



## New Single Straight Tube Type OVAL Coriolis Mass Flowmeter

# ST<sub>mass</sub> MKII

Transmitter : ST9101, ST9801

## GENERAL SPECIFICATION GS.No.GBN034-2-E

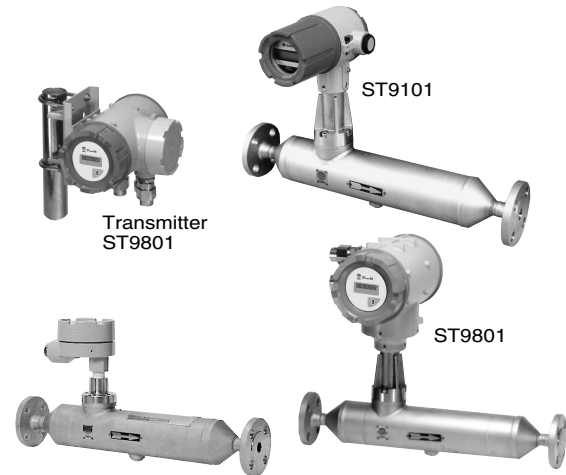
### ■ GENERAL

The ST<sub>mass</sub> 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 comes either in a highly sophisticated type, integrally mounted with or separately mounted from the sensor, ST9801, and a smallest-in-the-world type, ST9101.
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. Explosion-proof construction 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 (1/2")	15mm (1/2")	25mm (1")	40mm (1-1/2")	50mm(2")	80mm
Materials	Wetted	SUS316L or SUS316L+Hastelloy C (S015, S025 only)					
	Housing	SUS304					
Process connection		JIS 10, 20K RF, ANSI/JPI 150 RF, IDF ferrule					
Applicable fluid		Liquid					
Temp. Range	Non-explosion-proof type	-25~+130°C (For liquid Temp. above 120°C, the transmitter should be of separate type).					
	Explosion-proof type	-20~+130°C					
Max. Operating pressure		Up to 2.45MPa, Depends on the process connection pressure rating (see page 2).					
Sensor housing withstands		2.8MPa					
Flow direction		Normal or reverse					
Explosion-proof construction		See the transmitter specifications below.					

#### Transmitter

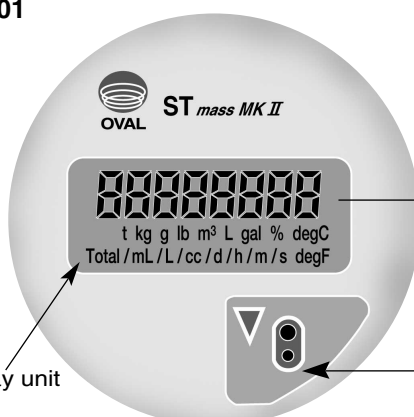
Item		Description	
Model		ST9801 (sophisticated model)	ST9101 (compact design)
Rangeability	Flowrate	See general performance table (page 2).	
	Temperature	-25~+130°C (-20~+130°C in the ex. model)	
Power supply		85~264VAC 50/60Hz or 20~30VDC	20~30VDC
Power consumption		Max. 25VA	Max. 6VA
Ambient temperature		-20~+50°C	-20~+55°C
Transmission length (separate type)		Max. 5 m (exclusive cable used)	—
Explosion-proof construction		Combined explosion-proof [Exd (ib) II BT3]	Combined explosion-proof [Exd (ib) II BT3]
Dust and waterproof construction		IP65	IP65 or equiv.
Mounting		Integrally or separately mounted	Integrally mounted
Display		8-digit (7-segment) LDC display	
Mass		4.6kg approx. (5.8kg approx., separate type)	1.6kg approx.
Communication interface		HART protocol and Bell 202	
Status input		Remote zero or optional feature/contact-closure input (From "a" contact)	None
Pulse output		Voltage pulse "0": 1.5V max., "1": 15V Output impedance 2.2kΩ or open collector output (10V min., ~30V max., 50mA DC), FS: 0.1~10000Hz	Select one from 1, 2, 3 and 4 below: 1 Current pulse output (4/20mA) "0": 4mA, "1": 20mA 2 Voltage pulse output "0": 1V max., "1": 15V 3 Open collector pulse output 30V, 50mA DC max. 4 Analog output (4/20mA) Mass/temp. * Either 1 or 4 for communications. ◆ In frequency output FS: 0.1~1000Hz ◆ 1 - 3 pulse output : Mass
Analog output		4~20mADC (max. load 600Ω) Two outputs from mass flow, or temperature. Additional damping: 0~200sec.	
Status output		Open collector output (Normal : ON; Abnormal: OFF) Select one from Error, Flow direction, Hi/Lo alarm	None
Drive control voltage output		DC voltage output (for checking)	

## ■ GENERAL PERFORMANCE

Item		Description					
<b>Model</b>		S010C	S015C	S025C	S040C	S050C	S080C
<b>Flow rate</b>	<b>Normal flow range (kg/min)</b>	0~12	0~40	0~120	0~300	0~600	0~1200
	<b>Allowable flow range (kg/min)</b>	0~18	0~60	0~180	0~450	0~900	0~1800
	<b>Min. range (kg/min)</b>	0~1.2	0~4	0~12	0~30	0~60	0~120
	<b>Accuracy in factory calibration</b>	[±0.2% ± zero stability error] of RD					
	<b>Repeatability</b>	[±0.1%±1/2 zero stability error] of RD					
	<b>Zero stability</b>	0.05% of max flow rate at normal flow range					
<b>Density (Liquids)</b>	<b>Measuring range</b>	0.5 ~ 1.0g/mL, 0.7 ~ 1.3g/mL, 1.0 ~ 1.5g/mL					
	<b>Accuracy in factory calibration(option)</b>	±0.004g/mL					
<b>Analog accuracy</b>	ST9801	Accuracy at the flow rate ±0.1% of FS					
	ST9101	Accuracy at the flow rate ±0.3% of FS					

## ■ DISPLAY

● **ST9801**




1: Instantaneous mass flow rate  
 2: Instantaneous volume flow rate  
 3: Density  
 4: Temperature  
 5: Totalized flow (mass or volume)  
 6: Analog out put 1 (Indicate with % of full scale valve)  
 7: Analog out put 2 (Indicate with % of full scale valve)

Display unit

Display modes are selectable with a sensor of infrared rays behind the display window.

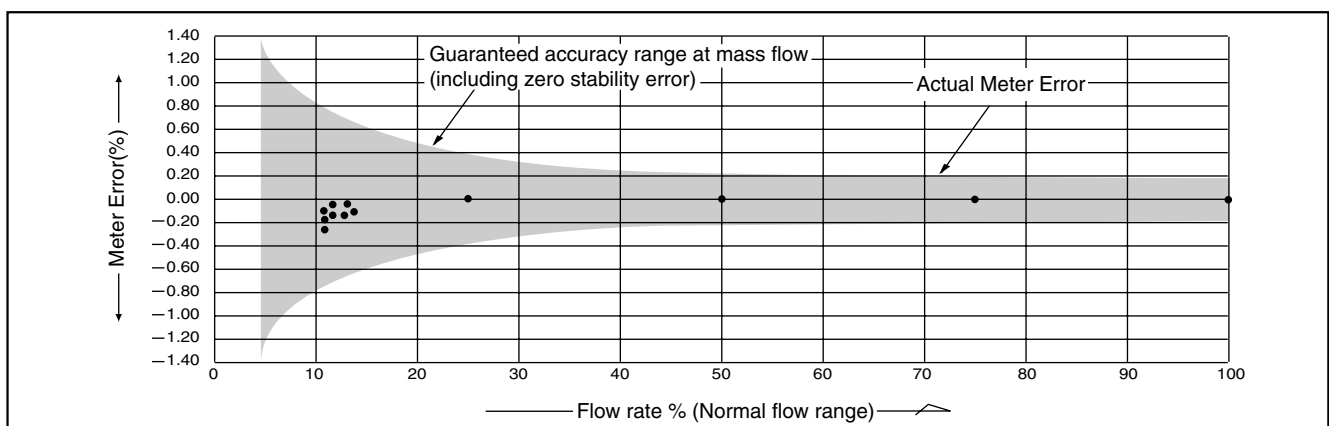
● **ST9101**



1 Totalized flow  
 2 Instantaneous flow rate  
 3 % Instantaneous flow rate  
 4 Density (optional)  
 5 Temperature

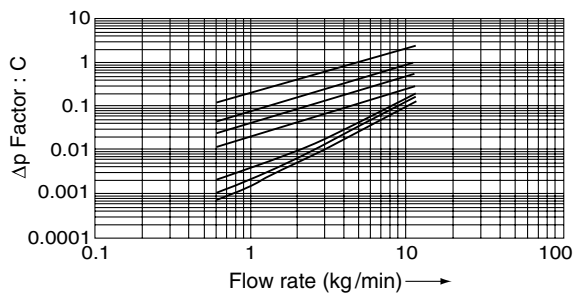
Mode select switch area (Hold the mode selector magnet over this area to change display modes.)

## ■ METER ERROR

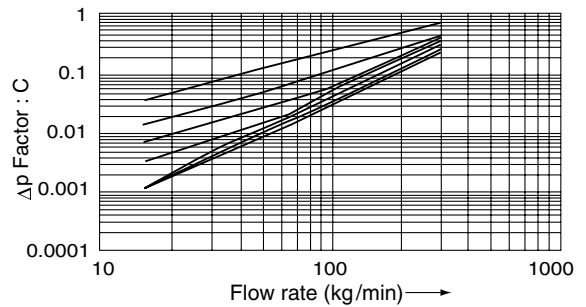


## ■ PRESSURE LOSS

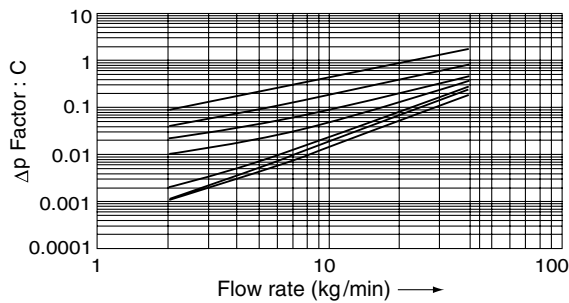
**S010C**



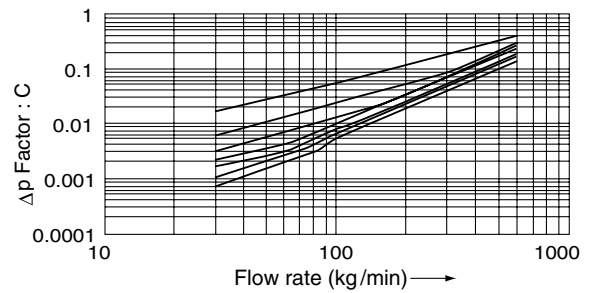
**S040C**



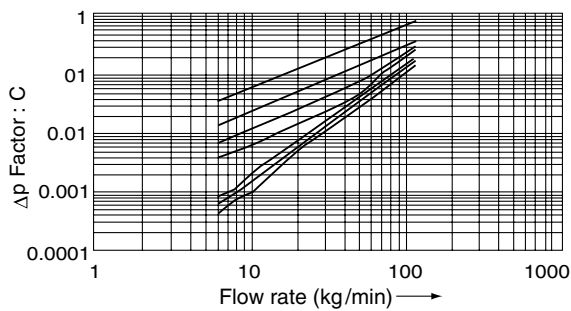
**S015C**



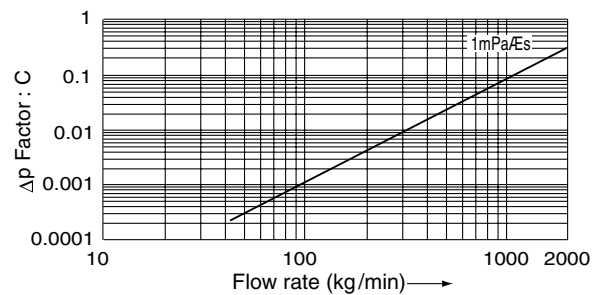
**S050C**



**S025C**



**S080C**



NOTE: Curves for Models S010C through S050C show pressure losses relative to viscosities (from top to bottom) 500, 200, 100, 50, 10, 1 (mPa·s).  
[except S080C Model]

### How to determine pressure loss

1. Find the pressure loss factor C from flow rate (kg/min) 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:

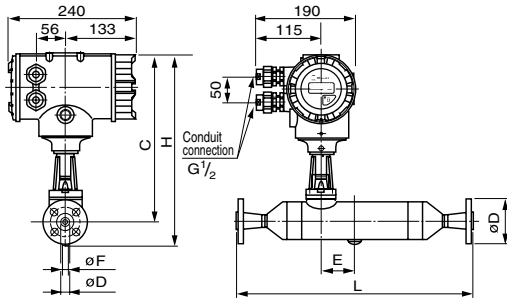
$$\Delta P_2 = C X \frac{\mu_2}{\mu_1} X \frac{1}{d}$$

- where  $\Delta P_2$ : Pressure loss of high viscosity liquid (MPa)  
 $\mu_2$ : Viscosity of high-viscosity liquid (mPa·s)  
d: Specific gravity of high-viscosity liquid (1 for water)  
 $\mu_1$ : Max. viscosity shown in the graph (mPa·s)  
C: Pressure loss factor found from the max. viscosity curve at a given flow rate.

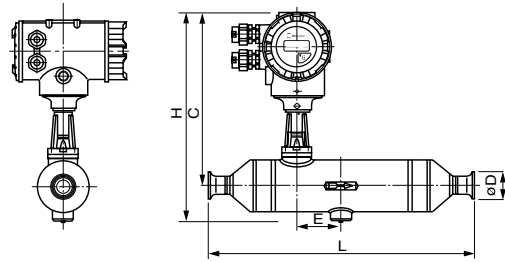
## ■ DIMENSIONS [Unit in mm]

### ● Transmitter Integrate Type

Flange connection



Ferrule connection



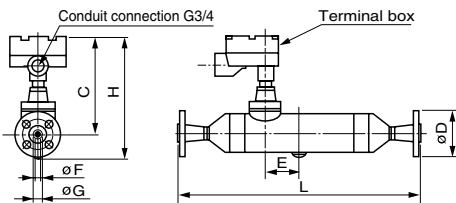
Type	JIS 10 K		ANSI 150		H	C	øF	øG	E	Mass(kg)
	L	øD	L	øD						
S010C	426	95	458	89	382	309	5.0	16.8	69	13
S015C	464	95	496	89	382	309	7.4	16.8	80	13
S025C	529	125	570	108	412	322	12.4	26.6	88	19
S040C	716	140	749	127	432	328	17.8	40.4	112	29
S050C	882	155	919	152	470	341	26.4	52.6	153	39
S080C	1068	185	-	191	494	361	38.0	77.8	192	70.2

Type	Nom. Size	L	H	C	øD	E	Mass(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	-	-	-	-	-	-	-

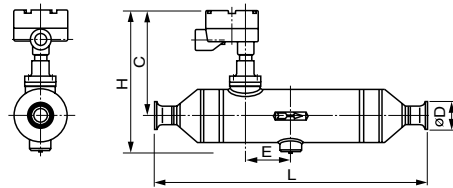
Nominal size : A :mm, S :Inch Sanitary version \* Under preparation

### ● Transmitter Separate Type

Flange connection



Ferrule connection



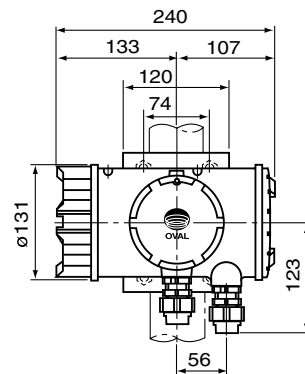
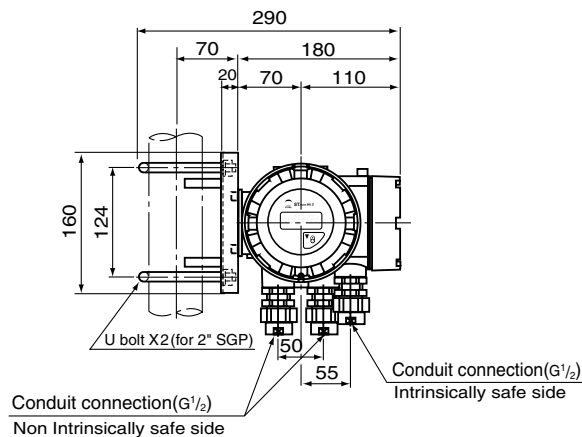
Type	JIS 10 K		ANSI 150		H	C	øF	øG	E	Mass(kg)
	L	øD	L	øD						
S010C	426	95	458	89	246	197	5.0	16.8	69	7
S015C	464	95	496	89	246	197	7.4	16.8	80	9
S025C	529	125	570	108	280	210	12.4	26.6	88	16
S040C	716	140	749	127	296	210	17.8	40.4	112	25
S050C	882	155	919	152	332	229	26.4	52.6	153	35
S080C	1068	185	-	191	366	245	38.0	77.8	192	66

Type	Nom. Size	L	H	C	øD	E	Mass(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)

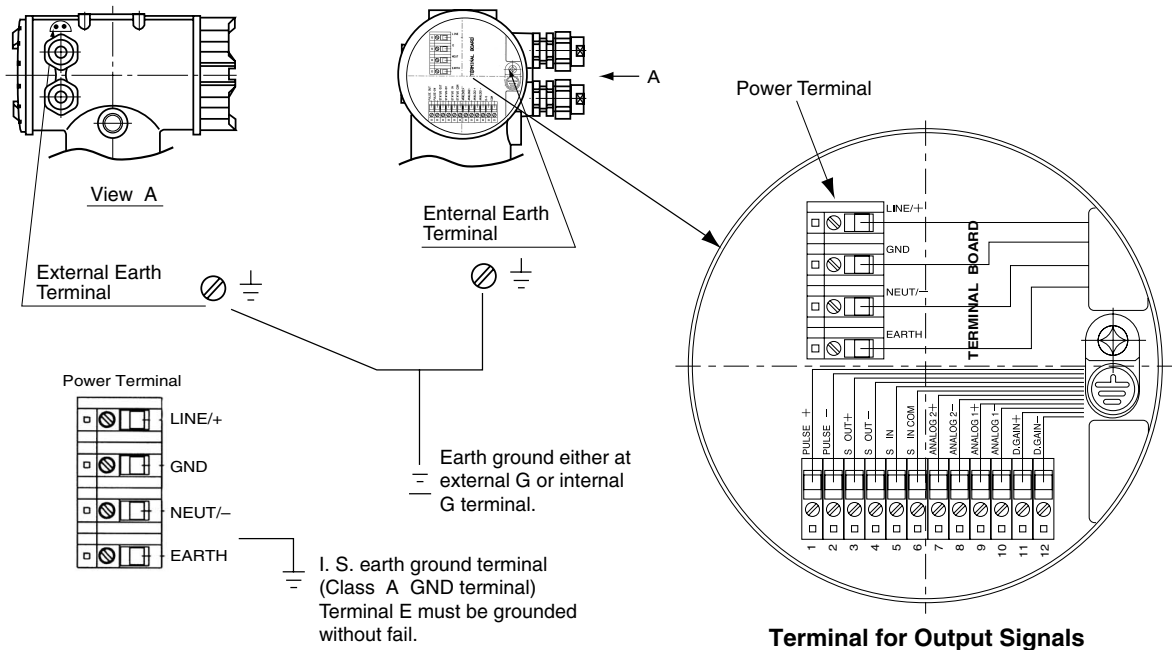
<Stand on Type>





## ■ WIRING for ST9801

### ● Transmitter Integrate Type



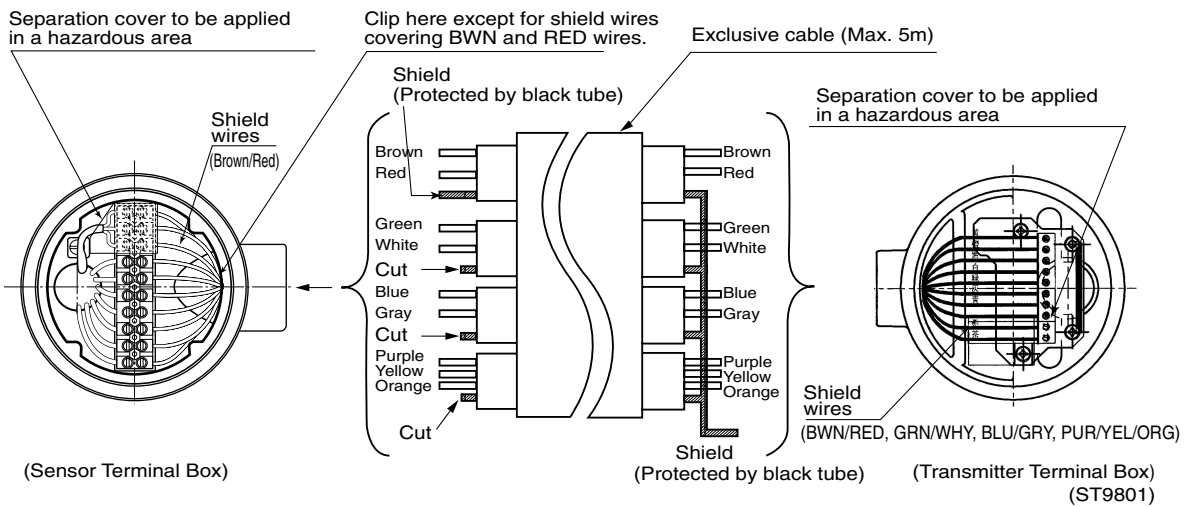
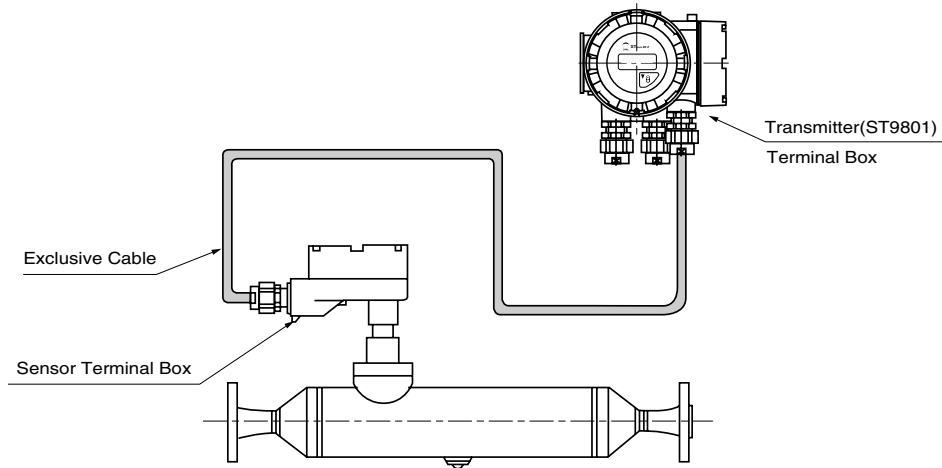
### ● Remote Output Signal Connection Terminals

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	11	D. GAIN +	Drive gain output (test output)	
	12	D. GAIN -	Common	
		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.
	Brown	(+)DRIVE	Flow tube drive output	
	Red	(-)DRIVE		
	Orange	(+)TEMP A'	Temp. Input (Outer side)	Transmission length : Max. 5m
	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

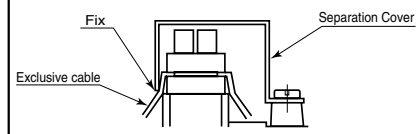
(1) Transmitter end:

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 other shield wires.

How to install the cover. After wiring with the relay terminals, install the cover as shown below.



## ■ WIRING for ST9101

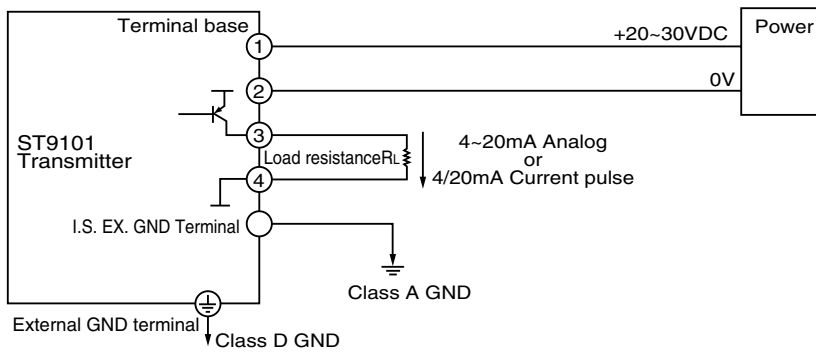
### ● Connecting terminals and Output signals.

Terminal No.	Display		Description
1	+	Power supply 20~30VDC	Power terminal (20~30VDC)
2	-		
3	+	Pulse/analog	Output terminal (Analog or Pulse output)
4	-		
-	Intrinsically safe GND		Intrinsic safety earth terminal ("Class A" GND work)

### 1. Analog or Current pulse output

Setting of **OUT** switch in Main unit. (Note : Set in factory on spec.)

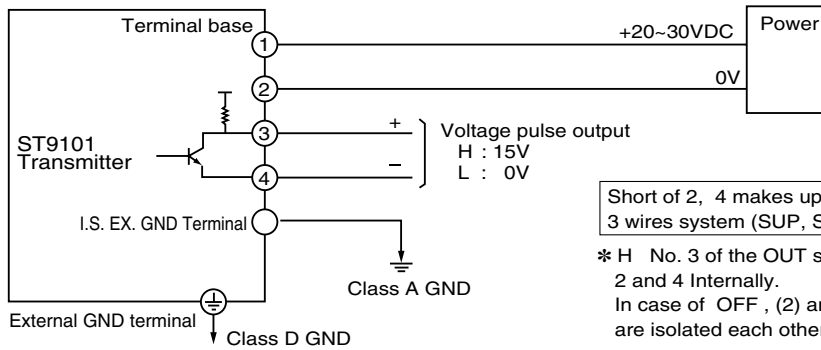
1 : ON, 2 : OFF, 3 : OFF, 4 : OFF



### 2. Voltage pulse output

Setting of **OUT** switch in Main unit. (Note : Set in factory on spec.)

1 : OFF, 2 : ON, 3 : OFF, 4 : ON



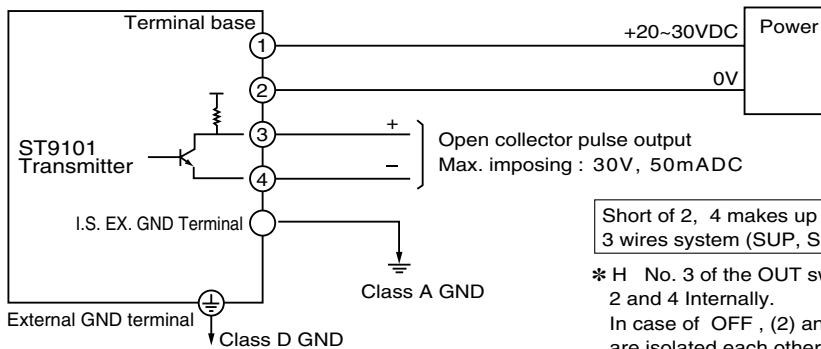
Short of 2, 4 makes up 3 wires system (SUP, SIG, COM)

\* H No. 3 of the OUT switch shorts, 2 and 4 Internally. In case of OFF, (2) and (4) are isolated each other.

### 3. Open collector pulse output

Setting of **OUT** switch in Main unit. (Note : Set in factory on spec.)

1 : OFF, 2 : ON, 3 : OFF, 4 : OFF



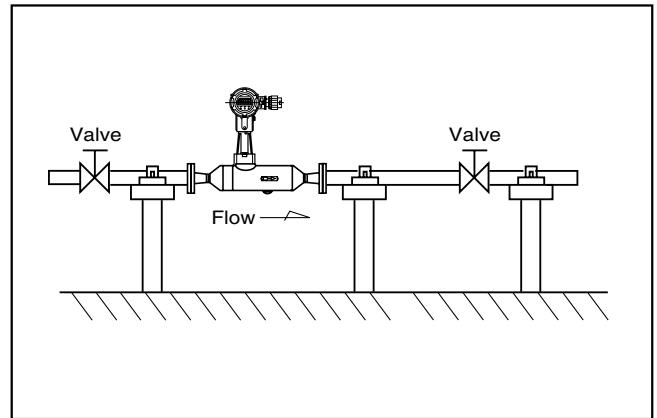
Short of 2, 4 makes up 3 wires system (SUP, SIG, COM)

\* H No. 3 of the OUT switch shorts, 2 and 4 Internally. In case of OFF, (2) and (4) are isolated each other.

## ■ STANDARD INSTALLATION

### 1. Typical Installation (See figure at right.)

- 1) Avoid pipeline stresses on the STmass MKII.
- 2) A 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 construction. 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 MK II
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+Hastelloy-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					0.5~1.0 g/mL
										3					0.7~1.3 g/mL
										4					1.0~1.5 g/mL
Installation mode of transmitter														K	Integrate type ST9801(Temperature range Max.120°C)
														R	Separate type ST9801(Rack mount type MT9603(Preparation))
														S	small size transmitter Integrate type(ST9101)

### ● 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						20~30 VDC
									7						85~264 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	Nonexplosion-proof
														1	TIIS (domestic explosion-proof)
														2	CENELEC (available in near future)

### ● Local mount small size transmitter (ST9101)

Item	Code No.												Description		
	1	2	3	4	5	6	-	7	8	9	10	11		12	
Model	S	T	9	1	0	1	-	S							Small size transmitter (Integrate type)
Power supply									6						20~30VDC
Display										D					LCD display provided
Output										M	0	0			Mass flow rate analog output
										D	0	0			Density analog output
										T	0	0			Temperature analog output
									*	0	M	1			Mass flow rate voltage pulse output
									*	0	M	2			Mass flow rate open collector pulse
									0	M	3			Mass flow rate current pulse output	

Selection of pulse output  
 Selection of Analog output

NOTE: \* function is not provided in case of voltage and open collector.

**■ PLEASE SUPPLY THE FOLLOWING INFORMATION WHEN YOU INQUIRE.**

<b>1. Process fluid</b> *1	Name_____ Sp.gr._____ Viscosity_____ Slurry content in a slug flow_____ %
<b>2. Flow range</b>	Max._____ Normal_____ Full scale_____ <input type="checkbox"/> kg/min <input type="checkbox"/> kg/h
<b>3. Fluid temperature</b>	Max._____°C Normal_____°C Min._____°C
<b>4. Operating pressure</b>	Max._____ MPa Normal_____MPa Min._____MPa
<b>5. Ambient temperature</b>	Max._____°C Min._____°C
<b>6. Fluid flow direction</b>	<input type="checkbox"/> Left → Right <input type="checkbox"/> Right → Left <input type="checkbox"/> Bottom → Top ( <input type="checkbox"/> Top → Bottom)
<b>7. Nominal size</b>	<input type="checkbox"/> _____mm <input type="checkbox"/> _____inch
<b>8. Required accuracy</b>	±_____ % of reading ±_____ % of full scale
<b>9. Process connection</b>	<input type="checkbox"/> Flanged connection(Flange rating) <input type="checkbox"/> Ferrule connection
<b>10. Explosion-proof</b>	<input type="checkbox"/> Required <input type="checkbox"/> Not required
<b>11. Power supply</b>	Power_____V <input type="checkbox"/> AC <input type="checkbox"/> DC (ST9101: DC only)
<b>12. Output specifications</b>	<input type="checkbox"/> Volt. pulse : [0] : 1.5V [1] : 15VDC min. Out. impedance : 2.2kΩ <input type="checkbox"/> Open collector : Min.10V~Max. 30VDC, 50mA <input type="checkbox"/> Output frequency : Any point from 0.1~10000Hz at full scale (ST9101: 0.1~1000Hz at full scale)
	Analog output 4~20mA DC Max. load : 600Ω 2 outputs from instant. flow rate ,temp. or density (option)
	Additional damping 0~200sec.(variable)
	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 Batch controller <input type="checkbox"/> Computer Others
	Sensor unit ( → )m Transmitter ( → )m Receiving instrument
<b>14. Transmission length</b>	
<b>15. Exclusive cable length</b>	In case of separate mounted type _____ m
<b>16. In case of a separated type transmitter</b>	<input type="checkbox"/> Stand on type w/bracket and 2" U bolts
<b>17. No. of units required</b>	
<b>18. Application</b>	
<b>19. Other considerations</b>	

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

\*2. Option

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The specification as of July, 2001 is stated in this GS Sheet. Specifications and design are subject to change without notice.

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**Sales Representative:**

00.10	初版
	改訂
02.2	印刷