Category	Factored or unfactored: 0/1 = 1V DC max. / 7V DC min.
		Pulse width	Factored: 1 ms (standard), 50 ms Unfactored: 2 ms
		Voltage pulse units	Same as the indicated unit.
Power Supply	Less Output		Built-in dedicated lithium battery pack good for 8 years approx. (Depends on operating conditions.)
	Output provided		External power 12 to 45V DC (analog, current pulse) 12 to 24V DC (open collector pulse, voltage pulse) 12 to 45V DC (analog, current pulse combined) Current drain 30mA DC max. See the acceptable load resistance range on page 15. (Note 1)
Signal Transmission Cable			Externally shielded cabtyre cable (VCTF 1.25 mm²) Finished O.D. 8.5 to 12 mm (Note 3)
Transmission Length			One kilometer max.
Transmission Lines		2-wire system	Analog or current pulse
		3-wire system	Open collector pulse or voltage pulse
		4-wire system	Analog current pulse
Ambient Temperature			-10 to +60°C
Explosionproof Construction			Select either one of the following: ① Non-explosionproof type ② TIIS : ExdⅡBT4/ExiaⅡBT4 ③ NEPSI : Exd ⅡBT4 ④ KOSHA : ExdⅡBT4
Applicable EU Directives			RoHS : 2011/65/EU EMC : 2014/30/EU
Applicable EN standard			RoHS : EN50581 : 2012 EMC : EN61326-1 : 2013 Class A
Enclosure Protection Rating			IP66 (dustlight/watertight) IEC/EN60529, JIS C 0920
Enclosure Material			Aluminum die casting
Finish			Munsell 2.5PB 5/8, baked melamine resin coating

➡ NOTE : 1. When powered by the battery pack, the register provides local readout only with no remote output.
2. If pulse width in excess of 1 ms is desired with minimum factored pulse unit, the max. flowrate can possibly be restricted; consult the factory.
3. For wiring of explosionproof type (output available models), do not fail to use the ancillary pressure-resistant packing.
Also, in case of TIIS explosionproof type used under the ambient temperature of 45℃ or higher, use a cable resistant to the temperature of 75℃ or higher.

17.2 Smart Type ULTRA register Specifications

Item \ Meter Size				80 and 8
Local Display (LCD) Mode select		Grand total (8-digits)	-	×1 L (standard) ×10 L, ×100 L
		Instantaneous flowrate (4-digit)	b mode	×100 L/h
			p mode	0 to 100 %
			Bar graph	8-section bar graph
Output	Current	Analog		4 to 20mA DC Damping: 0 to 100 sec. See the acceptable load resistance range on page 15.)
		Pulse (Note 4)	Category	Factored or unfactored: 0/1 = 4/20mA DC (Note 1)
			Pulse width	Factored: 1 to 1000 ms (standard 1 ms), Unfactored: 2 ms
			Voltage pulse units	Same as the indicated unit.
	Open collector	Pulse (Note 4)	Category	Factored or unfactored: Max. voltage impression 30V DC Allowable current 50 mA (Note 1)
			Pulse width	Factored: 1 to 1000 ms (standard 1 ms), Unfactored: 2 ms
			Voltage pulse units	Same as the indicated unit.
		Alarm output status		Max. allowable voltage impression: 30V DC Allowable current 50mA
Communication				Current output 4 to 20mA Bell 202 standard FSK (frequency modulation) signal superimposed on the instantaneous flowrate signal.
Power Supply				12 - 45V DC Current drain 30mA max. (See acceptable load resistance range on page 15.)
Ambient Temperature				-10 to + 60 °C
Function		3α correction		Corrects for volumetric expansion coefficient of meter's measuring chamber material.
		Meter error correction		A 4-point broken line graph. Meter error correction factor at 4 flowrate points is entered in % meter error.
		Instant flowrate span setting		Any point more than 3 times the minimum flowrate and less than 2 times the maximum flowrate within the accuracy guaranteed range.
		4-20mA DC trim		
		Communication		Permits parameter setting and reading with EL2310. Communication under HART protocol.
		Alarm		Normally: Transistor OFF; In error: Transistor ON (Tells the operator sensor error, full scale exceeded or preset flowrate exceeded.) (Note 3)
		Self diagnostic loop check		
Accuracy				Total flow ±0.01% ±1 count Instantaneous flowrate ± 0.3% of F.S.
Transmission cable				Externally shielded cabtyre cable (VCTF 1.25mm^2) Finished O.D. 8.5 to 12 mm (Note 2)
Transmission length				One kilometer max.
Transmission lines			2-wire system	Analog or current pulse
			4-wire system	Analog or current pulse + open collector
Construction				Select one of the following enclosures: ① Non-explosionproof type ② Explosionproof type: TIIS Exd ⅡBT4/Exia ⅡBT4 ③ Explosionproof type: KOSHA ExdⅡBT4
Finish				Munsell 2.5PB 5/8

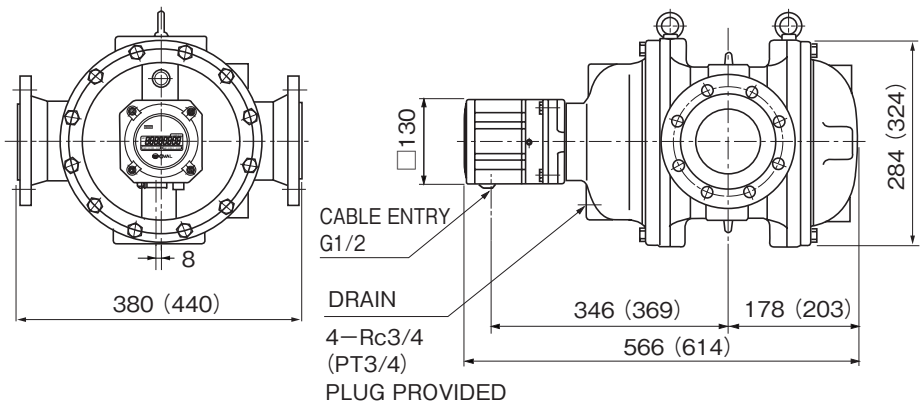
➡ NOTE : 1. Current pulse and open collector pulse share the same category for setting. A combination of factored and unfactored pulses is unacceptable.
2. For wiring of explosionproof type, do not fail to use the ancillary pressure-resistant packing. Also, in case of TIIS explosionproof type used under the ambient temperature of 50°C or higher, use a cable resistant to the temperature of 70°C or higher.
3. In an alarmed condition, the register shows an error message and flow information one after the other.
4. If pulse width in excess of 1ms is desired with minimum factored pulse unit, the max. flowrate can possibly be restricted; consult the factory.

17.3 Nominal Meter Factor

Meter Size	No. of Pulses, P/r	Nominal Meter Factor
80	6	250.6 mL/P
81	10	279.0 mL/P

18. OUTLINE DIMENSIONS

Unit: mm



● Approx. WT of Meter Body

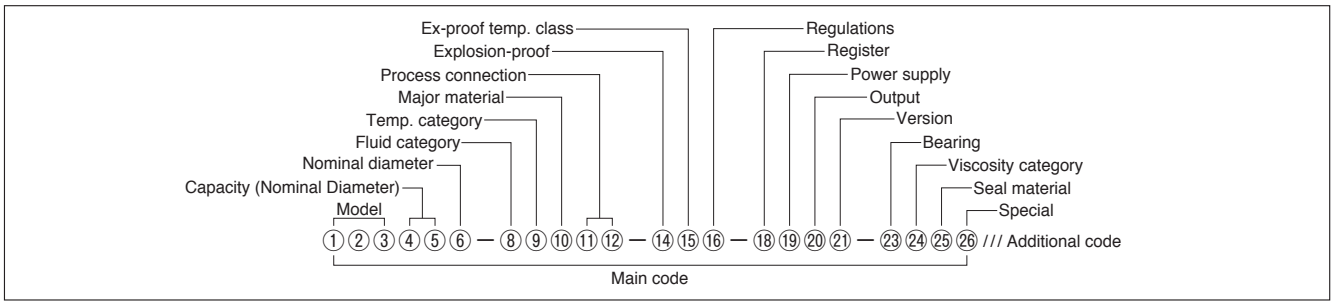
Meter Size	FC body	SCPH2 body
80	90kg	96kg
81	130kg	135kg

➡ NOTE : Figures in brackets ( ) show dimensions of Size 81 meter.

➡ NOTE : For outline dimensions and pipe connection dimensions, refer to the approval drawing.

19. PRODUCT CODE EXPLANATION

〈STANDARD〉



●Main code (Meter Size: 80, 81)

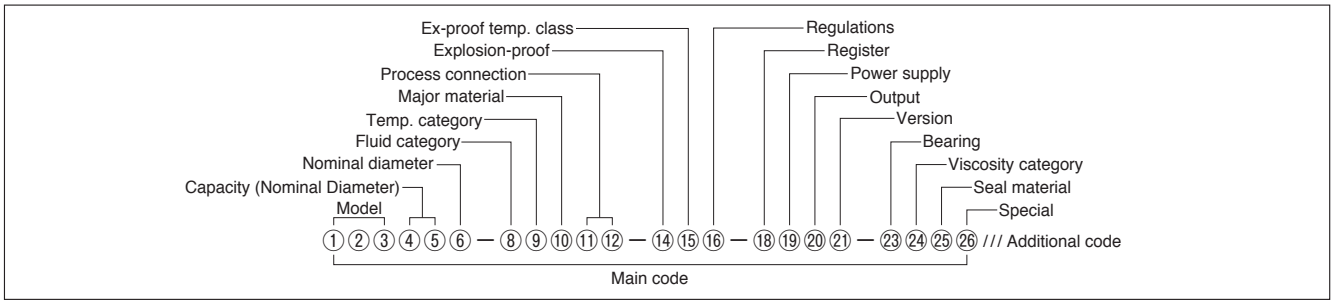
①	②	③	**Model**
L	R	S	UFⅡ Element: cast iron + surface treatment
④	**⑤**		**Capacity (Nominal Diameter)**
8	0		80mm or 100mm (3" or 4") ND (Small (special) or Big)
8	1		100mm (4") ND (Big)
⑥			**Nominal diameter**
3			Nominal diameter (Small)
4			Nominal diameter (Big)
⑦			**—**
⑧			**Fluid category**
L			Liquid
⑨			**Temp. category**
1			120℃ and lower
⑩			**Major material**
F			SCPH2
Z			Special
⑪	**⑫**		**Process connection**
J	1		JIS10K RF
A	1		ASME150 RF
P	1		JPI150 RF
Z	9		Special
⑬			**—**
⑭			**Explosion-proof**
0			Non-explosionproof
4		TIIS	When register code ⑱ is "A, B or D", selectable
7		NEPSI	
8		KOSHA	When register code ⑱ is "A", selectable
T		ITRI	When register code ⑱ is "A, B", selectable
⑮			**Ex-proof temp. class**
0			Non-explosionproof
3			T3
4			T4
⑯			**Regulations**
0			Standard
T		Fire Service Act	※ w/Material test certificate
F		w/Material test certificate	※ w/Material test certificate
Z		Special	

※ 1: See General Specification Sheet No. GBC201 for detail.

※ 2: Consult with OVAL.

⑰	**—**	
⑱	**Register**	
A	Standard ULTRA register	
B	Batch controller equipped ULTRA register ※1	
D	Auto temp. compensator equipped ULTRA register ※2	
⑲	**Power supply**	
0	External power supply (standard)	
V	Battery drive	When register code ⑱ is "A, B", selectable
⑳	**Output**	
G	Standard output (open collector pulse output)	When register code ⑱ is "A", selectable
A	Analog	When register code ⑱ is "A", selectable
D	Current pulse	When register code ⑱ is "A", selectable
B	Voltage pulse	When register code ⑱ is "A, D", selectable
T	Current pulse + analog	When register code ⑱ is "A", selectable
M	Current pulse + open collector pulse output	When register code ⑱ is "A, D", selectable
W	open collector pulse output + Analog	When register code ⑱ is "A, D", selectable
N	No output	When register code ⑱ is "A, D", selectable
1	Pneumatic 1 step open and close (w/LW74E register)	When register code ⑱ is "B", selectable
2	Pneumatic 2 step open and close (w/LW76E register)	When register code ⑱ is "B", selectable
Z	Special	
㉑	**Version**	
A	Version A	
㉒	—	
㉓	**Bearing**	
0	Standard (carbon bearing)	
㉔	**Viscosity category**	
U	Always "U"	
㉕	**Seal material**	
F	O-ring (FPM), gasket (T#1120)	
C	O-ring (IIR), gasket (T#1120)	
Z	Special	
㉖	**Special**	
0	Standard	
Z	Special	

〈STANDARD〉



●Additional code

Category of High Pressure Gas				
H	P	0	Other than High Pressure Gas	
H	P	1	Toxic gas and flammable gas	
H	P	2	Toxic gas	
H	P	3	Flammable gas	
H	P	4	Other than toxic or flammable gas	
Accuracy				
R	0	5	±0.50% ACCURACY	
L	0	1	±0.15% LINEARITY ※Only for export	
L	0	3	±0.35% LINEARITY ※Only for export	
R	0	2	±0.20% ACCURACY	
R	9	9	Special	
Operating condition				
F	C	0	Continuous	
F	M	0	Intermittent	
Special test (instrumental error)				
A	1	0	Taxed custody transfer	
A	2	0	By certified measurer	
A	6	0	Standard oil meter	According to JMIF standard (Bore size 80mm and over)
A	7	0	Std. fuel oil meter, std. water meter	
A	8	0	Std. fuel oil meter, std. water meter	
A	9	9	Designation of instrumental error test method	Addition of one (1) test point, etc.
Flow direction				
F	R	0	R→L	
F	L	0	L→R	
F	U	0	T→B: Electric conduit at the bottom	
F	D	0	B→T: Electric conduit at the bottom	
Designated special paint on body				
B	C	0	Corrosion proof	
B	A	0	Salinity and acid tolerance	120℃ and lower
B	X	0	Customer designation	
Designated special paint on transmitter				
S	F	0	Corrosion proof	Special treatment
S	D	0	Salinity tolerance	
S	E	0	Acid tolerance	Special treatment
S	X	0	Customer designated paint	Special treatment
Label				
N	P	J	Label (Japanese)	
N	P	E	Label (English)	

Document			
D	S	J	SPEC. & DWG (Approval Drawing) (Japanese)
D	S	E	SPEC. & DWG (Approval Drawing) (English)
D	R	0	Re-submission of SPEC. & DWG
D	C	J	Final DWG (Japanese)
D	C	E	Final DWG (English)
D	P	J	Strength Calculation sheet (Japanese)
D	P	E	Strength Calculation sheet (English)
S	E	J	Inspection Certificate (Calibration report) (Japanese)
S	E	E	Inspection Certificate (Calibration report) (English)
S	T	J	Pressure test report (Japanese)
S	T	E	Pressure test report (English)
S	A	J	Airtight test report (Japanese)
S	A	E	Airtight test report (English)
D	D	J	Dimensional check record (Japanese)
D	D	E	Dimensional check record (English)
S	P	J	Penetrant test report (Japanese) Welded part of pressure resistant vessel
S	P	E	Penetrant test report (English) Welded part of pressure resistant vessel
S	M	J	Magnetic particle inspection (Japanese) Welded part of pressure resistant vessel
S	M	E	Magnetic particle inspection (English) Welded part of pressure resistant vessel
S	R	J	Radiographic inspection (Japanese) Welded part of pressure resistant vessel
S	R	E	Radiographic inspection (English) Welded part of pressure resistant vessel
S	U	J	Ultrasonic inspection (Japanese) Welded part of pressure resistant vessel
S	U	E	Ultrasonic inspection (English) Welded part of pressure resistant vessel
S	X	J	PMI test report (Japanese)
S	X	E	PMI test report (English)
S	S	J	Impact test report (Japanese)
S	S	E	Impact test report (English)
D	Y	J	WPS/PQR (Japanese)
D	Y	E	WPS/PQR (English)
D	9	J	Photo (Japanese)
D	9	E	Photo (English)
D	T	J	Inspection procedure (Japanese)
D	T	E	Inspection procedure (English)
C	A	J	Traceability certificate: A set Only Japanese
C	B	J	Traceability certificate: B set Only Japanese
C	C	J	Traceability certificate: C set Only Japanese
C	D	J	Traceability certificate: D set Only Japanese
Witness Test			
V	1	0	Required

〈SMART TYPE〉

●Main code (Meter Size: 80, 81)

Model:①~③			**①②③***-*****-***-****-******
L	R	S	UFⅡ Element: cast iron＋surface treatment
Capacity (Nominal Diameter): ④~⑤			*****④⑤*-*****-***-****-******
8	0		80mm or 100mm (3″ or 4″) ND (Small (special) Big)
8	1		100mm (4″) ND (Big)
Nominal diameter:⑥			*******⑥-*****-***-****-******
3			Nominal diameter (Small)
4			Nominal diameter (Big)
Hyphen:⑦			********-*****-***-****-******
Fluid category:⑧			********-⑧****-***-****-******
L			Liquid
Temp. category:⑨			********-*⑨***-***-****-******
1			120℃ and lower
Major material:⑩			********-**⑩**-***-****-******
F			SCPH2
Z			Special
Process connection:⑪~⑫			********-***⑪⑫-***-****-******
J	1		JIS 10K RF
A	1		ASME 150 RF
P	1		JPI 150 RF
Z	9		Special
Hyphen:⑬			********-*****-***-****-******
Explosion-proof:⑭			********-*****-⑭**-****-******
0			Non-explosionproof
2			TIIS
8			KOSHA
Ex-proof temp. class:⑮			********-*****-*⑮*-****-******
0			Non-explosionproof
4			T4
Regulations:⑯			********-*****-**⑯-****-******
0			Standard
T			Fire Service Act ※w/Material test certificate
F			w/Material test certificate ※w/Material test certificate
Z			Special

※:If cooling fin is required, please consult with us.

Hyphen:⑰	********-*****-***-****-******
Register:⑱	********-*****-***-⑱***-******
H	Smart Type ULTRA OVAL register
Power supply:⑲	********-*****-***-*⑲**-******
0	External power supply (Standard)
Output:⑳	********-*****-***-**⑳*-******
G	Standard output (open collector pulse output)
A	Analog
D	Current pulse
M	Current pulse + open collector pulse
W	Open collector pulse + analog
Z	Special
Version code:㉑	********-*****-***-***㉑-******
A	Version code:A
Hyphen:㉒	********-*****-***-****-******
Bearing:㉓	********-*****-***-****-㉓*****
0	Standard (carbon bearing)
Viscosity category:㉔	********-*****-***-****-*㉔****
U	Always "U"
Seal material:㉕	********-*****-***-****-**㉕***
F	O-ring (FPM), gasket (T#1120)
C	O-ring (IIR), gasket (T#1120)
Z	Special
Special:㉖	********-*****-***-****-***㉖**
0	Standard
Z	Special

〈SMART TYPE〉

●Additional code

Category of High Pressure Gas					
H	P	0	Other than High Pressure Gas		
H	P	1	Toxic gas and flammable gas		
H	P	2	Toxic gas		
H	P	3	Flammable gas		
H	P	4	Other than toxic or flammable gas		
Accuracy					
R	0	5	±0.50%	ACCURACY	
L	0	1	±0.15%	LINEARITY	※Only for export
L	0	3	±0.35%	LINEARITY	※Only for export
R	0	2	±0.20%	ACCURACY	
R	9	9	Special		
Operating condition					
F	C	0	Continuous		
F	M	0	Intermittent		
Special test (instrumental error)					
A	1	0	Taxed custody transfer		
A	2	0	By certified measurer		
A	6	0	Standard oil meter	According to JMIF standard (Bore size 80mm and over)	
A	9	9	Designation of instrumental error test method	Addition of one (1) test point, etc.	
Flow direction					
F	R	0	R→L		
F	L	0	L→R		
F	U	0	T→B	Electric conduit at the bottom	
F	D	0	B→T	Electric conduit at the bottom	
Designated special paint on body					
B	C	0	Corrosion proof		
B	A	0	Salinity and/or acid tolerance	Only when 120℃ and lower	
B	X	0	Customer designation		
Designated special paint on transmitter					
S	F	0	Corrosion proof	Special treatment	
S	D	0	Salinity tolerance		
S	E	0	Acid tolerance	Special treatment	
S	X	0	Customer designated paint	Special treatment	
Label					
N	P	J	Label (Japanese)		
N	P	E	Label (English)		

Document				
D	S	J	DWG and specifications for approval (Japanese)	
D	S	E	DWG and specifications for approval (English)	
D	R	0	Re-submission of DWG with specifications	
D	C	J	Final DWG (Japanese)	
D	C	E	Final DWG (English)	
D	P	J	Calculation sheet (Japanese)	
D	P	E	Calculation sheet (English)	
S	E	J	Instrumental error test report (Japanese)	
S	E	E	Instrumental error test report (English)	
S	T	J	Pressure test report (Japanese)	
S	T	E	Pressure test report (English)	
S	A	J	Airtight test report (Japanese)	
S	A	E	Airtight test report (English)	
D	D	J	Dimensional check record (Japanese)	
D	D	E	Dimensional check record (English)	
S	P	J	Penetrant test report (Japanese)	Welded part of pressure resistant vessel
S	P	E	Penetrant test report (English)	Welded part of pressure resistant vessel
S	M	J	Magnetic particle inspection (Japanese)	Welded part of pressure resistant vessel
S	M	E	Magnetic particle inspection (English)	Welded part of pressure resistant vessel
S	R	J	Radiographic inspection (Japanese)	Welded part of pressure resistant vessel
S	R	E	Radiographic inspection (English)	Welded part of pressure resistant vessel
S	U	J	Ultrasonic inspection (Japanese)	Welded part of pressure resistant vessel
S	U	E	Ultrasonic inspection (English)	Welded part of pressure resistant vessel
S	X	J	PMI test report (Japanese)	
S	X	E	PMI test report (English)	
S	S	J	Impact test report (Japanese)	
S	S	E	Impact test report (English)	
D	Y	J	WPS/PQR (Japanese)	
D	Y	E	WPS/PQR (English)	
D	9	J	Photo (Japanese)	
D	9	E	Photo (English)	
D	T	J	Inspection procedure (Japanese)	
D	T	E	Inspection procedure (English)	
C	A	J	Inspection certificate: A set	Only Japanese
C	B	J	Inspection certificate: B set	Only Japanese
C	C	J	Inspection certificate: C set	Only Japanese
C	D	J	Inspection certificate: D set	Only Japanese
Witnessed by customer				
V	1	0	Required	

《PRODUCT CODE EXPLANATION OF THE OLD PRODUCT CODE》

The new product code has been implemented since April 2017.
Therefore, the product code explanation of the old product code will not be updated after April 2017.
Contact OVAL if you wish to order with the old product code for reasons such as type approval.

ITEM	PRODUCT CODE																	DESCRIPTION
	(1)	(2)	(3)	(4)	(5)	–	(6)	(7)	(8)	–	(9)	(10)	(11)	(12)	–	(13)	(14)	(15)	
Model	L																		Positive displacement flowmeter for liquid service
	K																		Standard oil meter
Material		R																	FC250 + surface treatment
Meter Size			8	0															Nominal dia. 100mm, 80mm (special specification)
			8	1															Nominal dia. 100mm
Style					3														Single case construction Nominal dia. (small)
					4														Single case construction Nominal dia. (large)
						–													
Register Assembly							U	A											Electronic register (Standard Ultra 2 type)
							U	8											Electronic register (Smart Ultra 2 type)
Cooling Tube									0										None
									5										Provided
										–									
Outer Case Material											F								SCPH2 (cast steel)
Pressure Rating												1							Nominal pressure 10K
Bearings													1						Carbon bearings
Transmission System														5					Electronic register (Ultra 2) coupled
															–				
Register Construction																1			Non-explosionproof (Smart type register)
																2			Explosionproof TIIS (Smart type register)
																3			Non-explosionproof (Battery pack provided) (Standard type register)
																4			Explosionproof TIIS (Battery pack provided) (Standard type register)
																7			Explosionproof NEPSI (Standard type register)
																8			Explosionproof KOSHA (Standard, Smart type register)

Output Signal Type					
Standard type register (Model UA)			0	0	No remote output (local totalizer only)
			0	1	Unfactored pulse, current pulse
			0	2	Factored pulse, current pulse
			0	5	Unfactored pulse, open collector
			0	6	Factored pulse, open collector
			0	7	Unfactored pulse, voltage pulse
			0	8	Factored pulse, voltage pulse
			1	0	Analog
			1	1	Analog + unfactored pulse (current pulse)
			1	2	Analog + factored pulse (current pulse)
Smart type register (Model U8)	No. 1 output signal (Note 3)		1		Analog (current signal)
			2		Factored pulse (current pulse)
			3		Unfactored pulse (current pulse)
	No. 2 output signal		–	0	No. I output signal only
			–	5	Open collector pulse Unfactored pulse
			–	6	Open collector pulse Factored pulse
			–	A	Alarm output
			–	B	Bidirectional flow detector output

➡ NOTE : 1. For output signals 11 and 12, the only available pulse is current pulse.
2. Product code in special specifications is represented by “z” for alphabets; "9" for numerals.
3. Communications can take place on this No. 1 output signal.

2021.09 Revised
2021.06 Revised△
B-525-8-E (2)