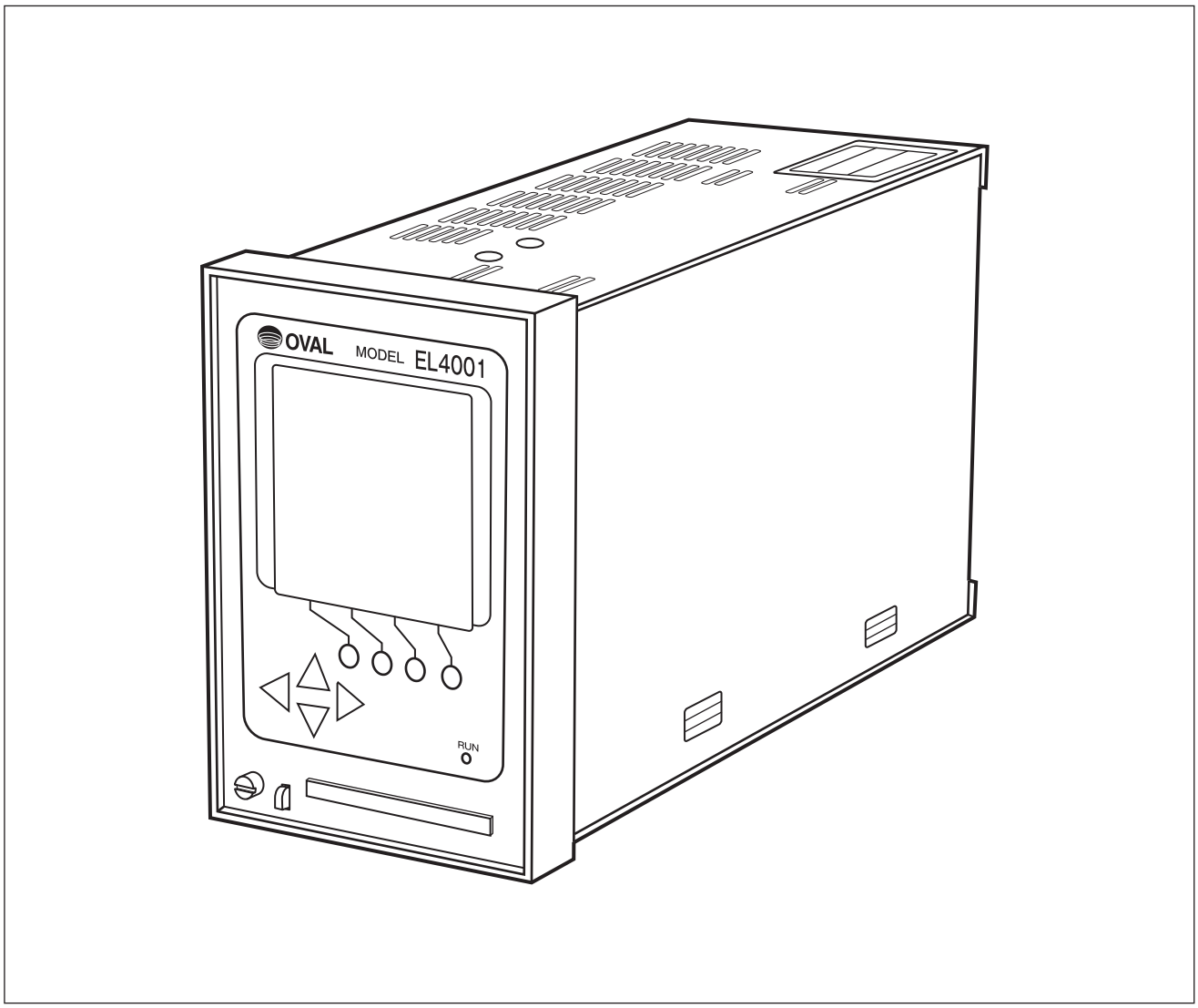
OVAL INSTRUCTIONS

Ins. No. E-881-5-E

# STEAM FLOW COMPUTER
## (Superheated steam service)

MODEL : EL4111




This manual has been prepared to provide you with the information pertinent to the STEAM FLOW COMPUTER (superheated steam service).

With the proper application of the information and knowledge contained in this manual, you can expect the best possible results over a long service life of this instrument. Keep this manual for ready reference.

It is suggested that the instruction manuals for the companion pulse generator (flowmeter) and receiving instrument be referred to at the same time.

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**About the SI units of measurement**

While some examples in this manual are shown to read in non-SI units (e.g., kgf/cm$^2$ and cal), this computer can select measurement units of your option, including the SI units (e.g., Pa and J).

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.**

# COMPANION VOLUME

# KEY OPERATION MANUAL Ins. No. E-880TM-E

## CONTENTS



**(※: Model with communication capabilities)**

# COMMUNICATION MANUAL (※) Ins. No. E-880CM-E

## CONTENTS

# 1. BEFORE YOU BEGIN

Every OVAL product is thoroughly tested and inspected before shipment from our factory.
When received, its appearance should be inspected for possible damage by rough handling during transit. First of all, thoroughly read the handling precautions described in this section. For topics other than those covered in this section, refer to the respective sections of this manual.

**If at any time in the future you seek our assistance, contact the nearest sales office in your area.**

## 1.1 Confirming the Nameplate

The instrument is adjusted to individual specifications before shipment from our factory. Model number appears on the nameplate attached to the top of the housing.
Make sure to see that the instrument you received conforms to the General Specifications and the Product Code Explanation.

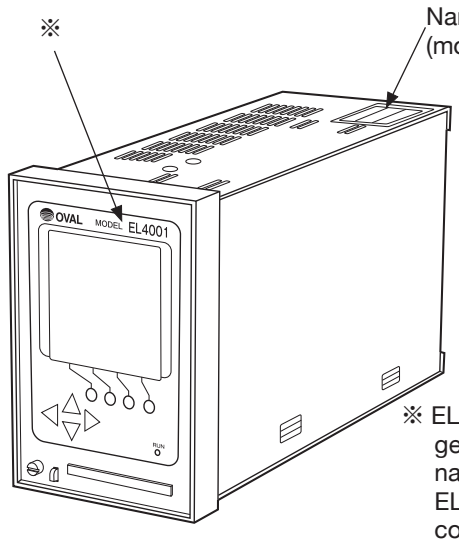



Fig. 1.1 Nameplate Location

◆ **When you make inquiries, please make sure to specify product name, meter model, serial number, operating conditions, specifications and other necessary information.**

## 1.2 Transportation Precautions

(1) In order to safeguard against damage during transportaion, transport your instrument to the installation location in the original package used for shipment from the factory if possible.
(2) Use care to avoid impact shocks to the instrument during transportaion.

## 1.3 Storage Precautions

If the instrument upon receipt is to be stored for extended periods of time before installation, unexpected problems could arise. If such is the case, the following considerations should be taken:

(1) The instrument can best be stored in the original package used for transit from the factory.
(2) The place of storage should meet the following requirements:
- ☆ Free from rain and water
- ☆ Free from vibration and impact shocks
- ☆ With minimal temperature and humidity variation (around 25°C and 65% R.H.)

## 2. GENERAL

Using the most advanced electronic tehcnologies, this digital instrument has been developed specifically to meet the most demanding steam flow measurement applications where accuracy is the prime requirement. In response to flowrate, temperature, and pressure information arriving from the sensing terminal, such as a delta flowmeter, it calculates superheated steam flow, transforms it to mass and calorific quantities, and totalizes the flow. It also provides a totalizer pulse output and an instant flowrate analog output (mass equivalent).

### 2.1 Features

(1) Changing the meter factor, ranges of temperature, pressure, or other parameters, of the companion flowmeter is simple by keystrokes on the front-panel keypad, or by inserting an IC card into the slot.
(2) Built around a microprocessor, the instrument carries out calculations entirely in digital signal processing circuits to achieve a high degree of accuracy and reliability.
(3) Variables, such as temperature and pressure, can be reviewed on command with the front panel keypad, whether or not calculation is in progress.
(4) A nonvolatile memory ($E^2$PROM) retains all parameters and variables. Variables are resettable following a power cycle or reset if so configured.

### 2.2 Part Names and Functions

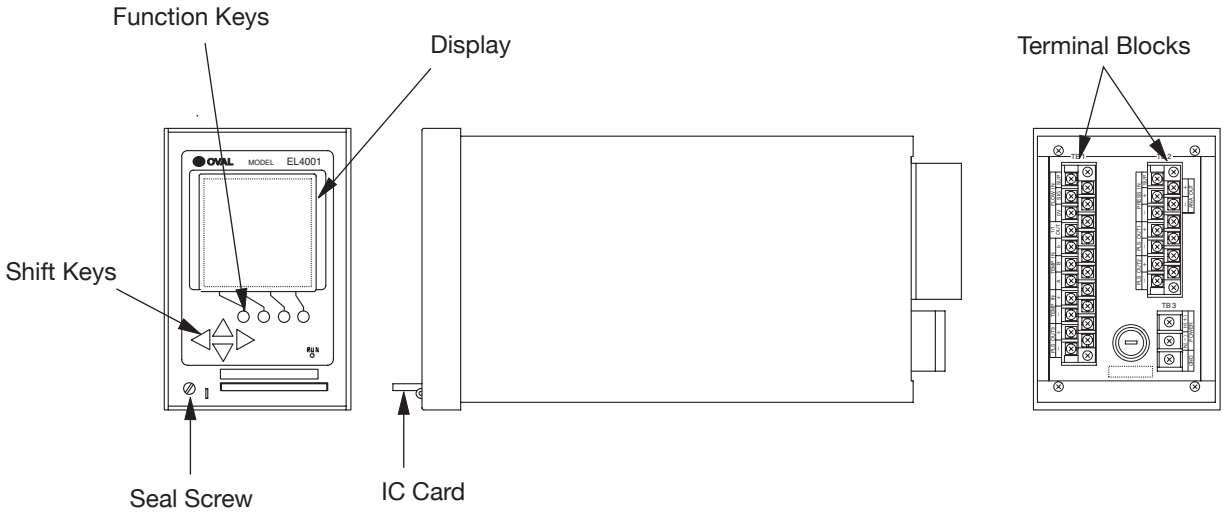



Fig. 2.1 Part Names

# 3. INSTALLATION

## 3.1 Outline Dimensions

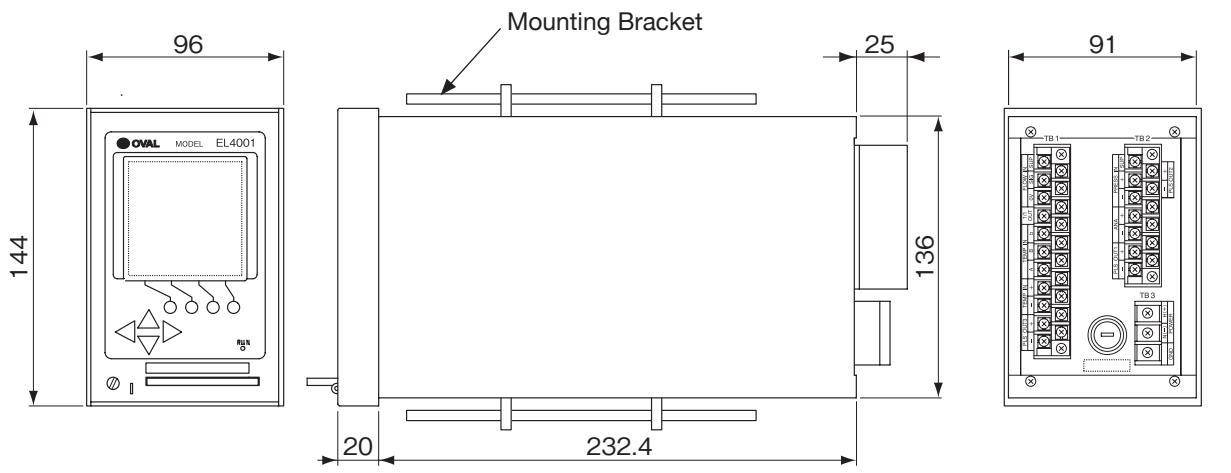



Fig. 3.1 Outline Dimensions

## 3.2 Installation

### 3.2.1 Installation Location

Select an installation site where:

(1) Less mechanical vibration, impact shock or corrosive gas exist.

(2) Air is dry and temperature is stable at room temperature.

➡ NOTE: Although the manufacturer guarantees stated performance at ambient temperatures up to +50°C, it is recommended that the instrument be placed in service at room temperature.

(3) Provide a sufficient working space behind the instrument - at least 50 centimeters from the rear panel of the instrument to facilitate wiring and servicing.

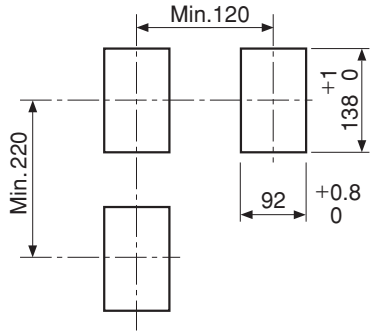



Fig. 3.2 Panel Cut

### 3.2.2 Panel

(1) Panel material shall be a rigid steel plate with minimum thickness 1.6mm. Standard recommendation is 3.2mm thickness.

(2) If it is required to install instruments alongside each other, dimensions in Fig. 3.2 are suggested.

(3) Recommended mounting height is given in Fig. 3.3.

### 3.2.3 Installation

(1) Mount the instrument through the cutout in the front panel.

(2) Fit the furnished enclosure mounting bracket into the top and bottom slots in the enclosure and, confirming that the instrument is positioned horizontal, secure the instrument to the panel with mounting bracket (Fig. 3.1).

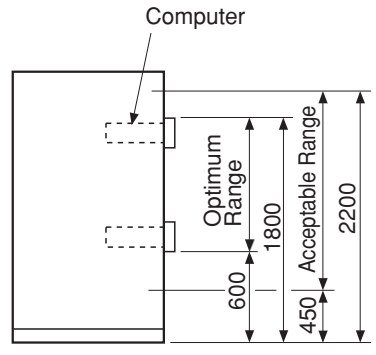



Fig. 3.3 Instrument Mounting Height

# 4. WIRING

**(See the "Wiring Guidelines" in the instruction manual of the companion pulse generator.)**

## 4.1 Field Wiring Cables

(1) Use electrostatically shielded, polyethylene insulated, vinyl sheathed control cables (CEVS, 1.25 to 2 mm, 2-conductor or 3-conductor), or equivalent, for input signal cables from the flowmeter.
For output signal cables, use insulated vinyl sheathed cables (CVV, CVS ... JIS C 3401).

(2) Ground the end of shield wire to "G" terminal of the instrument. At the sensor end, leave the end of shield wire unconnected.

## 4.2 Wiring Connections

(1) Field wiring through a conduit is recommended.

➡NOTE: In routing field wiring, use a separate conduit for power cable from other signal cables to eliminate the possibility of stray current pickup.

(2) Separate field wiring from other power lines and power circuits to minimize the possibility of inductive interference.

(3) Using crimp-type lugs for wiring, ensure good electrical connections.
Terminals are found on the back of the instrument (Fig. 4.1).

## 4.3 Description of Terminal Blocks for External Connections

Terminal blocks for external connections (TB1, TB2 and TB3) are found on the back of the instrument as shown in Fig. 4.1. Terminal identification appears in Table 4.1 while terminal connections appear in Table 4.2.

➡NOTE: TB1 and TB2 terminal numbers are indicated on the side of terminal blocks.

**⚠CAUTION**
**Make wiring connections upon confirmation of the validity of flowmeter (pulse generator) to receiving instrument combination by their product model code, serial number, etc.**

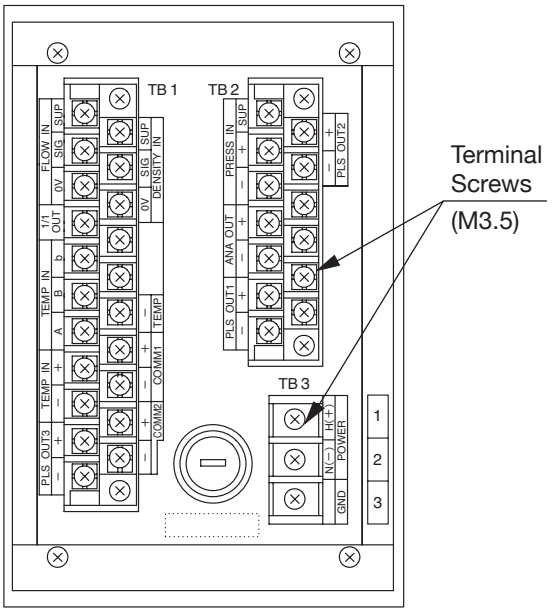



Fig. 4.1 Terminal Blocks for Ext. Connections

Table 4.1 Terminal Identification and Functions

| TB1 | | | | | |
|---|---|---|---|---|---|
| 1 | SUP. | Flow in | 12 | | |
| 2 | SIG. | | 13 | | |
| 3 | 0V | | 14 | | |
| 4 | OUT 1/1 | | 15 | | |
| 5 | b | Temp. in | 16 | | |
| 6 | B | | 17 | | |
| 7 | A | | 18 | + | Comm1 ※ |
| 8 | + | | 19 | − | |
| 9 | − | | 20 | + | Comm2 ※ |
| 10 | + | Alarm out | 21 | − | |
| 11 | − | | | | |

| TB2 | | | | | |
|---|---|---|---|---|---|
| 1 | SUP. | Press. in | 8 | + | Pulse out 2 |
| 2 | + | | 9 | − | |
| 3 | − | | 10 | | |
| 4 | + | Analog out | 11 | | |
| 5 | − | | 12 | | |
| 6 | + | Pulse out 1 | 13 | | |
| 7 | − | | | | |

| TB3 | | |
|---|---|---|
| 1 | H(+) | Power |
| 2 | N(−) | |
| 3 | GND | |

➡NOTE : ※ Mode provided with communication interface.

Table 4.2 Terminal Connections

| TB1 | | | |
|---|---|---|---|
| No | Label | | Description |
| 1 | Flow in | SUP. | Flowmeter preamp (ex. PA15) |
| 2 | | SIG. | (+) |
| 3 | | 0V | (−) Output sync with input signal (O.C.) |
| 4 | | OUT 1/1 | (+) |
| 5 | Temp. in | b | Pt100Ω 3-wire |
| 6 | | B | |
| 7 | | A | |
| 8 | | + | 4 to 20mADC/1 to 5VDC |
| 9 | | − | |
| 10 | Pulse out 3 | No polarity | Alarm out Static relay |
| 11 | | | |

➡NOTE : ※Mode provided with communication interface.

| TB2 | | | |
|---|---|---|---|
| No | Label | | Description |
| 1 | Press. in | SUP. | +24V |
| 2 | | + | 4 to 20mADC/ 1 to 5VDC |
| 3 | | − | |
| 4 | Analog out | + | Instant mass flowrate 4 to 20mADC/1 to 5VDC |
| 5 | | − | |
| 6 | Pulse out 1 | No Polarity | Total mass flow Static relay |
| 7 | | | |
| 8 | Pulse out 2 | No Polarity | Total calorific flow Static relay |
| 9 | | | |
| 10 | | | |
| 11 | | | |
| 12 | | | |
| 13 | | | |

| TB3 | | | |
|---|---|---|---|
| No | Label | | Description |
| 1 | Power | H(+) | 85 to 264VAC or 20 to 30VDC |
| 2 | | N(−) | |
| 3 | Ground | | |

Screws on the terminal block: M3.5

## 5. GENERAL SPECIFICATIONS

Table 5.1

| Item | | Description | | | | |
|---|---|---|---|---|---|---|
| Input signals | Flow input | Signal name | Pulse generator | Power to generator | | Speed of response |
| | | Contact closure pulse | – | 13.5VDC | Allowable current 40mA app. Shortcircuit protection circuit provided | 50Hz |
| | | 2-wire, 12VDC 3-wire Voltage pulse | – | 13.5VDC | | 2kHz |
| | | 24VDC 2-wire Current pulse (4/20mA) | PA15, 25 | 24.0VDC | | |
| | | Open collector pulse | – | 13.5VDC | | |
| | Temperature input | Resist. thermometer | Pt 100Ω at 0℃, 3-wire system, current 2mA | | | |
| | | Analog | 4 to 20mADC or 1 to 5VDC | | | |
| | Pressure input | 4 to 20mADC or 1 to 5VDC Transmitter power supply 24VDC, max 30mA | | | | |
| Output signals | Pulse output | Total mass flow | Static relay Capacity: 230VAC/340VDC 0.2A Pulse width: 1ms/50ms | | | |
| | | Total calorific flow | | | | |
| | | Output sync with flow input signal | Open collector pulse | | | |
| | Alarm output | Static relay Capacity: 230VAC/340VDC 0.2A | | | | |
| | Analog output | Instant mass flowrate | 4 to 20mADC (Max. load resistance 500Ω) or 1 to 5VDC (Output impedance 250Ω) Conversion accuracy: ±0.1% of F.S. | | | |
| Display type | | Display: ST display (128×128 dots), backlighted (※1), (※2) Information displayed: Data, units, error message simultaneously | | | | |
| Menu items | Total mass flow | Same as output pulse unit (kg, for example) | Display capacity: 8 digits | | | |
| | Total calorific flow | Same as output pulse unit (Mcal, for example) | | | | |
| | Instant mass flowrate | (kg/h, for example) | | | | |
| | Temperature | To the 2nd decimal place (when ℃ is selected.) | | | | |
| | Pressure | To the 4th decimal place (when MPa is selected.) | | | | |
| | Correction factor 1 | To the 5th decimal place | | | | |
| | Correction factor 2 | To the 5th decimal place | | | | |
| | Meter error corr. fctr. | To the 5th decimal place | | | | |
| | Meter correction fctr. | To the 5th decimal place | | | | |
| | Specific weight | To the 4th decimal place (when kg/m$^3$ is selected.) | | | | |
| | Specific enthalpy | To the 2nd decimal place (when kJ/kg is selected.) | | | | |
| | Error alarm | Number of errors + error messages | | | | |
| Computing range | Temperature | Pt 100Ω at 0℃ | Range: 100 to 350℃ | | Std. Span: 70℃ | |
| | | 4 to 20mADC or 1 to 5VDC | | | Std. Span: 200℃ | |
| | Pressure | 0 to 3MPa Standard span: 1MPa | | | | |
| Computing accuracy | Mass flow | ±0.5% of R.D. | | | | |
| | Calorific flow | ±0.6% of R.D. | | | | |
| | Temperature | Pt 100Ω at 0℃ | ±0.3% of span | | | |
| | | 4 to 20mADC or 1 to 5VDC | ±0.1% of span | | | |
| | Pressure | ±0.1% of SPAN | | | | |
| Clock IC battery backup | | Lithium battery (Battery life: 10 years approx.) | | | | |
| Communication (when com. interface is provided.) | | Interface: RS485 Multipoint (Up to 16 units can be connected.) Dedicated protocol Baud rate: 4800 bps standard 9600 bps max. | | | | |
| Transmission cable | | Use 3-conductor shielded cable to the resistance thermometer bulb. Loop resist. 5Ω max. Example: 300 meters max. with 3-conductor 1.25mm$^2$ cable; 500 meters with 2.0mm$^2$ cable | | | | |
| Power source | | 85 to 264VAC, 50/60Hz or 20 to 30VDC | | | | |
| Power consumption | | 20W max. | | | | |
| Ambient temperature | | −10 to +50°C | | | | |
| Mounting | | Panel mount | | | | |
| Finish | | Munsell N1.5 | | | | |
| Weight | | 2.5 kilograms, approx. | | | | |

➡NOTES (※1): ST display stands for Super Twisted Nematic display.
(※2): Backlight life (luminance declined to one half its original luminance) : 2500 h.

# 6. INTERNAL COMPONENTS AND FUNCTIONS

## 6.1 Front Panel

### 6.1.1 Display

The display is a 128 × 128-dot multiple function display capable of showing the data, units of measure, error messages, and other information at the same time. (The display is backlighted.)

### 6.1.2 On-Screen Menu Items

The units of measurement vary with configuration. Their selection is made in the SET mode. Available menu items are:

(1) Total mass flow (TOTAL COUNT1)
Incoming flow pulses are calculated to read in mass units, integrated, and the obtained totalized mass flow is indicated. Resolution, or the minimum unit of measurement, which varies with customer specifications, is set up with front-panel keys. This unit automatically becomes identical with the output pulse unit.
While the total mass flow is retained in a nonvolatile memory ($E^2$PROM) irrespective of power cycling, it is resettable to zero following a power cycle if so configured in the SYS mode.

(2) Total calorific flow (TOTAL COUNT2)
Total flow after conversion to calorific units is indicated on the display. Other specifications remain the same as (1).

(3) Instant mass flowrate (FLOW RATE)
Instant flowrate (hourly) after conversion to weight units is indicated. Resolution, or the minimum unit of measurement, varies with customer specifications.

(4) Temperature (TEMPERATURE)
The temperature information currently fed to the instrument is indicated. If a problem arises in the course of temperature conversion, such as out-of-scale, a default fallback value is indicated. With a model dedicated to pressure only, a default fixed temperature value is indicated.

(5) Pressure (PRESSURE)
The pressure value currently fed to the instrument is indicated. If a problem arises in the course of pressure conversion, such as out-of-scale, a default fallback value is indicated

(6) Correction factor 1 (COMP. FACTOR1)
The value determined by correction factors and the relative density is indicated.
Correction factor 1 = Meter error correction factor × Meter correction factor × Relative density

(7) Correction factor 2 (COMP. FACTOR2)
The value determined by correction factors, the relative density, and specific enthalpy is indicated.
Correction factor 2 = Meter error correction factor × Meter correction factor × Relative density × Specific enthalpy

(8) Meter error correction factor (METER ERROR)
Meter error correction factor corresponding to the flow rate currently fed to the instrument is indicated.

(9) Meter correction factor (METER COEF.)
Based on the temperature information currently fed to the instrument, the meter error correction factor dependent on the volumetric expansion of meter body ($3\alpha$) is indicated.

(10) Relative density (specific weight) (SPEC. WEIGHT (SAT))
The relative density determined by the temperature and pressure values currently fed to the instrument is indicated. If a problem arises in the temperature and pressure inputs, it is calculated based on their default fallback values.

(11) Specific enthalpy (SPEC. ENTHALPY (SAT))
Similar to obtaining the relative density, the value determined by temperature and pressure is indicated. Calorific conversion is carried out based on this reading in indicated unit and the reading in (6).
Specific calorific value = Relative density×Specific enthalpy

➡ NOTE: For more information about setup items and options, see "KEY OPERATION MANUAL".

### 6.1.3 Error Messages

When an erratic condition arises, an error message automatically appears on the display.
(The information represented by error messages are listed on page 15.)
If two or more concurrent errors are involved, individual messages will be scrolled at intervals of approximately 3 seconds. When an error condition disappears, an error message automatically goes out and the normal display is resumed.

➡ NOTE: An error logging function can store a maximum of 20 events each of which consists of year, month, day, hour and minutes of error occurrence and recovery. (Complete details are covered in the Key Operation Manual.)

### 6.1.4 Front Panel Keypad

The eight front panel key switches consist of two kinds of keys - functions keys and shift keys.

- Function keys: Four round keys
  Mainly used for function selection, such as activating the input conditions selected and reconfiguration.
- Shift keys: Four triangular keys
  Used for moving the cursor, moving between menu items, or changing numerical values.

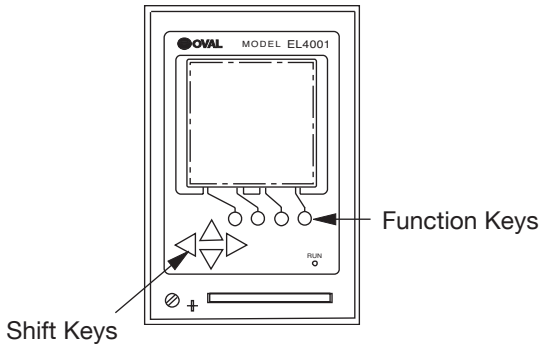



Fig. 6.1 Front Panel Keys

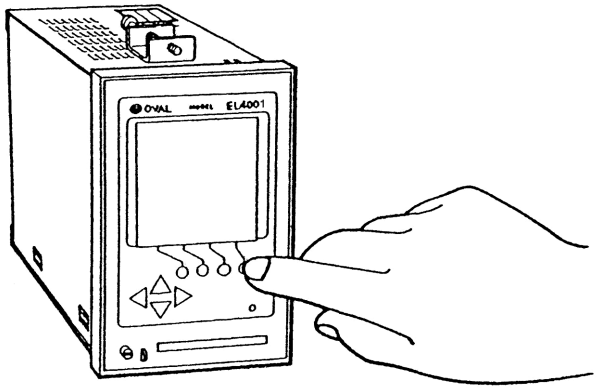



Fig. 6.2 Touch Key Operation

# 7. CALCULATION FORMULAS

## 7.1 Conversion to Mass Units (Total mass flow)

In superheated steam calculation, the temperature and pressure fed to the instrument are used in our proprietary formula of approximation to determine specific weight V", from which conversion is performed with respect to the flow input.

$$W = a \times Ip \times V'' \times \varepsilon_t \times \varepsilon p \times \left(1 + \frac{E}{100}\right)$$

where W : Mass [g]

a : Meter factor of the flowmeter [l/P]

Ip : Input pulse

V" : Relative density [kg/m$^3$ = g/l]

$\varepsilon_t$ : Meter's correction factor relative to temperature variation

$\varepsilon_t = 1 + 3\alpha\,(t-20)$

t = Operating temperature [℃]

$3\alpha = 4.8 \times 10^{-5}$ (stainless steel)

$\varepsilon p$ : Meter's correction factor relative to pressure variation

($\varepsilon p$ = always "1".)

E : Meter error correction of the flowmeter [%]

## 7.2 Conversion to Calorific Value (Total calorific flow)

Similar to obtaining the specific weight above, specific enthalpy h is determined and, based on mass conversion value W, calorific conversion is performed.

$$Q = W \times h$$

where Q : Calorific value [J]

h : Specific enthalpy [kJ/kg]

## 7.3 Instant Mass Flowrate

$$Wm = a \times f \times V'' \times \varepsilon_t \times \varepsilon p \times \left(1 + \frac{E}{100}\right) \times 3600$$

where Wm : Instant mass flow [g/h]

f : Input pulse frequency [P/s]

# 8. PREPARATIONAL CHECKS AND OPERATION

## 8.1 Preparation Before Operation

(1) Ensure that the instrument and related equipment are correctly installed and wired with no place left unfinished.

> ⚠**WARNING: Make sure to see that the power terminals are connected to a power source of the rated voltage. Applying a power source of incorrect voltage could ruin your instrument.**

(2) Supply power to this instrument and make certain to see that the front panel display is illuminated. The display will remain unilluminated for one second after power on, which however is by no means any indication of fault.

## 8.2 Preparational Checks

**⚠CAUTION: Allow a warmup period for 60 minutes or so after you turn on the power.**

Verify if the instrument operates with no fluid flow.

**How to Check**

(1) Couple sources of simulated temperature and pressure signals.
(2) Using the shift keys, select menu items and verify the information displayed.

⇨See the KEY OPERATION MANUAL.

(3) Inject a simulated input pulse train or density signal representing the type of the companion pulse generator.
(4) Select display menu items of the total mass flow and total calorific flow, and make sure that incoming pulses are being accumulated. Also, verify that pulse output and analog output are properly generated.
(5) Remove the simulated pulse input and compare the obtained readings on the display with corresponding theoretical values. Remember that this instrument is not equipped with a counter to accumulate incoming pulses. Hence, an external counter is required.

## 8.3 Operation

**⚠CAUTION: Allow a warmup period for 60 minutes or so after you turn on the power.**

(1) Select your power reset or non-reset (accumulated total) option.

⇨See the KEY OPERATION MANUAL.

(2) Turn on power. While the initial check screen remains displayed, indicating that the process of verifying parameters and variables is in progress after you turned on the power, your instrument will not accept any pulse input.
(3) Place your instrument in service operation by allowing the fluid to be metered.

## 9. TROUBLESHOOTING

**Reminder: If internal trouble is suspected, seek our service at the nearest sales office or customer service representative in your area.**

Table 9.1

| Symptom | | Check | Possible Causes |
|---|---|---|---|
| Display is dead. | | 1. Inspect fuse.<br>2. Make sure of power source voltage. | 1. Fuse is blown.<br>2. Line voltage is improper.<br>3. A fault in internal assembly. |
| Faulty temperature indication.<br>Erratic reading<br>Error messages<br>TEMP 1 (PT) OVER<br>or TEMP 1 (PT) UNDER<br>or TEMP 1 (ANA) OVER<br>or TEMP 1 (ANA) UNDER<br>(Same also with TEMP 2.) | | 1. Input signal line correctly wired?<br>2. Input signal specifications matched?<br>3. System configured correctly?<br>4. Temperature range set correctly? | 1. Input wiring is incorrect.<br>2. Thermometer resistance bulb is open or shorted.<br>3. Temperature converter is faulty.<br>4. A fault in internal assembly. |
| Faulty pressure indication.<br>Error messages<br>PRESS 1 OVER<br>or PRESS 1 UNDER<br>(Same also with PRESS 2.) | | 1. Input signal line correctly wired?<br>2. Input signal specifications matched?<br>3. System configured correctly?<br>4. Pressure range set correctly? | 1. Input wiring is faulty.<br>2. Pressure transmitter is faulty.<br>3. A fault in internal assembly. |
| Faulty relative density and/or specific enthalpy reading. | | 1. Temperature and pressure readings correct? | 1. A fault in internal assembly. |
| While steam is allowed to flow. | Fails to count pulses; fails to produce a pulse output. | 1. Input signal line correctly wired?<br>2. Pulse signal coming in?<br>3. Pulse generator specifications matched? | 1. Incorrect input wiring.<br>2. Pulse generator itself is faulty.<br>3. A fault in internal assembly. |
| | Faulty total counter reading. | 1. Temperature and pressure readings correct?<br>2. Specific weight and specific enthalpy readings correct? | 1. Pulse generator itself is faulty.<br>2. A fault in internal assembly. |
| Error messages<br>A/D CONVERT ERROR<br>or 4mA SCALER 1 UNDER<br>(Same also with SCALER 2.)<br>or 20mA SCALER 1 OVER<br>(Same also with SCALER 2.) | | 1. System configured correctly?<br>2. Input pulse signal correct?<br>3. Flowrate full scale set properly? | 1. A fault in internal assembly. |

**⚠CAUTION: Once any printed circuit board(s) of the internal assembly has been removed for servicing, do not fail to reestablish all parameters in the SET mode.**

## 10. ERROR MESSAGES

Table 10.1 List of Error Messages

| No. | Error Message | Description |
|---|---|---|
| 1 | ADJUST DATA ERROR | Adjusted allowable range check error |
| 12 | A/D CONVERT ERROR | A/D converter circuit error |
| 13 | DENSITY CONVERT ERROR | Density converter circuit error |
| 14 | TEMP 1. (PT) OVER | Temperature Pt input 1 overflow |
| 15 | TENP 1. (PT) UNDER | Temperature Pt input 1 underflow |
| 16 | TEMP 2. (PT) OVER | Temperature Pt input 2 overflow |
| 17 | TEMP 2. (PT) UNDER | Temperature Pt input 2 underflow |
| 18 | TEMP 1. (ANA) OVER | Analog temperature input 1 overflow |
| 19 | TEMP 1. (ANA) UNDER | Analog temperature input 1 underflow |
| 20 | TEMP 2. (ANA) OVER | Analog temperature input 2 overflow |
| 21 | TEMP 2. (ANA) UNDER | Analog temperature input 2 underflow |
| 22 | PRESS 1. OVER | Analog pressure input 1 overflow |
| 23 | PRESS 1. UNDER | Analog pressure input 1 underflow |
| 24 | PRESS 2. OVER | Analog pressure input 2 overflow |
| 25 | PRESS 2. UNDER | Analog pressure input 2 underflow |
| 26 | DENSITY OVER | Density input overflow (unused) |
| 27 | DENSITY UNDER | Density input underflow (unused) |
| 28 | 4mA SCALER 1 UNDER | Analog output 1 underflow |
| 29 | 20mA SCALER 1 OVER | Analog output 1 overflow |
| 30 | 4mA SCALER 2 UNDER | Analog output 2 underflow |
| 31 | 20mA SCALER 2 OVER | Analog output 2 overflow |

➡NOTE: Depending on the model in service, some of the messages are not shown.

## 11. BEHAVIOR IN ERRATIC CONDITIONS

(1) Erratic A/D Converter

If the conversion is not completed within a certain period of time after starting the A/D conversion circuit, it is considered as a circuit failure. At this time, both temperature and pressure are calculated using the overfallback value.

(2) Temperature and Pressure Input Out of Range

If the input exceeds the high limit or falls below the low limit, its default fallback value is used for calculation.

(3) Analog Output Overflow

A full scale output is produced across the analog output terminals.

## 12. OVERALL BLOCK DIAGRAM

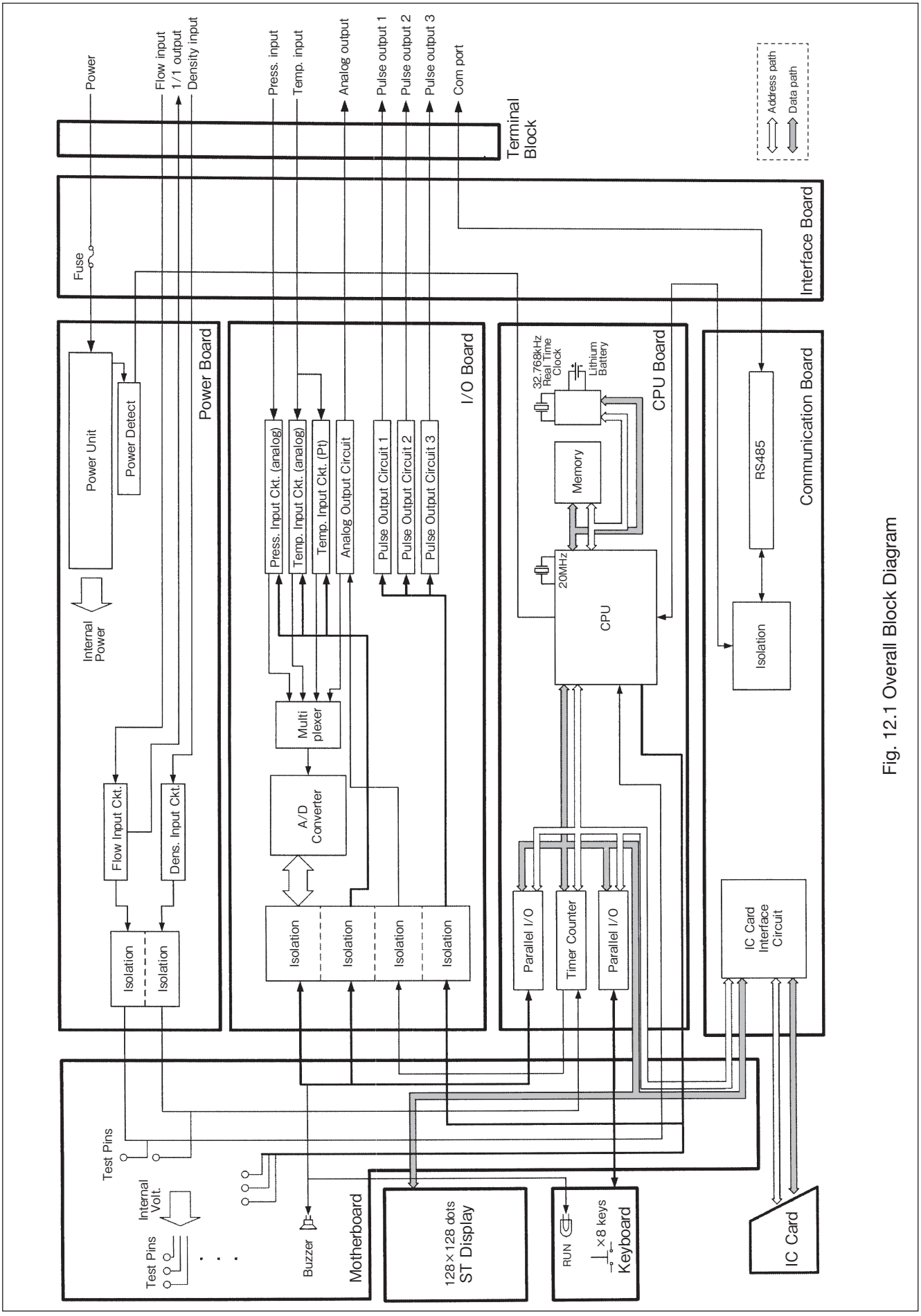
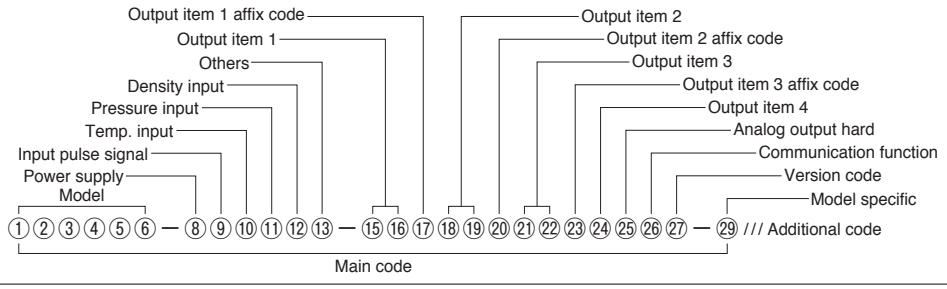



Fig. 12.1 Overall Block Diagram

# 13. PRODUCT CODE EXPLANATION




**●Main code**

| ① | ② | ③ | ④ | ⑤ | ⑥ | **Model** |
|---|---|---|---|---|---|---|
| E | L | 4 | 1 | 1 | 1 | Steam Flow Computer (superheated steam service) |

| ⑦ | — |
|---|---|

| ⑧ | **Power supply** |
|---|---|
| D | 20 to 30VDC |
| J | 85 to 264VAC 50Hz/60Hz |

| ⑨ | **Input pulse signal** |
|---|---|
| B | Voltage pulse 12VDC 2 wires/3 wires |
| D | Current pulse 24VDC (4/20mADC) |
| G | Open collector pulse 12VDC 2 wires/3 wires |
| K | Contact pulse 12VDC 2 wires/3 wires |
| Z | Special |

| ⑩ | **Temp. input** |
|---|---|
| N | None |
| B | 1 to 5V |
| E | 4 to 20mA |
| F | Pt100Ω |
| G | JPt100Ω |
| Z | Special |

| ⑪ | **Pressure input** |
|---|---|
| N | None |
| B | 1 to 5V |
| E | 4 to 20mA |
| Z | Special |

| ⑫ | **Density input** |
|---|---|
| N | None |

| ⑬ | **Others** |
|---|---|
| N | None |

| ⑭ | — |
|---|---|

| ⑮ | ⑯ | **Output item 1** |
|---|---|---|
| **Pulse output 1** | | |
| M | 1 | Total mass flow/pulse width 1ms |
| M | 5 | Total mass flow/pulse width 50ms |
| M | 9 | Total mass flow/pulse width special |
| H | 1 | Total calorie flow/pulse width 1ms |
| H | 5 | Total calorie flow/pulse width 50ms |
| H | 9 | Total calorie flow/pulse width special |
| A | L | Alarm output |
| Z | Z | Special |

| ⑰ | **Output item 1 affix code** |
|---|---|
| N | None |

| ⑱ | ⑲ | **Output item 2** |
|---|---|---|
| **Pulse output 2** | | |
| M | 1 | Total mass flow/pulse width 1ms |
| M | 5 | Total mass flow/pulse width 50ms |
| M | 9 | Total mass flow/pulse width special |
| H | 1 | Total calorie flow/pulse width 1ms |
| H | 5 | Total calorie flow/pulse width 50ms |
| H | 9 | Total calorie flow/pulse width special |
| A | L | Alarm output |
| Z | Z | Special |

| ⑳ | **Output item 2 affix code** |
|---|---|
| N | None |

| ㉑ | ㉒ | **Output item 3** |
|---|---|---|
| **Pulse output 3** | | |
| A | L | Alarm output |
| Z | Z | Special |

| ㉓ | **Output item 3 affix code** |
|---|---|
| N | None |

| ㉔ | **Output item 4** |
|---|---|
| **Analog output assignment** | |
| M | Instantaneous mass flow |
| Z | Special |

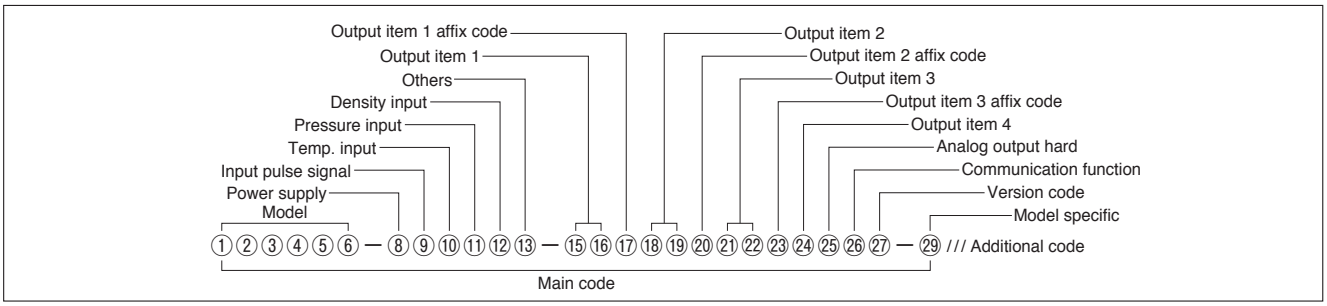
| ㉕ | **Analog output hard** |
|---|---|
| N | None |
| 2 | 1 to 5V |
| 5 | 4 to 20mA |
| Z | Special |

| ㉖ | **Communication function** |
|---|---|
| N | None |
| R | RS-485 |

| ㉗ | **Version code** |
|---|---|
| A | Version code: A |

| ㉘ | — |
|---|---|

| ㉙ | **Model specific** |
|---|---|
| 0 | Standard |
| Z | Special |




**●Additional code**

| | | | |
|---|---|---|---|
| **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 | W | J | Wiring diagram (Japanese) |
| D | W | E | Wiring diagram (English) |
| S | D | J | Inspection report of electronics (Japanese) |
| S | D | E | Inspection report of electronics (English) |
| D | A | J | Compression coefficient calculation process (Japanese) |
| D | A | E | Compression coefficient calculation process (English) |
| D | T | J | Inspection procedure (Japanese) |
| D | T | E | Inspection procedure (English) |
| C | B | J | Traceability certificate: B set Only Japanese |
| **Witness Test** | | | |
| V | 1 | 1 | Appearance, dimensions, quantity check |
| V | 1 | 4 | Appearance, dimensions, quantity check/performance (output confirmation, etc.) |

# 《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 | |
| Model | E | L | 4 | 1 | 1 | 1 | | | | | | | | Steam Flow Computer (superheated steam service) | |
| Power | | | | | | | | 6 | | | | | | 20 to 30VDC | Power consumption: 20W max. |
| | | | | | | | | 7 | | | | | | 85 to 264VAC, 50/60Hz | |
| Temperature Input | | | | | | | | | 1 | | | | | Pt 100Ω at 0℃ | |
| | | | | | | | | | 2 | | | | | 4 to 20mADC/1 to 5VDC | |
| | | | | | | | | | 9 | | | | | Other than above (special) | |
| Pressure Input | | | | | | | | | | 1 | | | | 4 to 20mADC/1 to 5VDC | |
| | | | | | | | | | | 9 | | | | Other than above (special) | |
| Pulse/Analog Output | | | | | | | | | | | 1 | | | Mass/calorific flow pulse<br>+ instant mass flowrate analog output + alarm output | |
| | | | | | | | | | | | 9 | | | Other than above (special) | |
| Communication Capability | | | | | | | | | | | | 0 | | No | |
| | | | | | | | | | | | | 1 | | Yes | |
| Finish | | | | | | | | | | | | | 1 | Munsell N1.5 | |

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