



New Single Straight Tube Type OVAL Coriolis Mass Flowmeter

ST_{mass} MKII

Transmitter : ST9801

GENERAL SPECIFICATION
GS.No.GBN034E-9

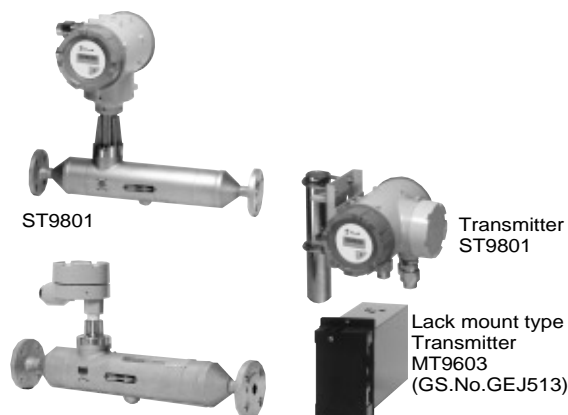
■ GENERAL

The *ST_{mass} MKII* is a user friendly Coriolis mass flowmeter capable of making direct mass flowrate measurement with a single straight tube.

Combined with our sensor technologies and most advanced electronics techniques accumulated over many years, this perfect full-moon shaped mass flowmeter finds a wide range of applications with a high degree of metering accuracy.

■ FEATURES

1. The sensor body has a welded one-piece construction made of stainless steel or Hastelloy C in a single straight tube design.
2. The transmitter has integrally mounted with, or remotely mounted from.
3. Has no pocket for the process fluid to stand - most desirable from an ease-of-cleaning point of view.
4. Process connections may be so finished as to comply with sanitary requirements.
5. The display in the transmitter shows variables, such as the flowrate, density, and temperature, with a touch of a mode select button (or with a mode select magnet) on the panel.
6. Compact design reduces space requirements for pipelines.



7. Absence of moving parts justifies its use for long life and ease of handling.
8. Communication interface is a standard feature.
9. Explosionproof configuration permits installation in hazardous locations.
10. Certified as a high pressure gas vessel. (The flow tube is made of SUS316L.)

■ GENERAL SPECIFICATIONS

Sensor Unit

| Item | Description | | | | | |
|------------------------------|---|---------------|------------|----------------|------------|------------|
| Model | S010C | S015C | S025C | S040C | S050C | S080C |
| Nominal size | 15mm or 1/2" | 15mm or 1/2" | 25mm or 1" | 40mm or 1-1/2" | 50mm or 2" | 80mm or 3" |
| Materials | SUS316L or SUS316L+Alloy C (S015, S025 only) | | | | | |
| | Wetted Housing | SUS304 | | | | |
| Process connection | JIS 10, 20K RF, ANSI/JPI 150 RF, IDF ferrule | | | | | |
| Applicable fluid | Liquid | | | | | |
| Temp. Range | -25 to +130°C (For liquid Temp. above 120°C, the transmitter should be of separate type). | | | | | |
| | Non-explosionproof type | -20 to +130°C | | | | |
| Explosionproof type | | | | | | |
| Density measuring range | 0.5 to 1.0g/mL, 0.7 to 1.3g/mL, 1.0 to 1.5g/mL (※1) | | | | | |
| Max. Operating pressure | Up to 2.45MPa (Depends on flange rating) | | | | | |
| Sensor housing withstands | 2.8MPa | | | | | |
| Flow direction | Normal or reverse | | | | | |
| Explosionproof configuration | See the transmitter specifications below. | | | | | |

※1 : Density ranges are different by a fluid of the use.

Transmitter

| Item | Description |
|-------------------------------------|---|
| Model | ST9801 |
| Rangeability | See general performance table (page 2). |
| | Flowrate |
| Temperature | -25 to +130°C (-20 to +130°C in the ex. model) |
| Power supply | 85 to 264VAC 50/60Hz or 20 to 30VDC |
| Power consumption | Max. 25VA or Max. 10W |
| Ambient temperature | -20 to +50°C (without dew condensation) |
| Transmission length (separate type) | Max. 5 m (exclusive cable used) |
| Explosionproof configuration | Combined explosionproof [Exd (ib) II BT3] |
| Dust and waterproof configuration | IP66 |
| Mounting | Integrally or separately mounted |
| Display | 8-digit (7-segment) LDC display |
| Weight | 4.6kg approx.(5.8kg approx., separate type) |
| Communication interface | HART protocol and Bell 202 |
| Status input | Remote zero or optional feature/contact-closure input (Form "a" contact) |
| Pulse output | Voltage pulse "0": 1.5V max., "1": 15V Output impedance 2.2kΩ or open collector output (10V min.-30Vmax.,50mA DC), FS:0.1-10000Hz |
| Analog output | 4-20mADC (max. load 600Ω) Two outputs from mass flow, Two outputs from instantaneous flow rate (mass), temperature or density. |
| Status output | Open collector output (Normal : ON; Abnormal: OFF) Select one from Error (std.), Flow direction, Hi/Lo alarm |

OVAL Corporation

<http://www.oval.co.jp>

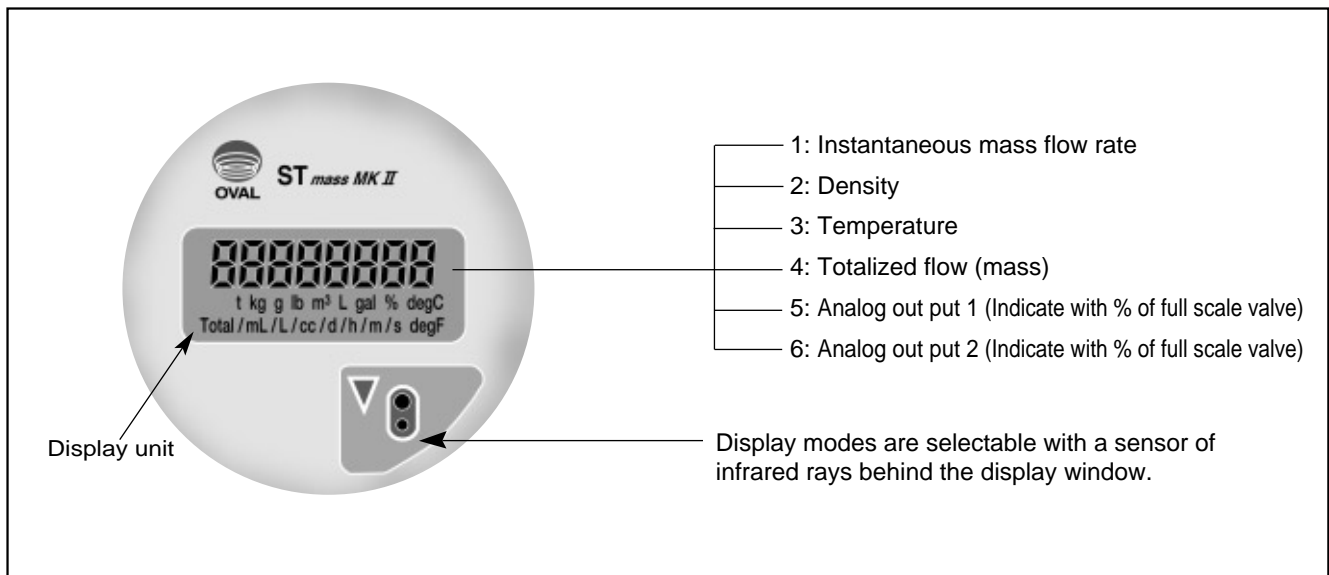
Head Office (Tokyo): Tel. 81-3-3360-5121. Fax. 81-3-3365-8605
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Overseas Branch Offices: Seoul, Singapore and Taipei

■ GENERAL PERFORMANCE

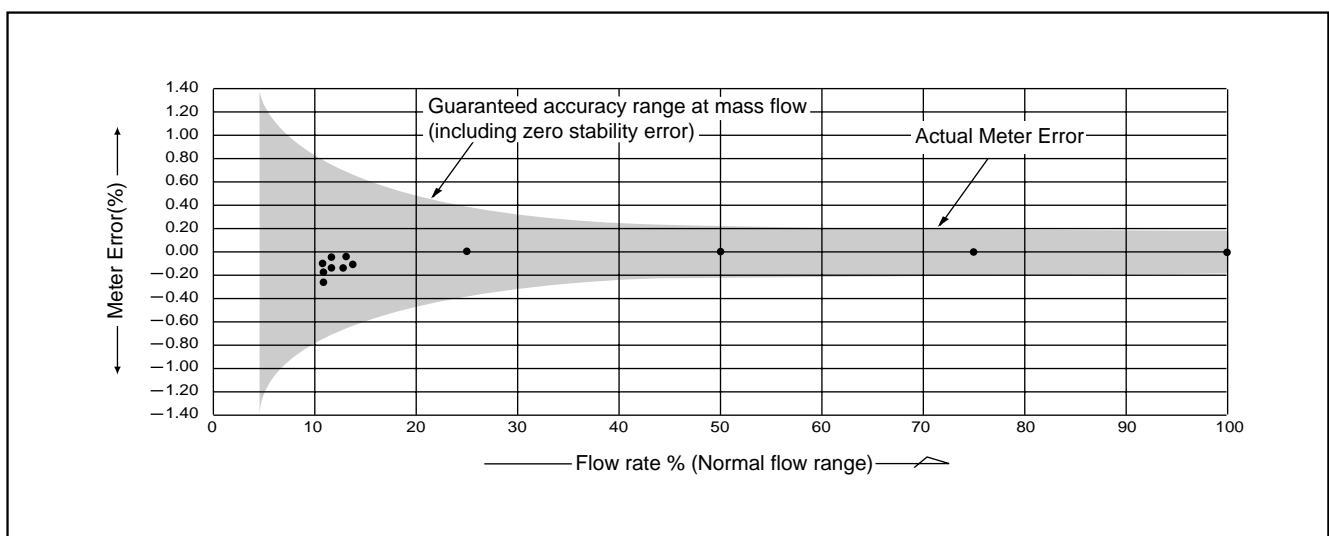
| Item | | Description | | | | | |
|-----------------|---|--|-----------|------------|------------|------------|-------------|
| Model | | S010C | S015C | S025C | S040C | S050C | S080C |
| Flow rate | Normal flow range (kg/h) | 0 to 720 | 0 to 2400 | 0 to 7200 | 0 to 18000 | 0 to 36000 | 0 to 72000 |
| | Allowable flow range (kg/h) | 0 to 1080 | 0 to 3600 | 0 to 10800 | 0 to 27000 | 0 to 54000 | 0 to 108000 |
| | Min. range (kg/h) | 0 to 72 | 0 to 240 | 0 to 720 | 0 to 1800 | 0 to 3600 | 0 to 7200 |
| | Accuracy in factory calibration | [±0.2% ± zero stability error] of RD | | | | | |
| | Repeatability | [±0.1%±1/2 zero stability error] of RD | | | | | |
| | Zero stability (kg/h) | 0.36 | 1.2 | 3.6 | 9 | 18 | 36 |
| Density | Measuring range | 0.5 to 1.0g/mL, 0.7 to 1.3g/mL, 1.0 to 1.5g/mL | | | | | |
| (Liquids) | Accuracy in factory calibration(option) | ±0.009g/mL (S010 : without density function) | | | | | |
| Analog accuracy | ST9801 | Accuracy at the flow rate ±0.1% of FS | | | | | |

$$\text{Zero stability error} = \frac{\text{Zero stability (kg/h)}}{\text{Flow rate at that time (kg/h)}} \times 100\%$$

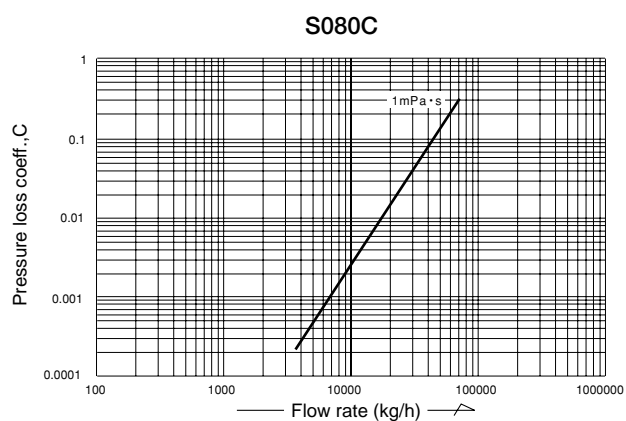
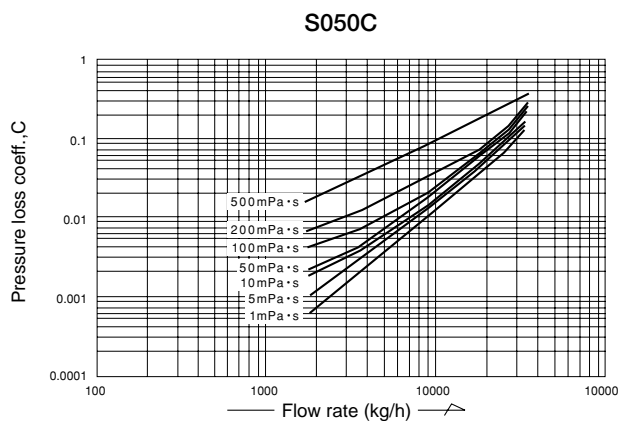
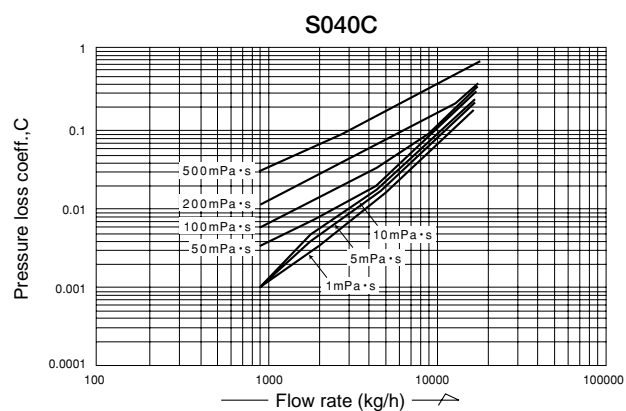
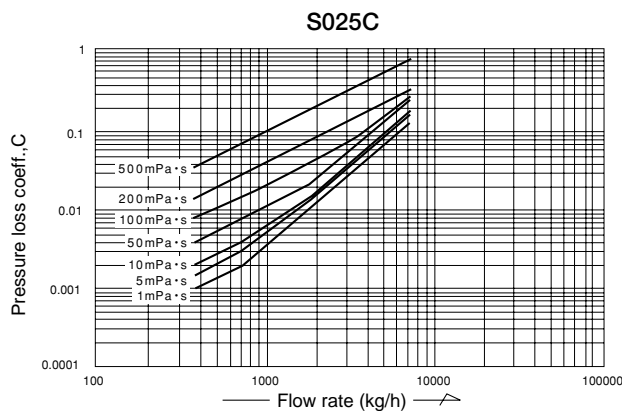
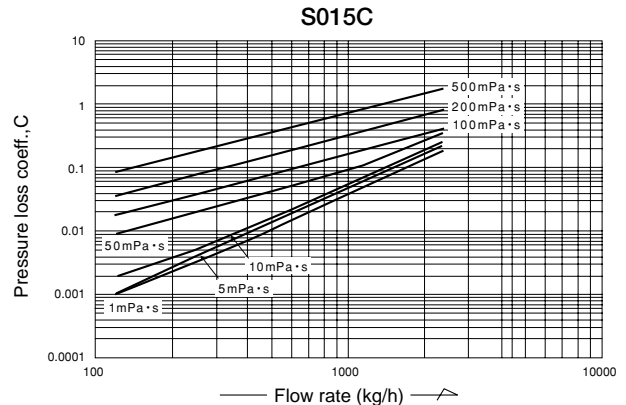
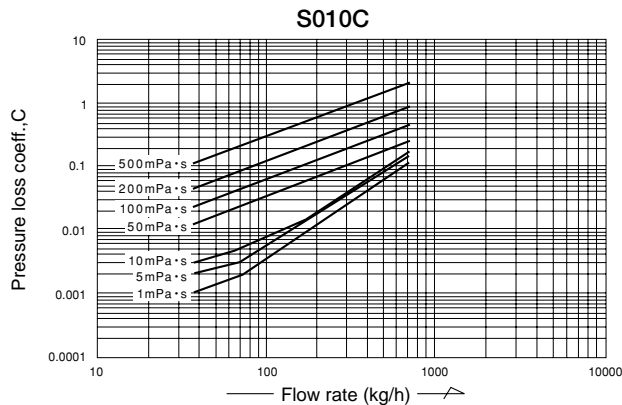
■ DISPLAY



■ METER ERROR



■ PRESSURE LOSS



How to determine pressure loss

1. Find the pressure loss factor C from flow rate (kg/h) and viscosity (mPa·s) of parameter. Dividing the obtained value C by specific gravity d (1 for water) gives the pressure loss. That is,

$$\Delta P = \frac{C}{d} \text{ (MPa)}$$

2. For high viscosity liquids not shown in these graphs, calculate the pressure loss by the following formula:

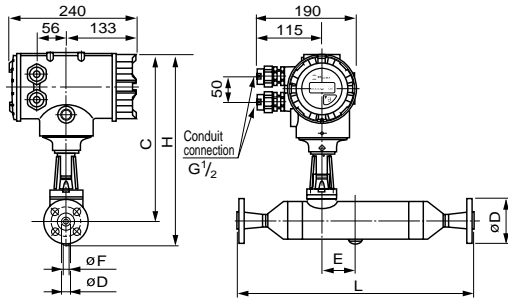
$$\Delta P_2 = C \times \frac{\mu_2}{\mu_1} \times \frac{1}{d}$$

- where ΔP_2 : Pressure loss of high viscosity liquid (MPa)
 μ_2 : Viscosity of high viscosity liquid (mPa·s)
 d: Specific gravity of high viscosity liquid (1 for water)
 μ_1 : Max. viscosity shown in the graph (mPa·s)
 C: Pressure loss factor found from the max. viscosity curve at a given flow rate (kg/h).

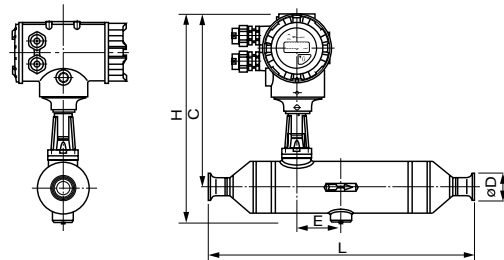
■ DIMENSIONS [Unit in mm]

● Transmitter Integrate Type

Flange connection



Ferrule connection



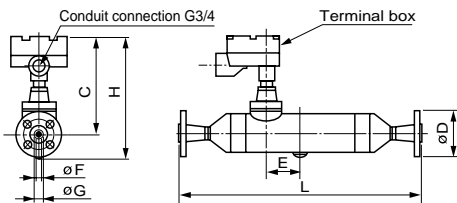
| Type | JIS 10 K | | ANSI 150 | | H | C | øF | øG | E | Weight (kg) |
|-------|----------|-----|----------|-----|-----|-----|------|------|-----|-------------|
| | L | øD | L | øD | | | | | | |
| S010C | 426 | 95 | 458 | 89 | 382 | 309 | 5.0 | 16.8 | 69 | 13 |
| S015C | 464 | 95 | 496 | 89 | 382 | 309 | 7.4 | 16.8 | 80 | 13 |
| S025C | 529 | 125 | 570 | 108 | 412 | 322 | 12.4 | 26.6 | 88 | 19 |
| S040C | 716 | 140 | 749 | 127 | 432 | 328 | 17.8 | 40.4 | 112 | 29 |
| S050C | 882 | 155 | 919 | 152 | 470 | 341 | 26.4 | 52.6 | 153 | 39 |
| S080C | 1032 | 185 | - | 190 | 503 | 385 | 38.0 | 77.8 | 176 | 70.2 |

| Type | Nom. Size | L | H | C | øD | E | Weight(kg) |
|-------|-----------|-----|-----|-----|------|-----|------------|
| S010C | 15A | 426 | 359 | 309 | 34 | 69 | 10 |
| S015C | 15A | 464 | 359 | 309 | 34 | 80 | 11 |
| S025C | 1-1/2S | 529 | 393 | 322 | 50.5 | 88 | 17 |
| S040C | 2S | 716 | 409 | 328 | 64 | 112 | 25 |
| S050C | 2-1/2S | 882 | 445 | 341 | 77.5 | 153 | 35 |
| S080C | - | - | - | - | - | - | - |

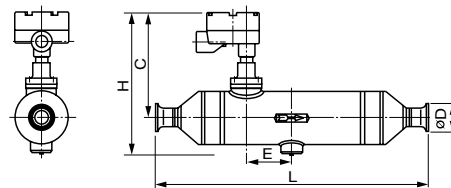
Nominal size : A :mm, S :Inch Sanitary version * Under preparation

● Transmitter Separate Type

Flange connection



Ferrule connection



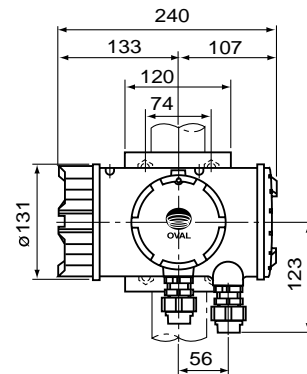
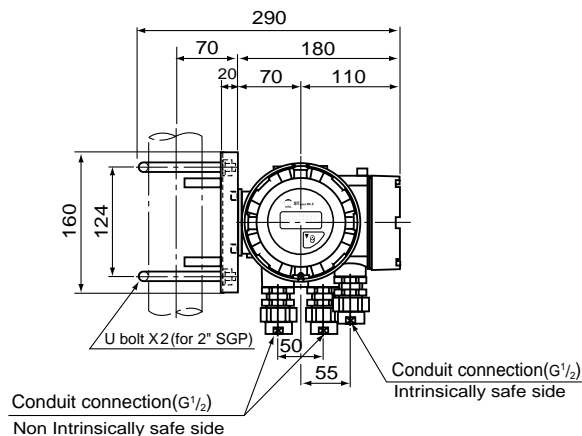
| Type | JIS 10 K | | ANSI 150 | | H | C | øF | øG | E | Weight (kg) |
|-------|----------|-----|----------|-----|-----|-----|------|------|-----|-------------|
| | L | øD | L | øD | | | | | | |
| S010C | 426 | 95 | 458 | 89 | 246 | 197 | 5.0 | 16.8 | 69 | 7 |
| S015C | 464 | 95 | 496 | 89 | 246 | 197 | 7.4 | 16.8 | 80 | 9 |
| S025C | 529 | 125 | 570 | 108 | 280 | 210 | 12.4 | 26.6 | 88 | 16 |
| S040C | 716 | 140 | 749 | 127 | 296 | 210 | 17.8 | 40.4 | 112 | 25 |
| S050C | 882 | 155 | 919 | 152 | 332 | 229 | 26.4 | 52.6 | 153 | 35 |
| S080C | 1032 | 185 | - | 190 | 371 | 253 | 38.0 | 77.8 | 176 | 66 |

| Type | Nom. Size | L | H | C | øD | E | Weight(kg) |
|-------|-----------|-----|-----|-----|------|-----|------------|
| S010C | 15A | 426 | 246 | 197 | 34 | 69 | 6 |
| S015C | 15A | 464 | 246 | 197 | 34 | 80 | 7 |
| S025C | 1-1/2S | 529 | 280 | 210 | 50.5 | 88 | 13 |
| S040C | 2S | 716 | 296 | 210 | 64 | 112 | 21 |
| S050C | 2-1/2S | 882 | 332 | 229 | 77.5 | 153 | 31 |
| S080C | - | - | - | - | - | - | - |

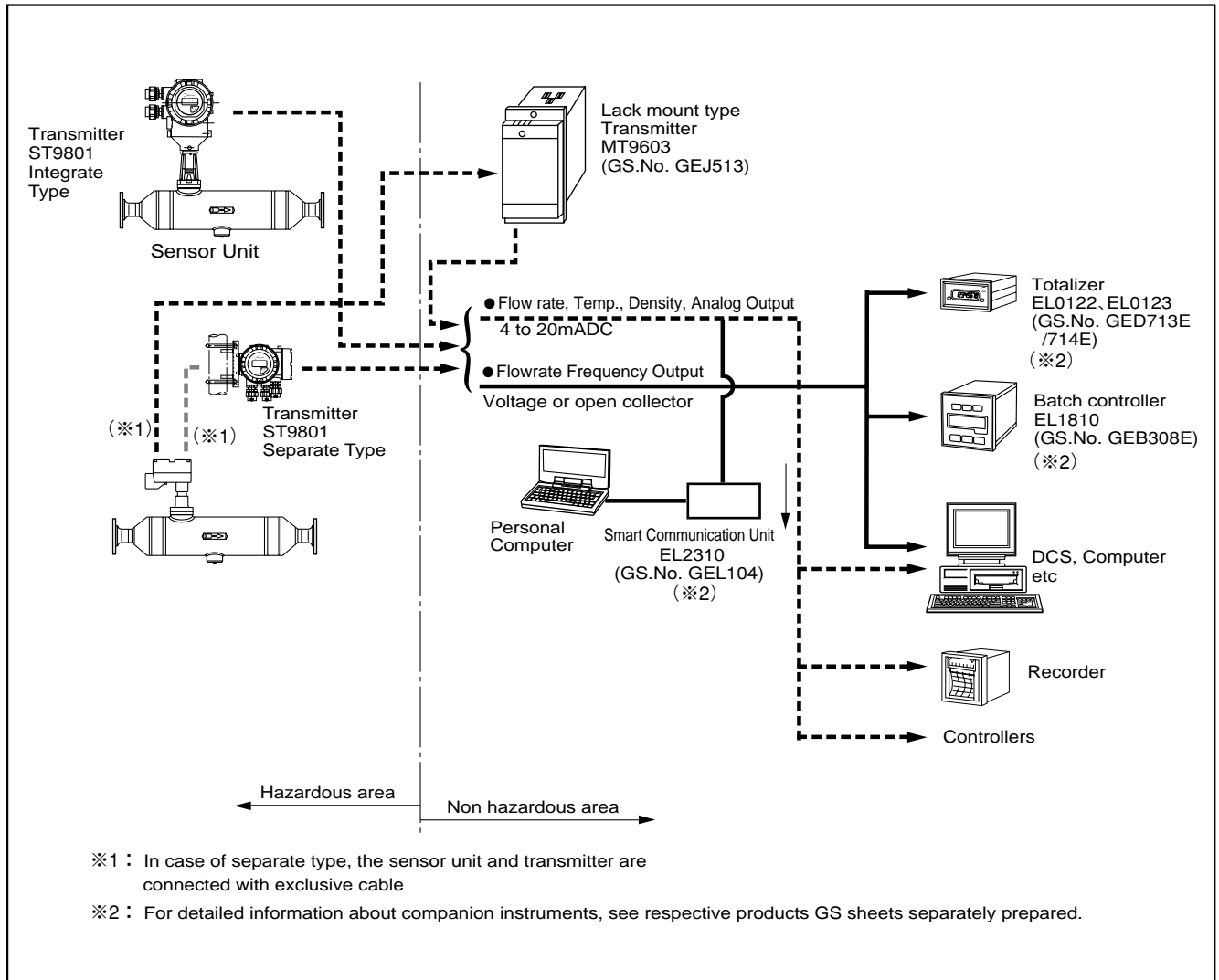
Nominal size : A :mm, S :Inch Sanitary version * Under preparation

Local Mount Type Transmitter (ST9801)

<Stand on Type>

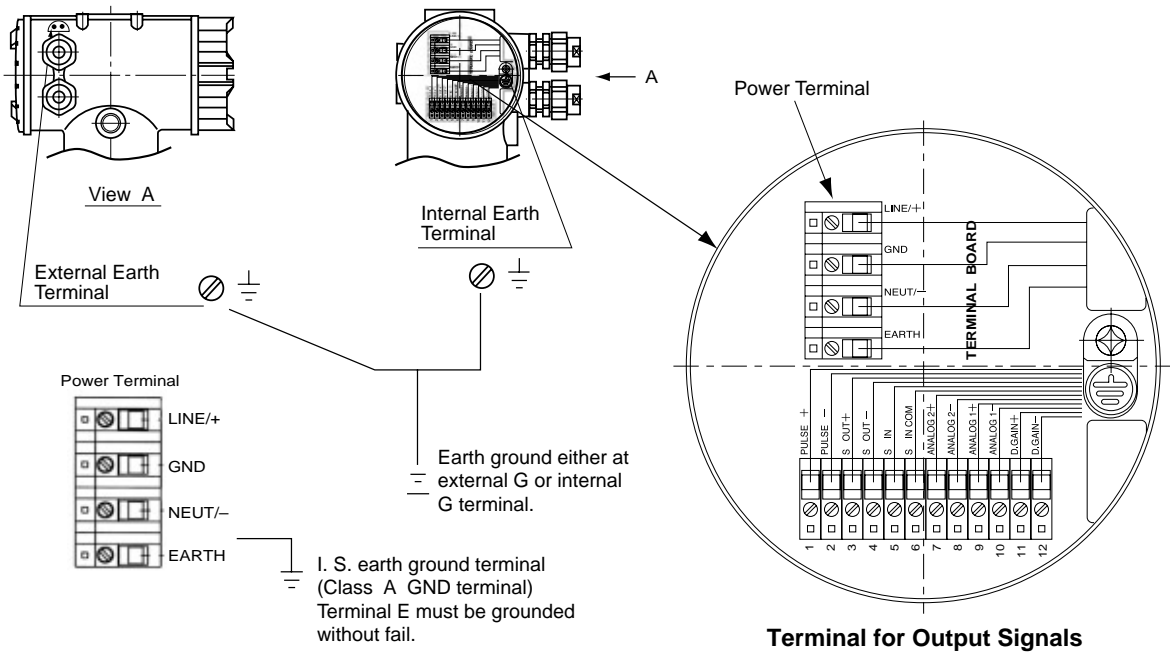


■ REMOTE MEASURING SYSTEM



■ WIRING for ST9801

● Transmitter Integrate Type



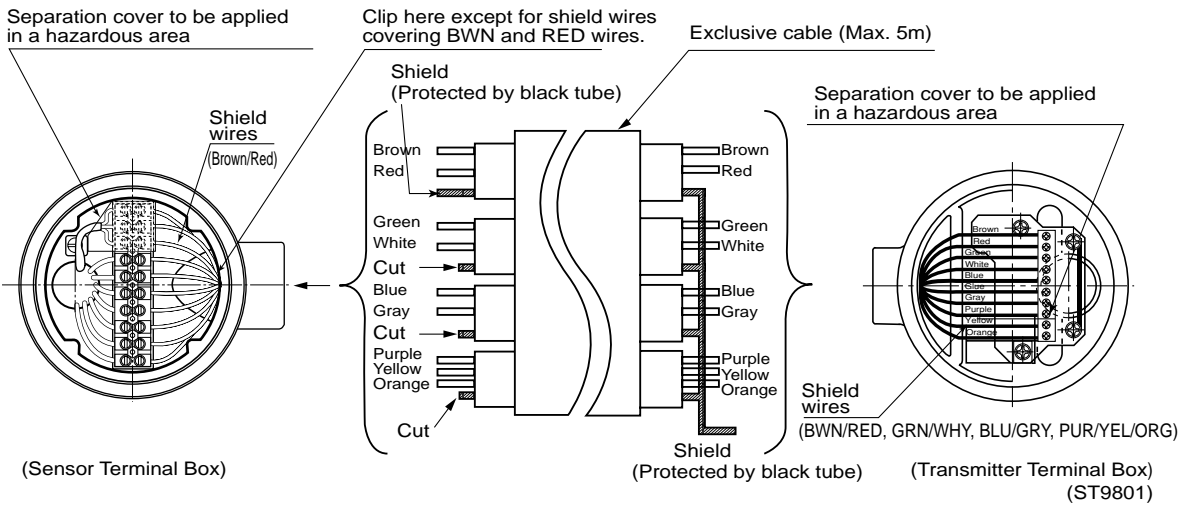
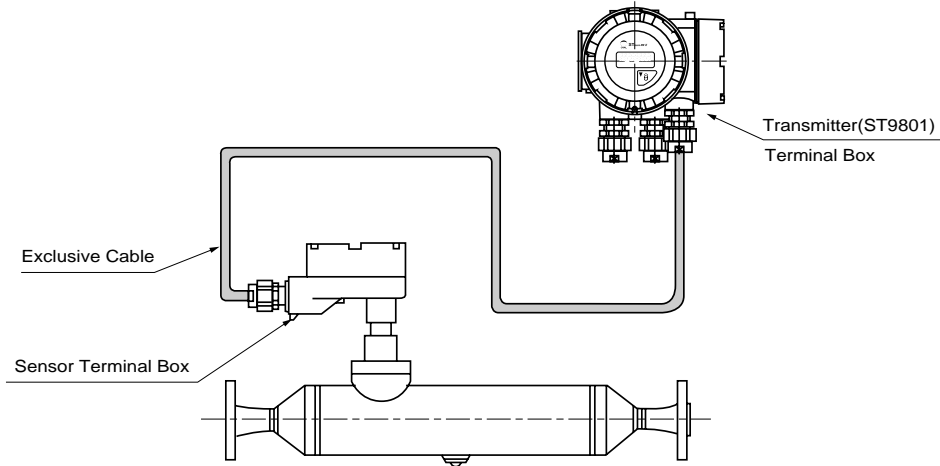
● Remote Output Signal Connection Terminals

| Item | Terminal No. | Label | Description | Remarks |
|---------------|--------------|----------|--|--|
| Output Signal | 1 | PULSE + | Pulse output | 1. Use shielded twisted pairs AWG24-16 for output wiring. 2. Max. load resistance is 600Ω for analog output 1 and 2. 3. Frequency output (voltage pulse) transmission length is Max. 10m (at 10kHz) Max. 20m (at 5kHz) Max. 100m (at 1kHz) Max. 1km (at 100Hz) |
| | 2 | PULSE - | | |
| | 3 | S OUT + | Open collector output | |
| | 4 | S OUT - | Normal: ON; Abnormal: OFF | |
| | 5 | S IN | Remote zero input (Form "a" contact input) | |
| | 6 | S IN COM | | |
| | 7 | ANALOG2+ | Analog output 2 | |
| | 8 | ANALOG2- | | |
| | 9 | ANALOG1+ | Analog output 1 | |
| | 10 | ANALOG1- | | |
| Power | | LINE/+ | Power | 1. In DC power LINE : + NEUT: - 2. Terminal G must be grounded. |
| | | GND | Earth ground | |
| | | NEUT/- | Power | |
| | | EARTH | Class "A" earth ground work | |

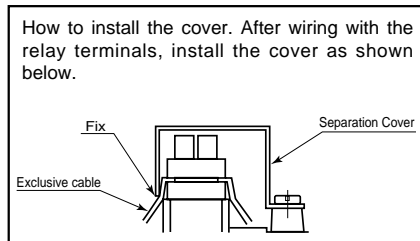
● Terminals to Sensor

| Category | Cable color | Subject | Description | Remarks |
|-----------------------|-------------|------------|---|--|
| Sensor to Transmitter | Black | SHIELD | Bundle BWN/RED, GRN/WHT, BLU/GRY, ORG/PUR/YEL shield wires. | Use 9-conductor Interconnect cable. Transmission length : Max. 5m |
| | Brown | (+)DRIVE | Flow tube drive output | |
| | Red | (-)DRIVE | | |
| | Orange | (+)TEMP A' | Temp. Input (Outer side) | |
| | Yellow | (+)TEMP | Temp. Input | |
| | Green | (+)LPO | Left position pickoff input | |
| | Blue | (+)RPO | Right position pickoff input | |
| | Purple | (+)TEMP | Temp. Input (Inner side) | |
| | Gray | (-)RPO | Right position pickoff input | |
| | White | (-)LPO | Left position pickoff input | |

● Transmitter Separate Type



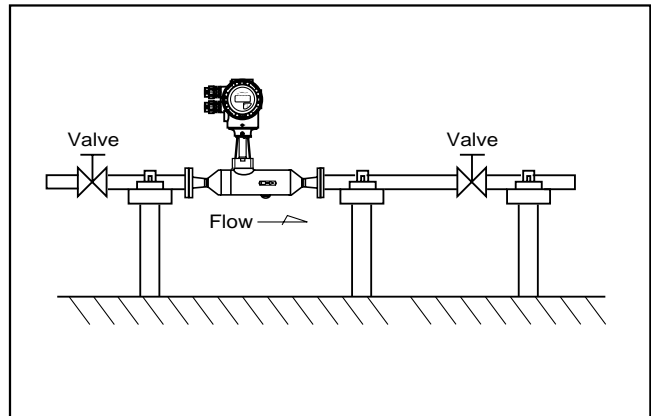
- NOTE 1. Do not fail to use exclusive cable.
 2. Shield wire preparation
- (1) Transmitter end:
 Bundle the shield wires corresponding with brown/red, green/white, blue/gray, purple/yellow/orange and slip a black sleeve over them as shown in the figure, exercising care to avoid potential contact with the housing and other conductive parts.
- (2) Sensor end:
 Slip a black sleeve over the shield wires corresponding with brown/red pair cable as shown in the figure, exercising care to avoid potential contact with the housing and other conductive parts. Clip all the other shield wires.



STANDARD INSTALLATION

1. Typical Installation (See figure at right.)

- 1) Avoid pipeline stresses on the *STmass MKII*.
- 2) The *STmass MKII* should be supported near and between connections to the process pipelines.
- 3) Avoid supporting the *STmass MKII* body directly.
- 4) Pipeline should be arranged such that the *STmass MKII* is constantly filled with the process fluid. Avoid, however, to install it in a pocket where slurries may build up.
- 5) Provide a valve downstream of the meter to allow zeroing by obtaining a true zero flow. We recommend to provide another valve upstream of the meter for servicing or maintenance.



2. Precautions at Installation

- 1) Locate the *STmass MKII* at least one meter from large transformers, motors, or other sources of electromagnetic induction. Also avoid installation near the sources of excessive vibration, such as motors and pumps.
- 2) If it is desired to make a measurement of a process fluid requiring heat retention, heat trace may be applied directly to the sensor body. Heat trace should be held below 130°C. Explosionproof models require the temperature to be held below their maximum allowable levels.

- 3) The sensor unit is of gastight configuration. To prevent dew condensation inside in a low temperature application, it is filled with argon gas. For this reason, avoid dropping or giving it impact shocks.
- 4) In a horizontal run, install the sensor unit with the transmitter up as shown in the figure.
- 5) A control valve should be located downstream of the *STmass MKII*.
In an arrangement where cavitation may possibly take place, locate it at least 5 meters away.

3. Physical Orientation

The sensor unit may be installed either in a horizontal or a vertical line. Installation in a vertical run facilitates fast process fluid replacement and self draining: you can make the most of the desirable characteristics of the single straight-tube *STmass MKII*.

| No. | 1 | 2 |
|-----------------------|-------------------|-----------------|
| | Horizontal Piping | Vertical Piping |
| Installation Position | | |

Do not forget to specify the physical orientation when you order.

■ PRODUCT CODE EXPLANATION

● Sensor Unit

| Item | Code No. | | | | | | | | | | | | Description | | |
|----------------------------------|----------|---|---|---|---|---|---|---|---|---|---|---|-------------|-----------------------------------|--|
| | ① | ② | ③ | ④ | ⑤ | ⑥ | — | ⑦ | ⑧ | — | ⑨ | ⑩ | | ⑪ | ⑫ |
| Model | S | | | | | | | | | | | | | | STmass MKII |
| Nom. size | | 0 | 1 | 0 | | | | | | | | | | | 15mm |
| | | 0 | 1 | 5 | | | | | | | | | | | 15mm |
| | | 0 | 2 | 5 | | | | | | | | | | | 25mm |
| | | 0 | 4 | 0 | | | | | | | | | | | 40mm |
| | | 0 | 5 | 0 | | | | | | | | | | | 50mm |
| | | 0 | 8 | 0 | | | | | | | | | | | 80mm |
| Construction | | C | — | | | | | | | | | | | Local installation | |
| Material | | S | S | — | | | | | | | | | | SUS316L | |
| | | S | H | — | | | | | | | | | | SUS316L+Alloy C (S015, S025 Only) | |
| Connection type | | | | | | | | | | | | | | 3 | Flange connection |
| | | | | | | | | | | | | | | 4 | Ferrule connection |
| Connection standard | | | | | | | | | | | | | | 1 | JIS |
| | | | | | | | | | | | | | | 2 | ANSI |
| | | | | | | | | | | | | | | 3 | JPI |
| | | | | | | | | | | | | | | 4 | IDF ferrule |
| Pressure rating | | | | | | | | | | | | | | 0 | Ferrule (5K) |
| | | | | | | | | | | | | | | 1 | 10K |
| | | | | | | | | | | | | | | 2 | 20K, 150Lb |
| Density range | | | | | | | | | | | | | | 2 | 0.5 to 1.0 g/mL |
| | | | | | | | | | | | | | | 3 | 0.7 to 1.3 g/mL |
| | | | | | | | | | | | | | | 4 | 1.0 to 1.5 g/mL |
| Installation mode of transmitter | | | | | | | | | | | | | | K | Integrate type ST9801(Temperature range Max.120°C) |
| | | | | | | | | | | | | | | R | Separate type ST9801(Rack mount type MT9603) |

● Local mount Transmitter (ST9801)

| Item | Code No. | | | | | | | | | | | | Description | | |
|----------------------|----------|---|---|---|---|---|---|---|---|---|---|---|-------------|-------------------------|--|
| | ① | ② | ③ | ④ | ⑤ | ⑥ | — | ⑦ | ⑧ | ⑨ | ⑩ | ⑪ | | ⑫ | |
| Model | S | T | 9 | 8 | 0 | 1 | — | | | | | | | Local mount transmitter | |
| Type of Construction | | | | | | | | | | | | | | K | Integrate type |
| | | | | | | | | | | | | | | R | Separate type |
| Power supply | | | | | | | | | | | | | | 6 | 20 to 30 VDC |
| | | | | | | | | | | | | | | 7 | 85 to 264 VAC 50/60Hz |
| Analog output | | | | | | | | | | | | | | M D | Mass flow + Density |
| | | | | | | | | | | | | | | M T | Mass flow + Temperature |
| | | | | | | | | | | | | | | D T | Density + Temperature |
| | | | | | | | | | | | | | | M X | Mass flow rate 1 Output (voltage pulse output) |
| | | | | | | | | | | | | | | D X | Density 1 Output (voltage pulse output) |
| Frequency output | | | | | | | | | | | | | | 1 | Mass flow voltage pulse (Option) |
| | | | | | | | | | | | | | | 3 | Mass flow open collector pulse |
| Explosionproof | | | | | | | | | | | | | | 0 | Non-explosionproof |
| | | | | | | | | | | | | | | 1 | TIIS (domestic explosionproof) |
| | | | | | | | | | | | | | | 2 | ATEX (available in near future) |

■ PLEASE SUPPLY THE FOLLOWING INFORMATION WHEN YOU INQUIRE.

| | |
|--|--|
| 1. Process fluid (※1) | Name_____ Sp.gr._____ Viscosity_____ Slurry content in a slug flow_____ % |
| 2. Flow range | Max._____ Normal_____ Full scale_____ <input type="checkbox"/> kg/min <input type="checkbox"/> kg/h |
| 3. Fluid temperature | Max._____°C Normal_____°C Min._____°C |
| 4. Operating pressure | Max._____ MPa Normal_____MPa Min._____MPa |
| 5. Ambient temperature | Max._____°C Min._____°C |
| 6. Fluid flow direction | <input type="checkbox"/> Left → Right <input type="checkbox"/> Right → Left <input type="checkbox"/> Bottom → Top (<input type="checkbox"/> Top → Bottom) |
| 7. Nominal size | <input type="checkbox"/> _____mm <input type="checkbox"/> _____inch |
| 8. Required accuracy | ±_____ % of reading ±_____ % of full scale |
| 9. Process connection | <input type="checkbox"/> Flanged connection(Flange rating) <input type="checkbox"/> Ferrule connection |
| 10. Explosionproof | <input type="checkbox"/> Required <input type="checkbox"/> Not required |
| 11. Power supply | Power_____V <input type="checkbox"/> AC <input type="checkbox"/> DC |
| 12. Output specifications | <input type="checkbox"/> Pulse output <input type="checkbox"/> Volt. pulse : [0] : 1.5V [1] : 15VDC min. Out. impedance : 2.2kΩ <input type="checkbox"/> Open collector : Min.10V to Max. 30VDC, 50mA <input type="checkbox"/> Output frequency : Any point from 0.1 to 10000Hz at full scale |
| | <input type="checkbox"/> Analog output 4 to 20mA DC Max. load : 600Ω 2 outputs from instant. flow rate, temp. or density (option) |
| | <input type="checkbox"/> Additional damping 0 to 200sec.(variable) |
| | <input type="checkbox"/> Alarm output Slug flow (※2) High _____ g/mL Low _____ g/mL |
| | <input type="checkbox"/> Totalizer <input type="checkbox"/> Indicator <input type="checkbox"/> Recorder <input type="checkbox"/> Flow controller <input type="checkbox"/> Batch controller <input type="checkbox"/> Computer <input type="checkbox"/> Others |
| 13. Companion receiver | |
| 14. Transmission length | Sensor unit (————→)m Transmitter (————→)m Receiving instrument |
| 15. Exclusive cable length | In case of separate mounted type _____ m (5m Max.) |
| 16. In case of a separated type transmitter | <input type="checkbox"/> Stand on type w/bracket and 2" U bolts |
| 17. No. of units required | |
| 18. Application | |
| 19. Other considerations | |

※1 : Special fluids, such as high viscosity fluids and slurries, should be stated precisely and in detail.

※2 : Option

The specification as of Jan., 2010 is stated in this GS Sheet. Specifications and design are subject to change without notice.



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