

Straight-Tube Coriolis Flowmeter

ALTI^{mass} Type S

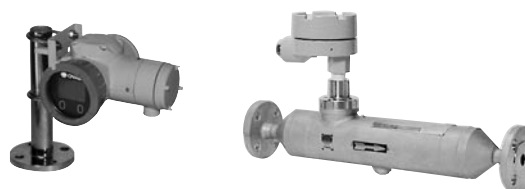
GENERAL SPECIFICATION
GS.No.GBN122E-9

■ GENERAL

Equipped with a sophisticated transmitter (self diagnosis feature, large size display, and field-reconfiguration capability using a touch panel), “ALTI^{mass} Type S” is a single straight-tube design Coriolis flowmeter capable of direct mass flow measurement at a high degree of accuracy.

■ FEATURES

1. Increased self-diagnostic capabilities: checking for cable faults, pipeline vibration, and monitoring transmitter temperatures, to name a few.
2. You can reconfigure transmitter parameters using a finger touch on the touch panel (also through communication).
3. Fast response: 10 times improved from conventional models.
4. Two alarm indicators provided
5. Increased output signals:
Pulse output (dual outputs), analog output (dual outputs), and status output (single output)
6. Enhanced maintenance functions:
Error logging, storing factory shipping data, and downloading programs
7. Readily expandable for additional application:
(Improved communication capability, comprehensive maintenance capability, and enhanced expandable functions)
8. Except for CS080, the models are the Japanese High Pressure Gas Safety Law compliant (flow tube material: SUS316L).



Local Mount
Transmitter

■ GENERAL SPECIFICATIONS

● Sensor unit

Item		Description					
Model		CS010	CS015	CS025	CS040	CS050	CS080
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	Wetted parts	SUS316L					
	Housing	SUS304					
Process connection		JIS 10, 20K RF, ASME/JPI 150 RF, IDF ferrule					
Applicable fluid		Liquid					
Temperature range		-40 to +130°C (*2)					
Density 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		Forward flow only					
Explosionproof configuration		ATEX II2G Ex ib IIB T3, T4 Gb (*3) KOSHA Ex ib IIB T3, T4 (*3)					
Dusttight, waterproof configuration		IP66 / 67					

*1 : The density range varies depending on the fluid to be used. Also, please consult OVAL if density measurement is required.

*2 : In case of explosionproof model, the integrally mounted type can support -20 to +80°C. In case of non-explosionproof type, the maximum measurement temperature is 130°C. However, the product must be used within the maximum ambient temperature of 45°C.

*3 : Integrally mounted type is applicable temperature grade T4.

● **Transmitter specifications**

Item	Description
Model	PA0K
Power supply	85 to 264VAC 50/60Hz or 20 to 30VDC
Power consumption	Max. 15W
Ambient temperature	-40 to +55°C (*1)
Transmission length (separate type)	Max. 5m (Exclusive cable used)
Applicable EU directive	EMC Directive : 2004/108EC, ATEX Directive : 94/9/EC
Applicable EN standards	EMC : EN55011 : 1998/A1 : 1999/A2 : 2002 Group 1 Class B EN61000-6-2: 2001/EN061326-1: 2006 ATEX : EN60079-0 : 2009 EN60079-1 : 2007 EN60079-11 : 2011
Explosionproof enclosure	ATEX II2G Ex d ib IIB T4 Gb : Integrally mounted, II2G Ex d [ib] IIB T6 Gb : Remotely mounted KOSHA Ex d ib IIB T4 : Integrally mounted, Ex d [ib] IIB T6 : Remotely mounted
Dusttight, waterproof configuration	IP66 / 67
Transmitter configuration	Integrally or remotely mounted
Finish	Sensor: Munsell 10B8/4, Covers (front and rear): 2.5PB4/10
Display	LCD display provided (128×64 dots), backlit (white, orange) Infrared light sensors: 2 Indicators: 2 (green, red)
Weight	Integrally mounted model 3.6kg approx., Remotely mounted model 5.0kg approx.
Communication interface	Bell 202 (HART protocol) (*2) Option : RS-485 Modbus protocol, Baudrate : 9600bps, 19200bps, 38400bps Transmission mode : RTU or ASCII, Response time : 25 to 50 ms Note : In Modbus communication, set SW3-4 on the maintenance board to ON (only Bell 202 is valid with SW3-4 set to OFF).
Operation	Additional damping: flow 0.8sec, density 4sec, temperature 2.5sec. Low flow cutoff (default) : 1.5% or less of max. service flowrate
Pulse output	Open collector output (10V min. to 30Vmax., 50mA DC) , or Voltage pulse ("Low Level": 1.5V max. "High Level": 15V min., Output impedance 2.2kΩ), Setting range: 0.1 to 10000Hz (max. output 11000Hz)
Analog output	4 to 20mADC (max. load 600Ω) Select two outputs from instant flowrate (mass or volume) temperature, and density.
Status output	Open collector output (Max.30V, 50mADC) Select one output from error (*3), flow direction, or high/low alarm (default is error)
Status input	Contact-closure input (Form "a" contact) Short: 200Ω max., Open: 100kΩ min. Select one output from remote zero, total reset, 0% signal lock, or function off (default is function off).

*1 : Below -20°C the display and infrared optical sensor may exhibit a slow response.

*2 : Analog output 1 is compatible only with Bell202 specification.

*3 : Of error outputs, "auto zero in progress" status output can be set up.

* : Due to the incorporation of a circuit protection device conforming to EMC requirements, insulation resistance and dielectric strength tests are unacceptable.

■ **GENERAL PERFORMANCE**

Item		Description					
Model		CS010	CS015	CS025	CS040	CS050	CS080
Flowrate	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
	Factory calib. acc.	[±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
Analog accuracy		±0.1% of FS added to each accuracy					

$$\text{Zero stability error} = \frac{\text{Zero stability (kg/h)}}{\text{Flowrate at the moment (kg/h)}} \times 100\%$$

■ DISPLAY

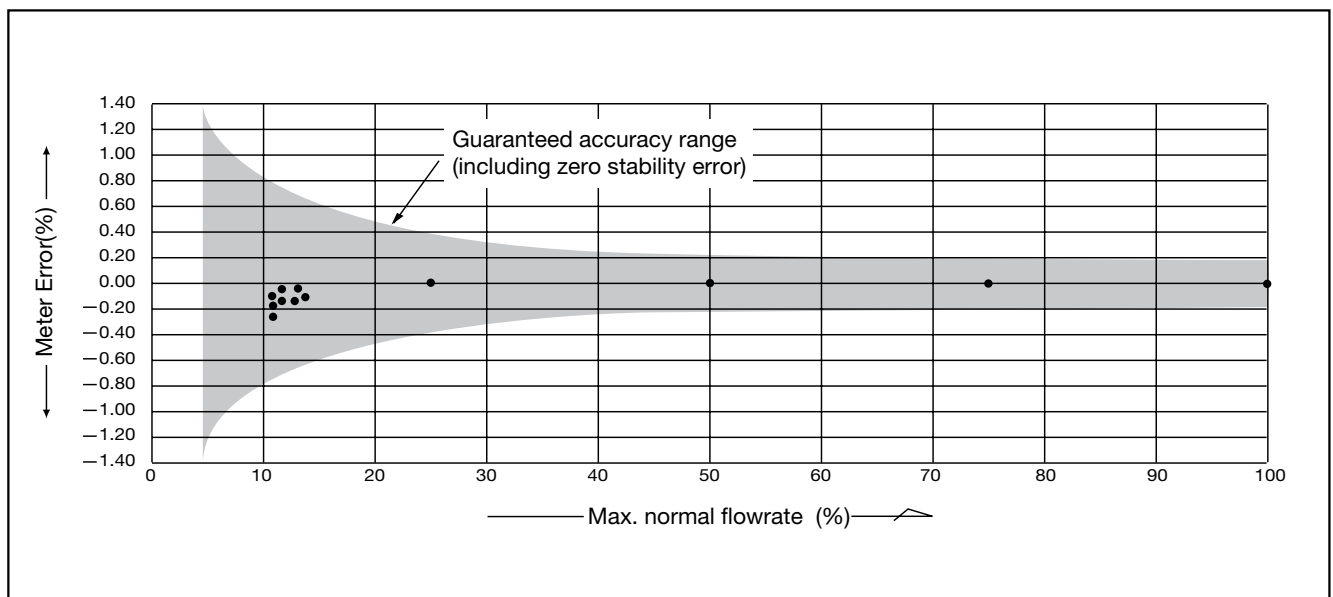
Available display modes

- ① Instantaneous mass flowrate
- ② Instantaneous volume flowrate (fixed density calculation) (*1)
- ③ Density
- ④ Temperature
- ⑤ Totalized flow 1 (no unit)
- ⑥ Totalized flow 2 (no unit)
- ⑦ Totalized flow 1 (has units)
- ⑧ Totalized flow 2 (has units)
- ⑨ Analog output 1 (% instant flowrate)
- ⑩ Analog output 2 (% instant flowrate)
- ⑪ Status information
- ⑫ Mode select (param. setting)

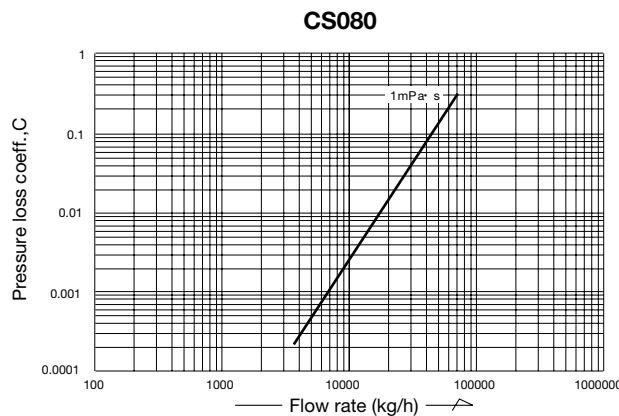
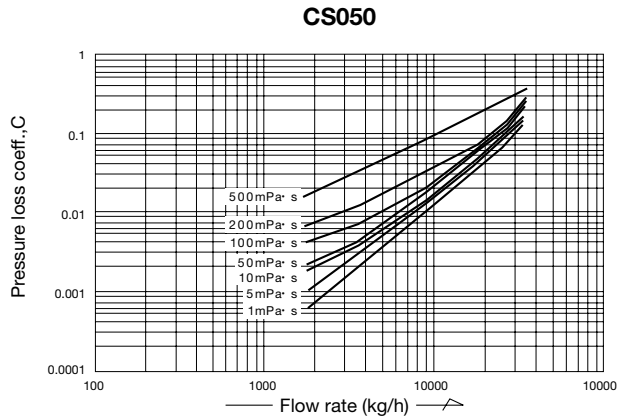
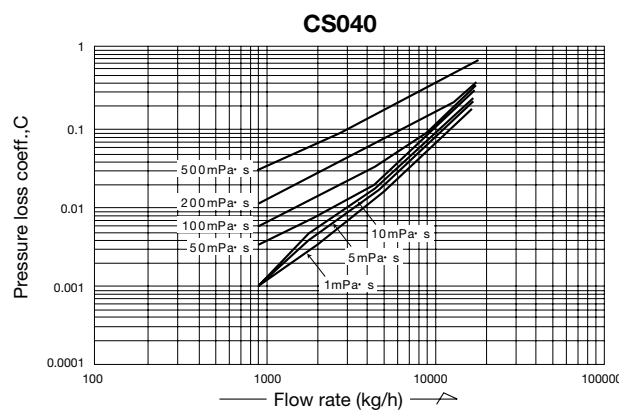
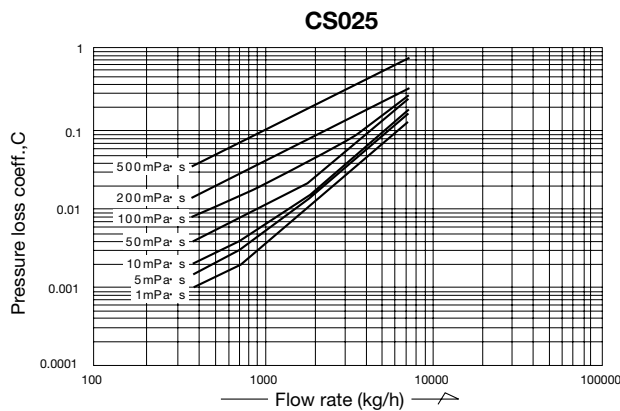
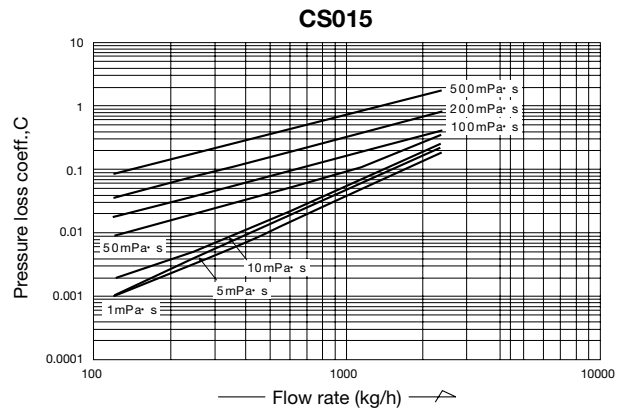
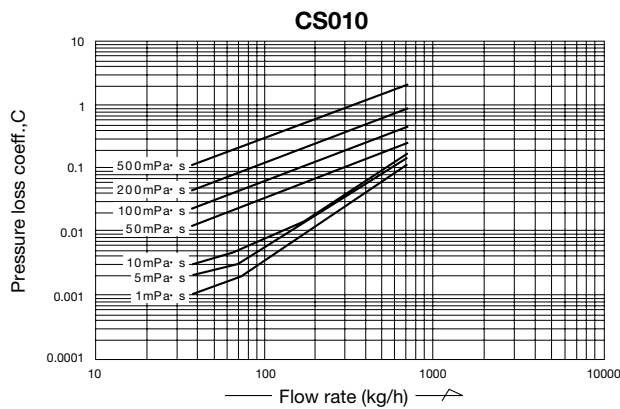
*1 : Indicated only when volumetric output by fixed density calculation is selected in the output specification.

A tap of a finger on this glass faceplate area (infrared light sensor) selects the desired display modes.
 ※LCD backlight in two colors: white and orange.
 Changes according to flowmeter status.
 Backlight goes out automatically when the optical sensor does not respond at all for a set time period.

■ 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,

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

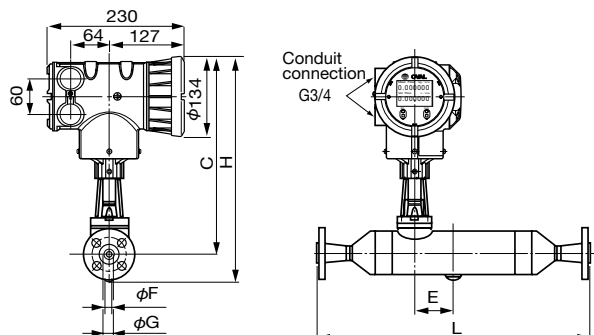
2. For high viscosity liquids not shown in these graphs, calculate the pressure loss by the following formula:

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

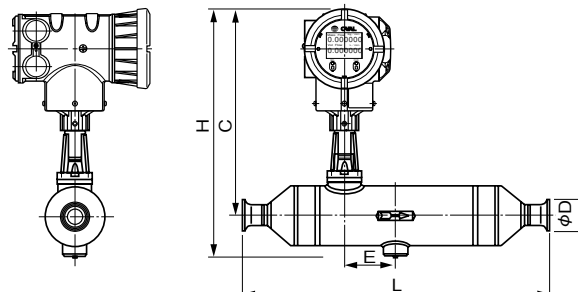
- where ΔP_2 : Pressure loss of high viscosity liquid (MPa)
 μ_2 : Viscosity of high viscosity liquid (mPa·s)
 d : Specific gravity of high viscosity liquid (1 for water)
 μ_1 : Max. viscosity shown in the graph (mPa·s)
 C : Pressure loss factor found from the max. viscosity curve at a given flow rate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

■ DIMENSIONS [Unit in mm]

● Transmitter, Integrally Mounted Type
Flange connection



Ferrule connection



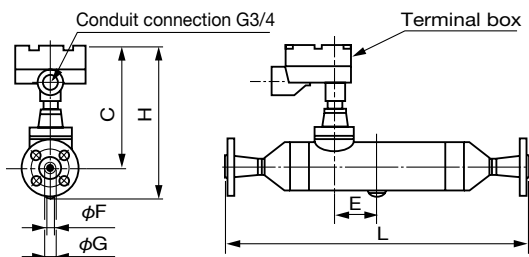
Model	Nom. Size	JIS 10K	ASME /JPI 150	H	C	φ F	φ G	E	Approx. Weight kg (JIS 10K)
		L	L						
CS010	15 (1/2")	426	458	390	340	5	16.8	69	12
CS015	15 (1/2")	464	496	390	340	7.4	16.8	80	12
CS025	25 (1")	529	570	423	353	12.4	26.6	88	18
CS040	40 (1-1/2")	716	749	439	359	17.8	40.4	112	28
CS050	50 (2")	882	919	474	372	26.4	52.6	153	38
CS080	80 (3")	1032	1073	510	392	38	77.8	176	69.2

Type	Nom. Size	L	H	C	φ D	E	Approx. Weight(kg)
CS010	15A	426	390	340	34	69	9
CS015	15A	464	390	340	34	80	10
CS025	1-1/2S	529	423	353	50.5	88	16
CS040	2S	716	439	359	84	112	24
CS050	2-1/2S	882	474	372	77.5	153	34
CS080	Compatible models available						

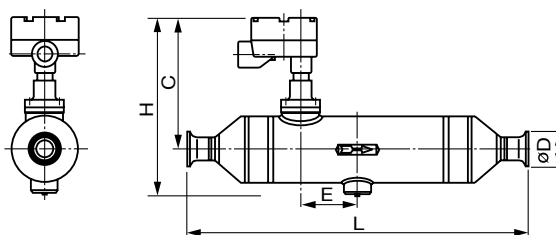
Nominal size : A :mm, S :Inch Sanitary version

● Transmitter Remotely Mounted Type

Flange connection



Ferrule connection



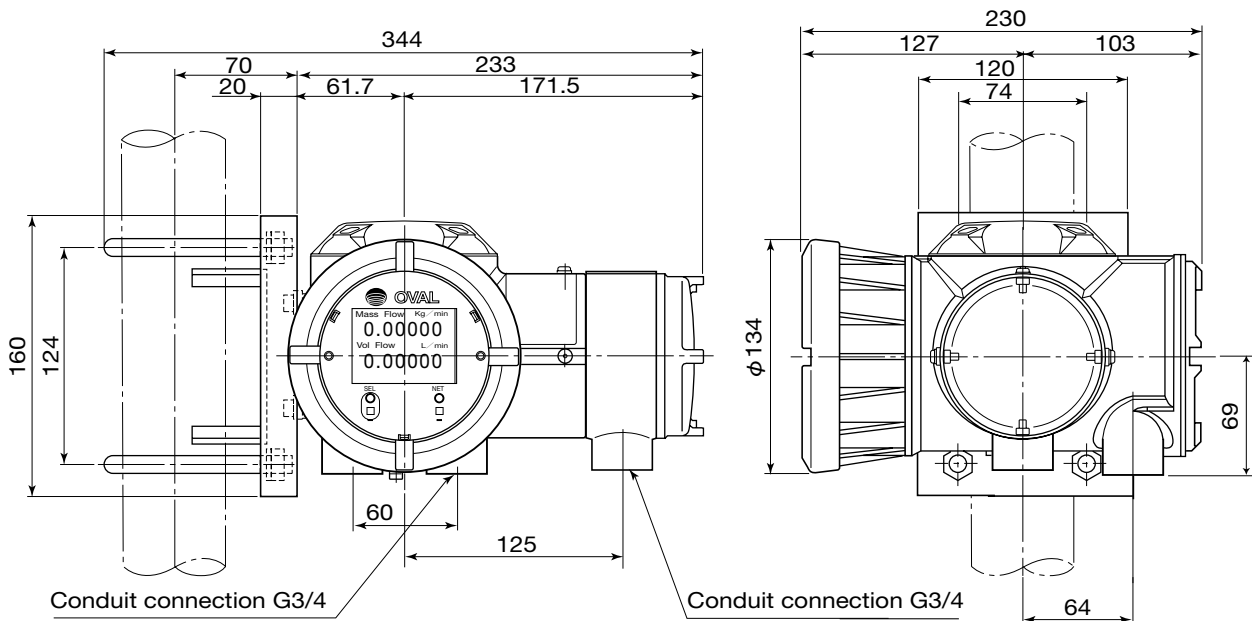
Model	Nom. Size	JIS 10K	ASME /JPI 150	H	C	φ F	φ G	E	Approx. Weight kg (JIS 10K)
		L	L						
CS010	15 (1/2")	426	458	246	197	5	16.8	69	7
CS015	15 (1/2")	464	496	246	197	7.4	16.8	80	9
CS025	25 (1")	529	570	280	210	12.4	26.6	88	16
CS040	40 (1-1/2")	716	749	296	216	17.8	40.4	112	25
CS050	50 (2")	882	919	332	229	26.4	52.6	153	35
CS080	80 (3")	1032	1073	367	249	38	77.8	176	66

Model	Nom. Size	L	H	C	φ D	E	Approx. Weight (kg)
CS010	15A	426	246	197	34	69	6
CS015	15A	464	246	197	34	80	7
CS025	1-1/2S	529	280	210	50.5	88	13
CS040	2S	716	296	210	64	112	21
CS050	2-1/2S	882	332	229	77.5	153	31
CS080	Compatible models available						

Nominal size : A :mm, S :Inch Sanitary version.

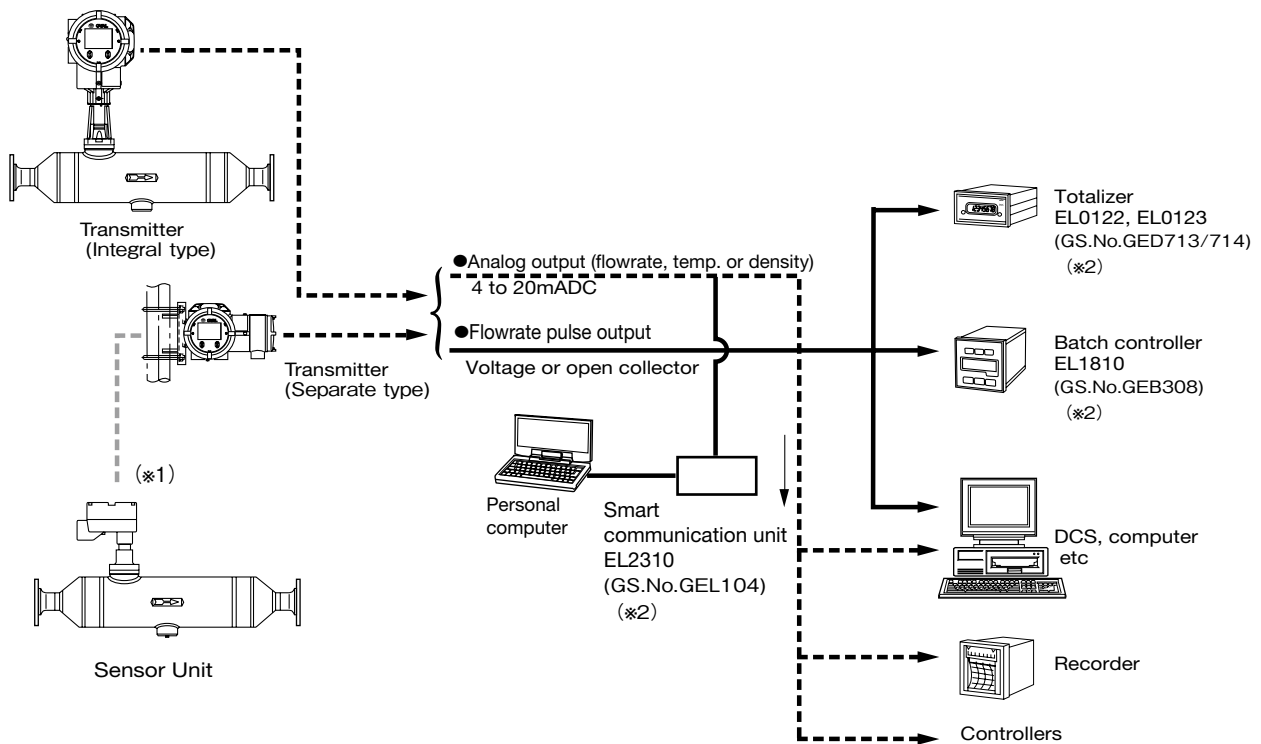
■ DIMENSIONS [Unit in mm]

● Remotely located transmitter



※ : While stanchion mounting hardware are furnished as standard accessories, the customer is to furnish the stanchion.

■ REMOTE MEASURING SYSTEM

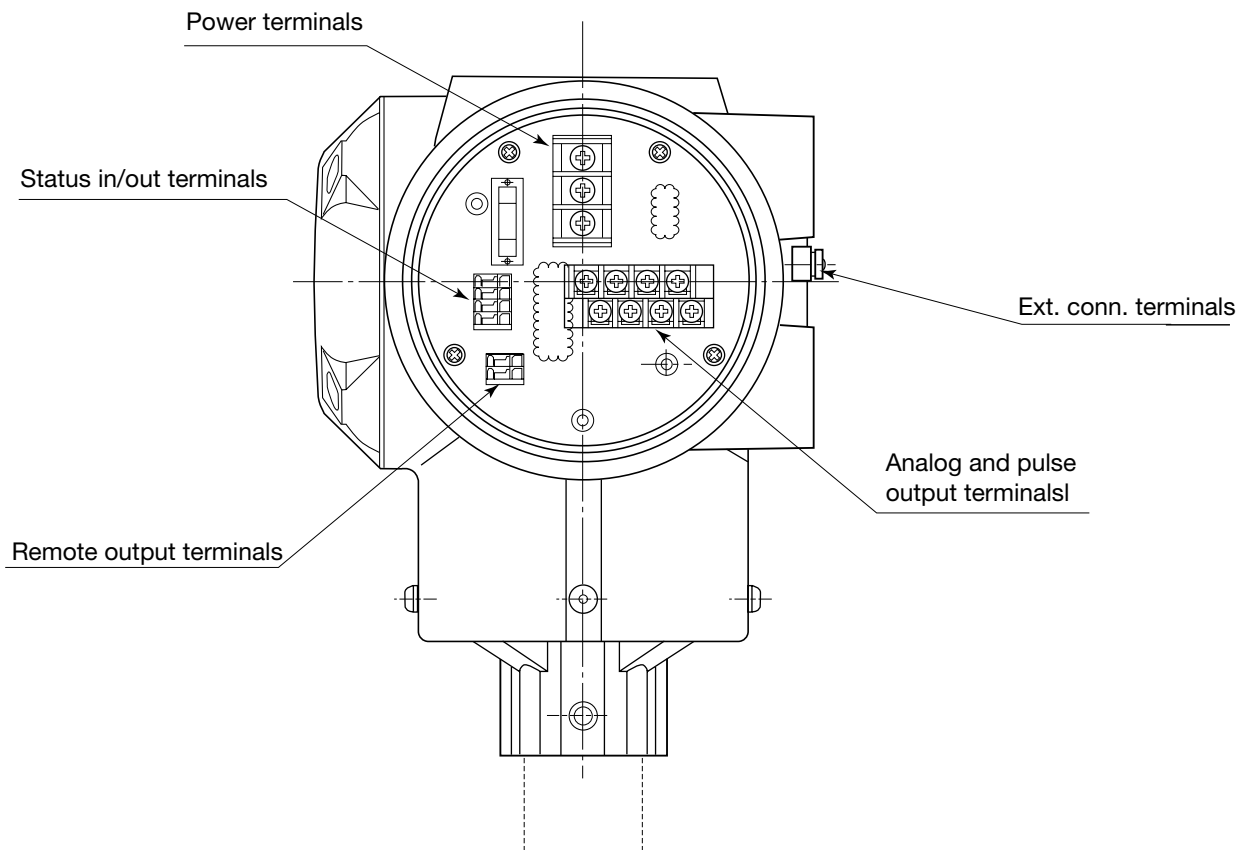


※1 : In case of the separate type, the sensor unit and transmitter are connected with exclusive cable.

※2 : For detailed information about companion instruments, see respective products GS sheets separately prepared.

■ WIRING DIAGRAM

● Transmitter power and in/out signal wiring connections



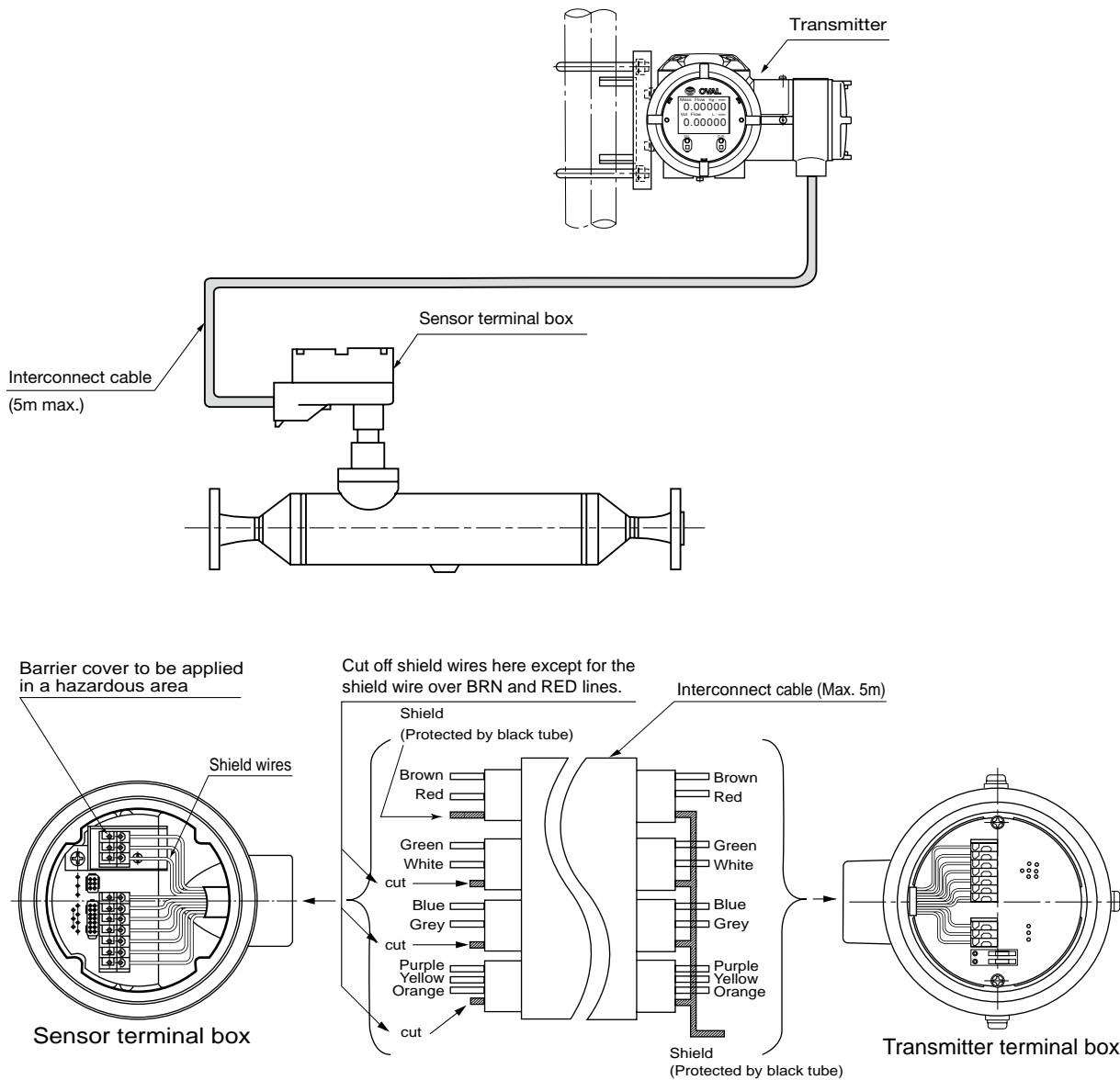
● Terminal identification and description

Item	Label	Description	Remarks
Signal	A1 (+)	Analog output 1 (4 to 20mA)	1. Max. load resistance is 600Ω for analog output 1 and 2. 2. Pulse output (voltage pulse) transmission length is Max. 10m (at 10kHz) Max. 100m (at 1kHz) Max. 1km (at 100Hz) finished O.D. : 0.75sq 3. In case of TIIIS explosionproof type used under the ambient temperature of 45°C or higher, use a cable resistant to the temperature of 75°C or higher.
	A1 (-)		
	A2 (+)	Analog output 2 (4 to 20mA)	
	A2 (-)		
	P1 (+)	Pulse output 1 (voltage/open collector output)	
	P1 (-)		
	P2 (+)	Pulse output 2 (voltage/open collector output)	
	P2 (-)		
	S.I. (+)	Status input (contact input)	
	S.I. (-)		
S.O. (+)	Status output (open collector output)		
S.O. (-)			
Power	I/O (+)	Expanded in/out (Modbus communication, etc.)	Max. 1km at 0.65sq
	I/O (-)		
	L (+)	Power (with DC power: +)	
	FG	Earth ground	
	N (-)	Power (with DC power: -)	

NOTE: The common terminals for pulse outputs 1 and 2 and the status outputs of this instrument are not isolated. Therefore, if you want to connect an external device to each output terminal with a load (resistance) added to the minus side, no correct output might be obtained. Please be sure to use the external device with the load connected to the plus side.

■ WIRING

● Wiring between Sensor Unit and Separately Mounted Transmitter



NOTE 1. Do not fail to use dedicated interconnect cable.

2. Shield wire preparation

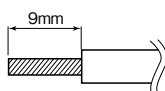
(1) Transmitter end:

As shown in the above figure, bundle shield wires colored in brown/red, green/white, blue/grey and purple/yellow/orange and cover the wires with a black tube. Then connect only one wire to the terminal box (black) taking care to avoid potential contact with the housing or conductive parts.

(2) Sensor end:

As shown in the figure, cover the brown/red shield wire with a black tube and connect it to the terminal box taking care to avoid potential contact with the housing or conductive parts. Clip all shield wires except brown/ red as shown in the above figure.

(3) Recommended cable end treatment:



※: Use of a stick type crimp terminal is not necessary.

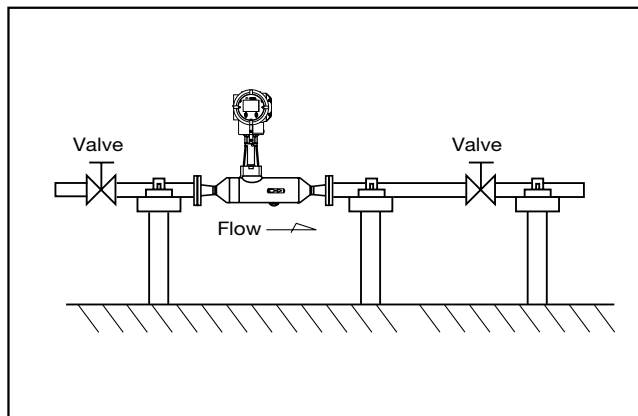
■ STANDARD INSTALLATION

1. Typical Installation (See figure at right.)

- 1) Avoid pipeline stresses on the meter.
- 2) The meter should be supported near and between connections to the process pipelines.
- 3) Avoid supporting the meter body directly.
- 4) Pipeline should be arranged such that the meter 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 meter 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 meter.
In an arrangement where cavitation may possibly take place, locate it at least 5 meters away.



3. Prevention of Cavitation

Cavitation can cause a loss of meter accuracy in measurement. Maintain line pressure that will not cause cavitation upstream and downstream of the meter for this reason. Avoid making such an arrangement as to open the line to the atmosphere immediately downstream of the meter. Care must be taken particularly with high steam pressure liquids. In practice, we recommend to keep the back pressure in the meter (downstream pressure) above the value calculated by the formula below:

$$P_d = 3\Delta P + 1.3P_v \text{ (MPa[absolute])}$$

P_d : Downstream pressure (MPa[absolute])

ΔP : Pressure loss across the meter (MPa)

P_v : Steam pressure of the process fluid at measurement (MPa[absolute])

4. Physical Orientation

The sensor can be installed either in a horizontal run or vertical run. Thanks to its unique straight-through design, installation in a vertical run in particular allows this flowmeter to perform to its fullest - in fast replacement of the process fluid and self drainage, for example.

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

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

RODUCT CODE EXPLANATION

Item	Code No.																		Description
	①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩	⑪	⑫	⑬	⑭	⑮	⑯	⑰	⑱	
Model	C	S																	ALTI $_{mass}$ Type S
Nominal size	0	1	0																Connection 15mm (1/2")
	0	1	5																Connection 15mm (1/2")
	0	2	5																Connection 25mm (1")
	0	4	0																Connection 40mm (1 1/2")
	0	5	0																Connection 50mm (2")
	0	8	0																Connection 80mm (3")
Applicable fluid	H																		High density liquid (1.0 to 1.5g/mL)
	M																		Normal density liquid (0.7 to 1.3g/mL)
	L																		Low density liquid (0.5 to 1.0g/mL)
Temperature rating (*1)			1																Standard (max. 130°C)
Pressure rating				1															Standard
Material					S														SUS316L
Connection standard						B													Ferrule connection
						C													JIS 10 K
						D													JIS 20 K
						H													ASME 150
						L													JPI 150
						Z													Others
Transmitter configuration (*2)							1												Integrally mounted
							2												Remotely mounted
Power supply							1												20 to 30VDC
							2												85 to 264VAC 50/60Hz
Analog output								A											Output 1 : Mass flow, Output 2 : Mass flow
								C											Output 1 : Mass flow, Output 2 : Temperature
								E											Output 1 : Mass flow, Output 2 : Volume flow (fixed density)
								K											Output 1 : Volume flow (fixed density), Output 2 : Temperature
Pulse output								A											Output 1 : Mass flow
								C											Output 1 : Volume flow (fixed density)
								D											Output 1 : Mass flow, Output 2 : Mass flow
								F											Output 1 : Mass flow, Output 2 : Volume flow (fixed density)
								H											Output 1 : Volume flow (fixed density) Output 2 : Volume flow (fixed density)
								K											Output 1 : Volume flow (fixed density), Output 2 : Mass flow
Pulse output form							1												Open collector pulse (default)
							2												Voltage pulse
Communication interface							1												Hybrid communication (Bell 202 under HART protocol)
							4												MODBUS communication (RS-485 Modbus protocol)
Explosionproof specification							0												Non-explosionproof
							2												ATEX (*3)
							3												KOSHA (*3)
							7												NEPSI
Explosionproof temp. class							0												Non-explosionproof
							3												Sensor unit temp. class T3; remote type transmitter only
							4												Sensor unit temp. class T4

*1 : With explosionproof specification, some temperature class related restrictions exist.

*2 : In applications where process fluid temperature exceeds 90°C, only "Remotely mounted" transmitter configuration applies.

*3 : Modbus is not supported.

* : Please consult OVAL if density measurement is required.

PLEASE SUPPLY THE FOLLOWING INFORMATION WHEN YOU INQUIRE.

(Fill in the form below to the extent possible. Further details will be finalized in later consultation.)

• Fill in the blanks. Tick the boxes that apply.

1. Sensor unit	CS <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	
2. Process fluid (*1)	Name : _____ SP. gr : _____ Viscosity : _____ Concentration : _____%	
3. Flow range	Max. _____ Normal _____ Full scale _____ <input type="checkbox"/> kg/h <input type="checkbox"/> Others _____	
4. Fluid temperature	Max. _____ °C Normal _____ °C Min. _____ °C	
5. Operating pressure	Max. _____ MPa Normal _____ MPa Min. _____ MPa Sudden change of Temperature : <input type="checkbox"/> Yes <input type="checkbox"/> No	
6. Ambient temperature	Max. _____ °C Min. _____ °C	
7. Fluid flow direction	<input type="checkbox"/> Left→Right <input type="checkbox"/> Right→Left <input type="checkbox"/> Bottom→Top (<input type="checkbox"/> Top →Bottom) Orientation : See sketch on page 9.	
8. Nominal size	_____ mm or _____ inch	
9. Required accuracy	± _____ % of reading ± _____ % of full scale	
10. Process connection	<input type="checkbox"/> Flanged connection (Flange rating) <input type="checkbox"/> Ferrule connection	
11. Explosionproof	<input type="checkbox"/> Not required <input type="checkbox"/> Required _____	
12. Power supply	<input type="checkbox"/> 20 to 30VAC <input type="checkbox"/> 85 to 264VAC (50/60Hz)	
13. Output specifications	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
	Analog output	Two outputs from instant flowrate (mass or volume).
		4 to 20mA DC Max. load: 600Ω 2 outputs from instant. flowrate (mass, fixed volume), temp.
	Additional damping	0 to 200s. (variable)
Alarm output	Slug flow(*2) High _____ g/mL Low _____ g/mL	
14. Companion receiver	<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"/> Density computer <input type="checkbox"/> Computer <input type="checkbox"/> Others	
15. Transmission length	Sensor unit (→) m Transmitter (→) m Receiving instrument	
16. Exclusive cable length	In case of separately- mounted type _____ m (Max. 5m)	
17. In case of separate type transmitter	<input type="checkbox"/> Stanchion type w/bracket and 2" U bolts	
18. No. of units required		
19. Application		
20. Other considerations		
21. Pressure-resistant packing	<input type="checkbox"/> Standard <input type="checkbox"/> ATEX directive compliant	
	<input type="checkbox"/> ATEX directive compliant for earthed cable	

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

*2 : Option.