OVAL

Straight-Tube Coriolis Flowmeter

ALTI*mass* Type S

GENERAL SPECIFICATION

GS.No.GBN122E-20

■ 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 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 output), analog output (dual output), and status output (single output)
6. Enhanced maintenance functions:
   Error logging, storing factory shipping data, and downloading programs
7. Compatible with various communication protocols
   (HART communication, FOUNDATION fieldbus communication, PROFIBUS communication, Modbus communication)
8. Rack-mount transmitter available
   (refer to GS No.GEJ516E for details)

Remote-mount transmitter

Rack-mount transmitter

■ GENERAL PERFORMANCE

Item		Description					
Model		CS010	CS015	CS025	CS040	CS050	CS080
Flow rate	Minimum setting rate (kg/h)	72	240	720	1800	3600	7200
	Maximum service rate (kg/h)	720	2400	7200	18000	36000	72000
	Maximum allowable rate (kg/h)	1080	3600	10800	27000	54000	108000
	Accuracy	±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 output accuracy		±0.1% of FS added to each accuracy					

※: The general performance is based on factory calibration accuracy.

$$\text{Zero stability error} = \frac{\text{Zero stability}}{\text{Flow rate at the moment}} \times 100\%$$

※: Zero stability and flowrate during the test should read in the same measurement unit.

■ 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					
Measurable temperature range		–40 to +130°C (※1)					
Heatproof temperature		Maximum 150°C (※2)					
Density range		0.5 to 1.0g/mL, 0.7 to 1.3g/mL, 1.0 to 1.5g/mL (※3)					
Maximum Operating pressure		Up to 2.45MPa (Depends on process connection)					
Sensor housing withstands		2.8MPa					
Flow direction		Bidirectional					
Explosionproof configuration		TIIS, ATEX, IECEx, KOSHA/KTL, CSA, GOST, NEPSI, ITRI Refer to page 10, 11 for details.					
Dusttight, waterproof configuration		IP66 / 67					

※1: Integral-mount type is applicable to temperature grade T4.
Refer to page 10, 11.
In case of non-explosionproof type, the maximum measurement temperature of integral type is 130°C. However, the product must be used within the maximum ambient temperature of 45°C.
※2: CIP/SIP procedures must be performed within the heatproof temperature range.
※3: The density range varies depending on the fluid to be used.

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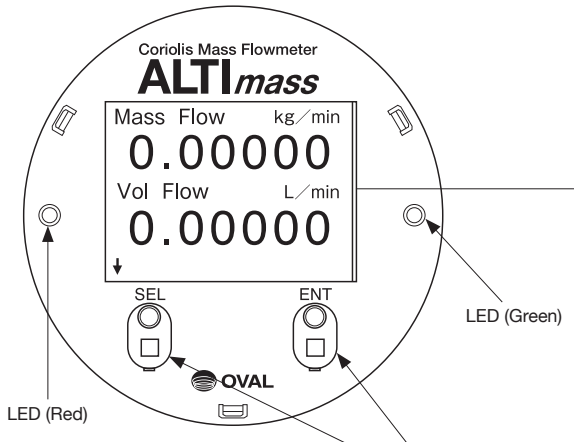
● Transmitter (For the rack-mount transmitter, refer to GS No.GEJ516E.)

Item		Description
Model		PA0K
Power supply		85 to 264VAC 50/60Hz or 20 to 30VDC (Safety rated 100 to 240VAC 50/60Hz)
Power consumption		Maximum 15W
Ambient temperature		–40 to +55°C (–20 to +55°C for CS080) (※1)
Transmission length (separate type)		Maximum 50m (dedicated 9-core cable used) (※2)
Applicable EU directive		EMC Directive: 2014/30/EU ATEX Directive: 2014/34/EU LVD Directive: 2014/35/EU
Applicable EN standards		EMC : EN61326-1: 2013 ClassA ATEX: EN60079-0: 2012+A11: 2013 EN60079-1: 2014 EN60079-11: 2012 IECEx: IEC60079-0: 2011 IEC60079-1: 2014-06 IEC60079-11: 2011 LVD: EN61010-1: 2010
Explosionproof configuration		TIIS, ATEX, IECEx, KOSHA/KTL, CSA, GOST, NEPSI, ITRI Refer to page 9, 10 for details.
Maritime certification		DNV GL Refer to page 10, 11 for details.
Dusttight, waterproof configuration		IP66 / 67
Transmitter configuration		Integral or Remote-mount
Painting		Sensor: Munsell 10B8/4, Covers (front and rear): 2.5PB4/10
Display		LCD display (128×64 dots), backlight (white, orange) Infrared sensors: 2, LED: 2 (green, red)
Weight		Integral-mount type 3.6kg approx., Remote-mount type 5.0kg approx.
Communication interface ※Optional except for HART	HART (Standard)	HART protocol version 7, Bell202 (※3)
	Modbus	RS-485 Modbus protocol, Baudrate : 9600bps, 19200bps, 38400bps (Standard) RTU or ASCII, Response time : 25 to 50 ms
	FOUNDATION fieldbus	AI block×4, IT block×2, with Link Master function
	PROFIBUS PA	AI block×4, TOT block×2
Damping (default)		Flow rate 0.8sec, temperature 2.5sec.
Low flow cutoff (default)		Under 1.5% of maximum service flow rate
Pulse output (※5)		Open drain (equivalent to open collector) [Minimum 10V to Maximum 30V, 50mADC, ON resiatance 0.6Ω or less] or Voltage pulse (Low level: 1.5V maximum, High level: 13V minimum Output impedance: 2.2kΩ) Setting range: 0.1 to 10000Hz (Maximum output 11000Hz)
Analog output (※5)		4 to 20mADC (maximum load 600Ω) Select two outputs from instant flowrate (mass or volume) and temperature. (※6)
Status output (※5)		Open drain (equivalent to open collector) [Maximum 30V, 50mADC, ON resiatance 0.6Ω or less] Select one from error (※4), flow direction, or high/low alarm (default is error)
Status input (※5)		Contact-closure input (Form "a" contact) Short: 200Ω maximum, Open: 100kΩ minimum Select one from remote zero, total reset, 0% signal lock, or function off (default is function off).

※1: Below –20°C, the display loses its visibility due to weakened contrast. Both the display and infrared sensor may exhibit slow responses below –20°C.
※2: If signal transmission length exceeds the maximum length, Please consult OVAL sales office or nearest representative.
The operating temperature range of the dedicated cable (PVC: model code CBP2) is –15 to +80°C.
To use in an environment that exceeds the above temperature range, use dedicated cable (PTFE: model code CBT2) instead.
※3: Of the two analog output systems,only analog output 1 is available for HART communication.
※4: Of error outputs, "zero is in progress" status output can also be set up.
※5: When FOUNDATION fieldbus, PROFIBUS PA is selected as the communication interface, all input and output signals will be turned off.
※6: For all volume outputs, the density is fixed.
※: Denoising parts are embedded in the lines between power source, output, communication, and the chassis.
Lower the applied voltage to the following levels in order to conduct insulation test or withstand voltage test on these lines.
AC: 200V, DC: 250V

■ DISPLAY



Display modes

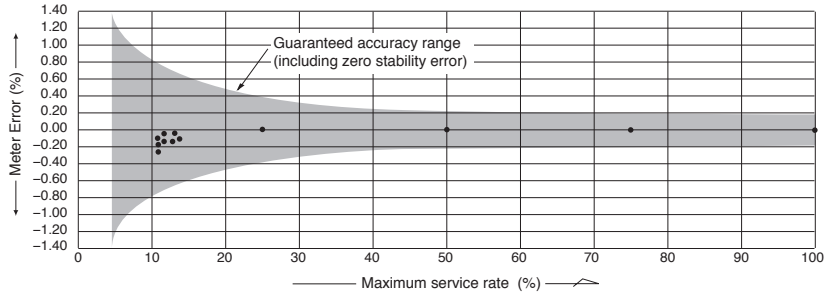
- ①Mass instant flowrate
- ②Volume instant flowrate
- ③Density
- ④Temperature
- ⑤Pulse count 1 (mass or volume)
- ⑥Pulse count 2 (mass or volume)
- ⑦Total 1 (mass or volume)
- ⑧Total 2 (mass or volume)
- ⑨Analog 1 (% instant)
- ⑩Analog 2 (% instant)
- ⑪Status information
- ⑫Mode select (parameter setup)

Communication interfaces FOUNDATION fieldbus, PROFIBUS PA display different contents.
For further information, refer to the instruction manuals of respective communication interfaces.

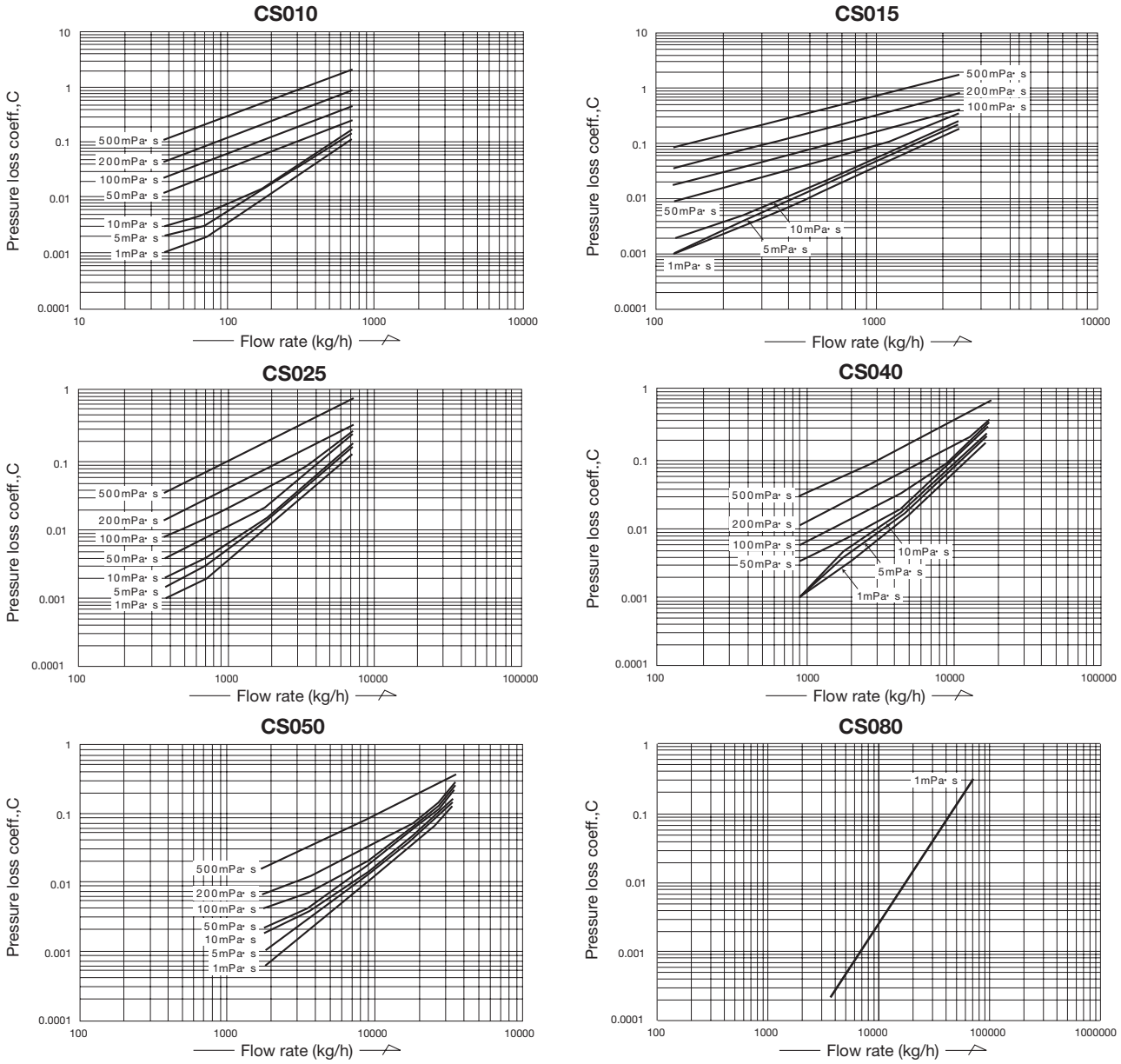
※ LCD backlight comes in two colors: white and orange. Color changes according to the status of flowmeter. Backlight usually comes off automatically if the optical sensor does not respond for a certain period of time.
※ Backlight duration is selectable.

A touch of a finger on the touch panel through the front glass (infrared optical sensor) selects the mode.

■ METER ERROR



■ PRESSURE LOSS



How to determine pressure loss (※1)

1. Seeing the graph of the type of flowmeter to be used, find the pressure loss coefficient C from the flowrate (g/min or kg/h) and viscosity (mPa·s). Dividing this value C by specific gravity d (1 for water) gives the pressure loss, or

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

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

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

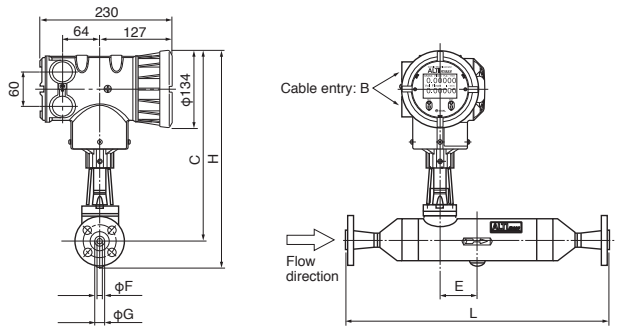
where ΔP_2 : Pressure loss of high viscosity liquid (MPa)
μ_1 : Maximum viscosity shown in the graph (mPa·s)
μ_2 : Viscosity of high viscosity liquid (mPa·s)
d : Specific gravity of high viscosity liquid (1 for water)
C : Pressure loss coefficient found from the maximum viscosity curve at a given flowrate

※1: Pressure loss is calculated with Newtonian fluid. For Non-Newtonian fluid, Please consult OVAL sales office or nearest representative.

■ DIMENSIONS [Unit: mm]

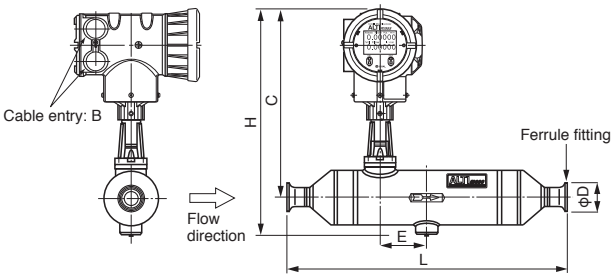
●Transmitter, Integral-mount Type

Flange connection



Model	Nominal Size	JIS 10K	JIS 20K	ASME /JPI 150	H	C	φF	φG	E	Approx. Weight kg (JIS 10K)
		L								
CS010	15 (1/2")	426	452	458	390	340	5	16.8	69	10
CS015	15 (1/2")	464	490	496	390	340	7.4	16.8	80	11
CS025	25 (1")	529	555	570	423	353	12.4	26.6	88	18
CS040	40 (1•1/2")	716	733	749	439	359	17.8	40.4	112	28
CS050	50 (2")	882	906	919	474	372	26.4	52.6	153	38
CS080	80 (3")	1032	1046	1073	510	392	38	77.8	176	69

Ferrule connection

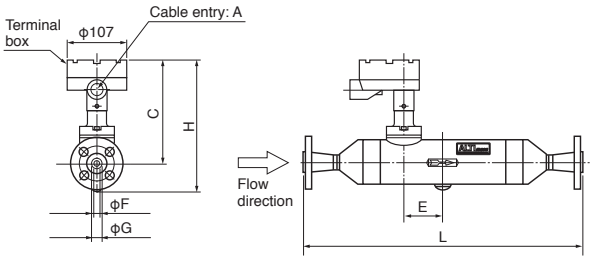


Model	Nominal Size	L	H	C	E	φD	Approx. Weight (kg)
CS010	15A	426	390	340	69	34	9
CS015	15A	464	390	340	80	34	10
CS025	1•1/2S	529	423	353	88	50.5	16
CS040	2S	716	439	359	112	64	24
CS050	2•1/2S	882	474	372	153	77.5	34
CS080	Compatible models available						

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

●Transmitter, Remote-mount Type

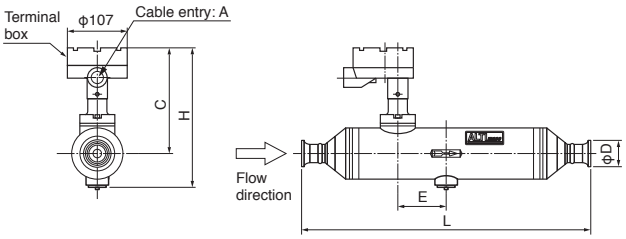
Flange connection



Model	Nominal Size	JIS 10K	JIS 20K	ASME /JPI 150	H	C	φF	φG	E	Approx. Weight kg (JIS 10K)
		L								
CS010	15 (1/2")	426	452	458	246	197	5	16.8	69	7
CS015	15 (1/2")	464	490	496	246	197	7.4	16.8	80	8
CS025	25 (1")	529	555	570	280	210	12.4	26.6	88	15
CS040	40 (1•1/2")	716	733	749	296	216	17.8	40.4	112	25
CS050	50 (2")	882	906	919	332	229	26.4	52.6	153	35
CS080	80 (3")	1032	1046	1073	367	249	38	77.8	176	66

※: Terminal box materials: SCS13A adds approximately +1kg.

Ferrule connection

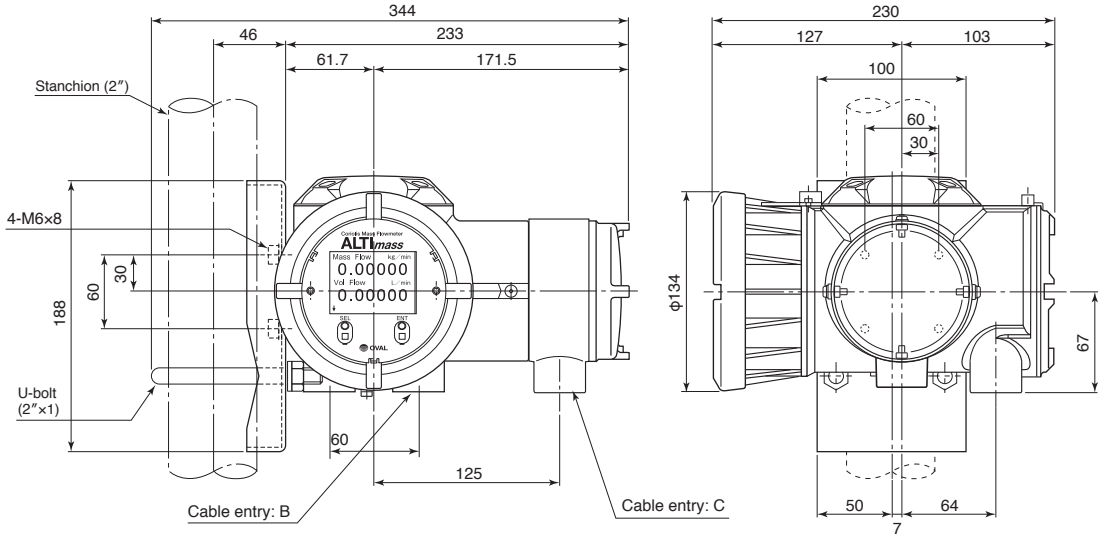


Model	Nominal Size	L	H	C	E	φD	Approx. Weight (kg)
CS010	15A	426	246	197	69	34	6
CS015	15A	464	246	197	80	34	7
CS025	1•1/2S	529	280	210	88	50.5	13
CS040	2S	716	296	210	112	64	21
CS050	2•1/2S	882	332	229	153	77.5	31
CS080	Compatible models available						

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

■ DIMENSIONS [Unit: mm]

● **Remote-mount transmitter (For the rack-mount transmitter, refer to GS No.GEJ516E.)**



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

■ LIST OF TRANSMITTER AND DETECTOR CONDUIT CONNECTIONS

〈Cable entry: A〉

Remote-mount detector

Explosionproof specifications	Connection thread specifications	Note
Non-explosionproof	Domestic: G3/4, Overseas: G3/4	
TIIS	G3/4	Adapter is connected (※1)
ATEX, IECEx	G3/4	Adapter is connected (※2)
KCs	G3/4	
CSA	G3/4	Adapter is connected (※3)
EAC	G3/4	Adapter is connected (※2)
NEPSI	G3/4	Adapter is connected (※2)
ITRI	G3/4	Adapter is connected (※2)

※1: An adapter to convert G3/4 to “G1/2” is connected.
※2: An adapter to convert G3/4 to “M20×1.5” is connected.
※3: You can choose an adapter to convert G3/4 to “1/2″NPT,” or to “M20×1.5.”

〈Cable entry: B〉

Integral-mount transmitter, Remote-mount transmitter

Explosionproof specifications	Connection thread specifications	Note
Non-explosionproof	Domestic: G3/4, Overseas: G3/4	
TIIS	G3/4	Cable gland is supplied.
ATEX, IECEx	M25×1.5	(※1)
KCs	M25×1.5	
CSA	M25×1.5	Adapter is connected (※2)
EAC	M25×1.5	(※1)
NEPSI	M25×1.5	
ITRI	M25×1.5	

※1: A cable gland can be supplied. Please consult OVAL sales office or nearest representative.
※2: You can choose an adapter to convert M25×1.5 to one of “3/4″NPT”, “1/2″NPT”, or “M20×1.5”.

〈Cable entry: C〉

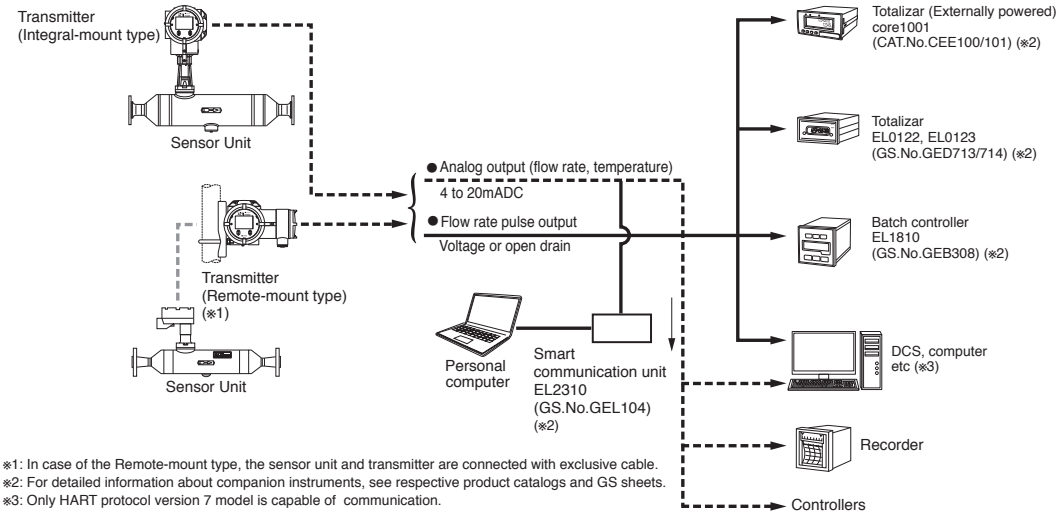
Remote-mount transmitter

Explosionproof specifications	Connection thread specifications	Note
Non-explosionproof	G3/4	
TIIS	G3/4	Cable gland is supplied.
ATEX, IECEx	G3/4	Adapter is connected (※1)
KCs	G3/4	
CSA	G3/4	Adapter is connected (※2)
EAC	G3/4	Adapter is connected (※1)
NEPSI	G3/4	Adapter is connected (※1)
ITRI	G3/4	Adapter is connected (※1)

※1: An adapter to convert G3/4 to “M20×1.5” is connected.
※2: You can choose an adapter to convert G3/4 to “1/2″NPT,” or to “M20×1.5.”

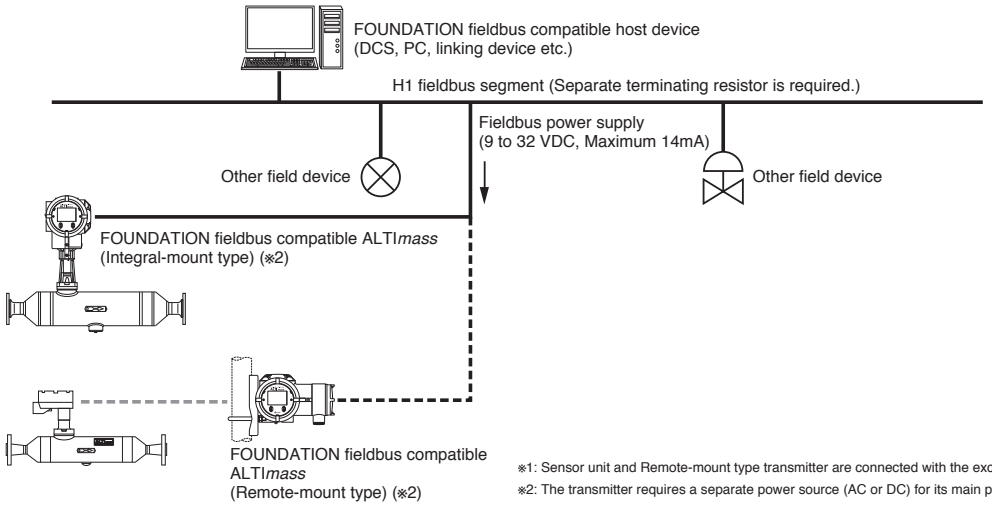
■ REMOTE MEASURING SYSTEM

● HART protocol



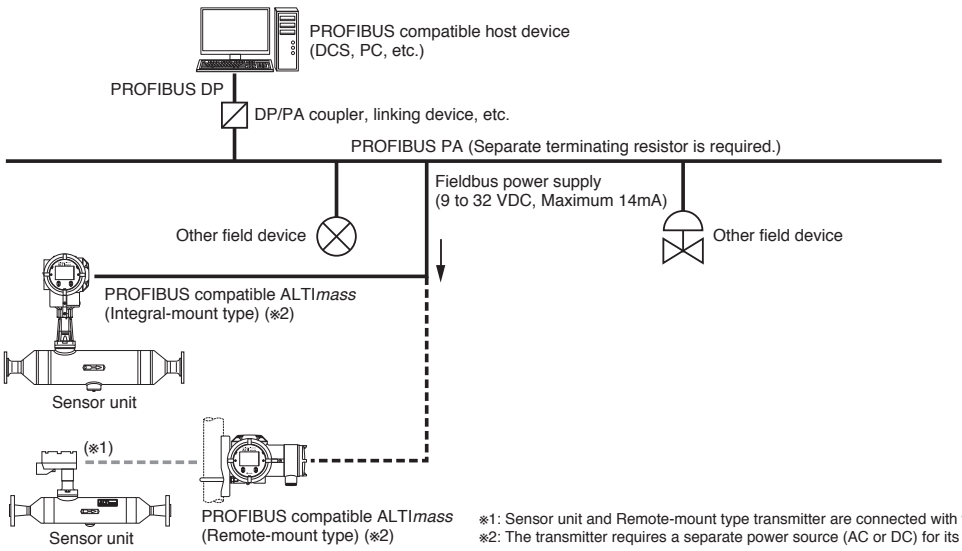
※1: In case of the Remote-mount type, the sensor unit and transmitter are connected with exclusive cable.
※2: For detailed information about companion instruments, see respective product catalogs and GS sheets.
※3: Only HART protocol version 7 model is capable of communication.

● FOUNDATION fieldbus



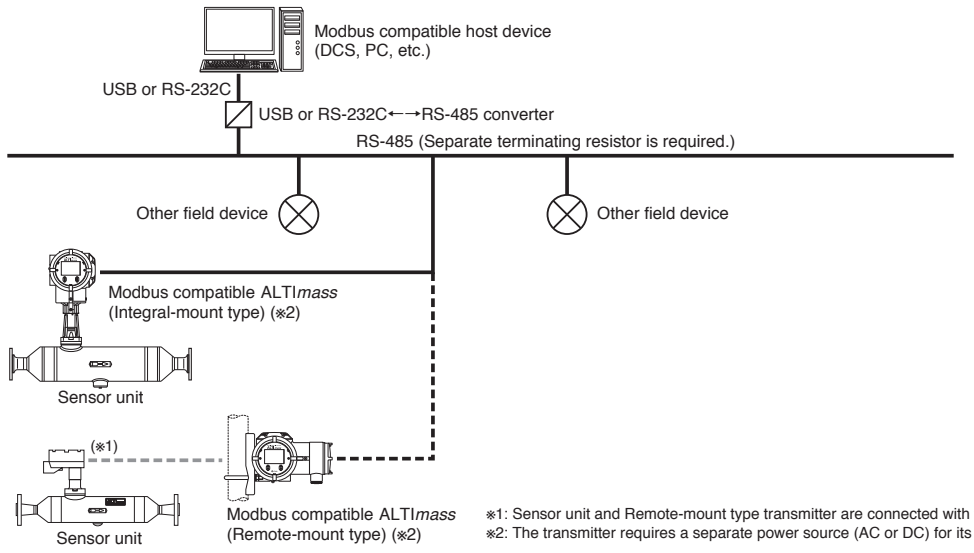
※1: Sensor unit and Remote-mount type transmitter are connected with the exclusive interconnect cable.
※2: The transmitter requires a separate power source (AC or DC) for its main power supply.

● PROFIBUS



※1: Sensor unit and Remote-mount type transmitter are connected with the exclusive interconnect cable.
※2: The transmitter requires a separate power source (AC or DC) for its main power supply.

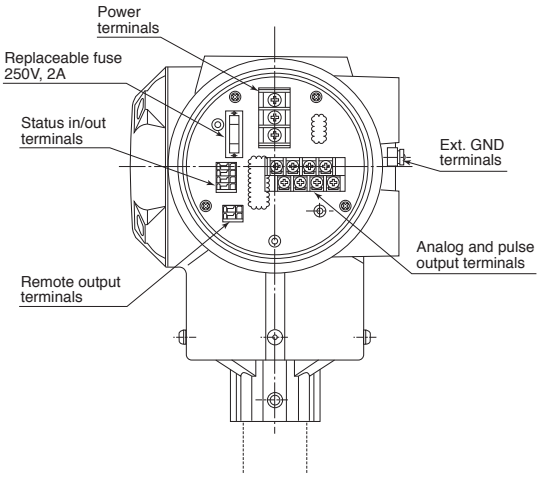
● Modbus



※1: Sensor unit and Remote-mount type transmitter are connected with the exclusive interconnect cable.
※2: The transmitter requires a separate power source (AC or DC) for its main power supply.

■ WIRING DIAGRAM

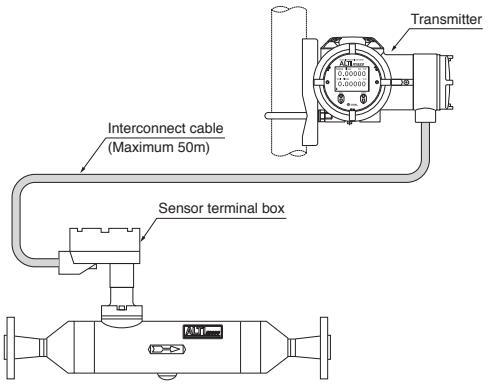
● Transmitter power and input/output signal wiring



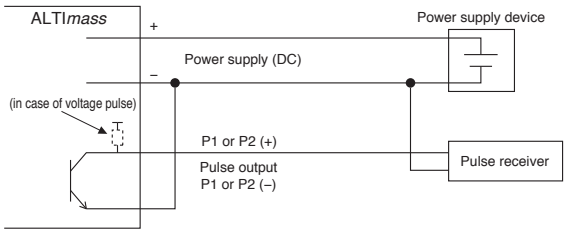
● Terminal identification and description

Item	Label	Description	Remarks
Signal	A1 (+)	Analog output 1 (4 to 20mA)	1. Maximum load resistance is 600Ω for analog output 1 and 2.
	A1 (–)		
	A2 (+)	Analog output 2 (4 to 20mA)	2. Pulse output (voltage pulse) transmission length is Maximum 10m (at 10kHz) Maximum 100m (at 1kHz) Maximum 1km (at 100Hz) finished O.D: 0.75sq
	A2 (–)		
	P1 (+)	Pulse output 1 (voltage/open drain output)	
	P1 (–)		
	P2 (+)	Pulse output 2 (voltage/open drain output)	3. In case of TIIS explosionproof type used under the ambient temperature of 45°C or higher, use a cable resistant to the temperature of 75°C or higher.
	P2 (–)		
	S.I. (+)	Status input (contact input)	
	S.I. (–)		
	S.O (+)	Status output (open drain output)	4. These input and output signals are invalid for FOUNDATION fieldbus, PROFIBUS PA.
	S.O (–)		
	I/O (+)	Expanded in/out (Modbus communication, etc.)	Modbus communication: Maximum transmission length1200m at 0.75sq FOUNDATION fieldbus or PROFIBUS PA communication: Maximum transmission length 1900m at 0.8sq
	I/O (–)		
Power	L (+)	Power (with DC power: +)	
	GND	Earth ground	
	N (–)	Power (with DC power: –)	

● Wiring between Sensor Unit and Remote-mount Transmitter

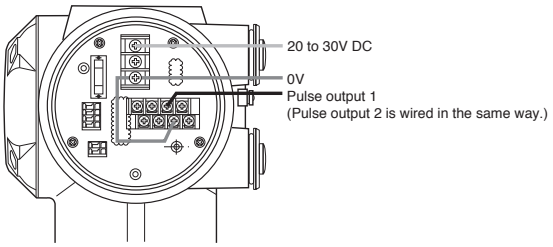


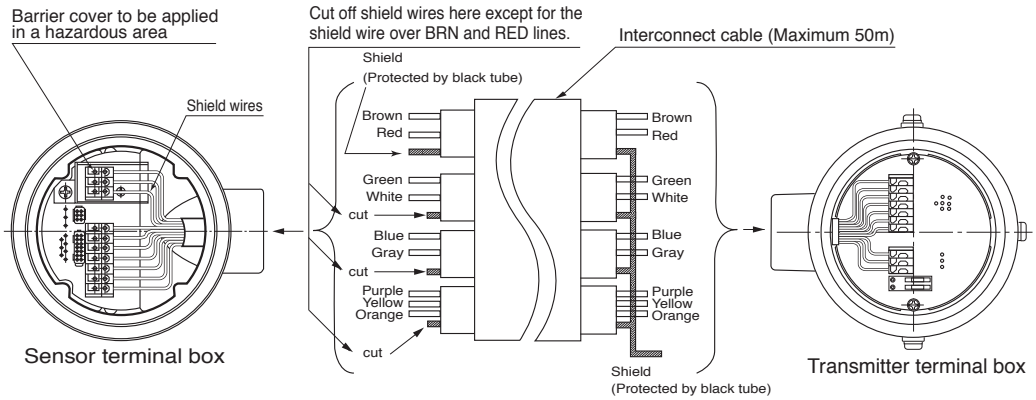
■ SPECIFICATIONS OF DC POWER SUPPLY
In case of 3-line type pulse output wire connection



※ If the cable length becomes long, Lo level power supply of pulse signal increases due to steady current of converter and line resistance of cable. Adjust the trigger value of receiver properly. (Example) When the cable length is 500m, Lo level increases about 2.5V (1.25sq: 16Ω/km)

● Wiring diagram





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

2. Shield wire preparation

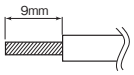
(1) Transmitter end:

As shown in the above figure, bundle shield wires colored in brown/red, green/white, blue/gray 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:

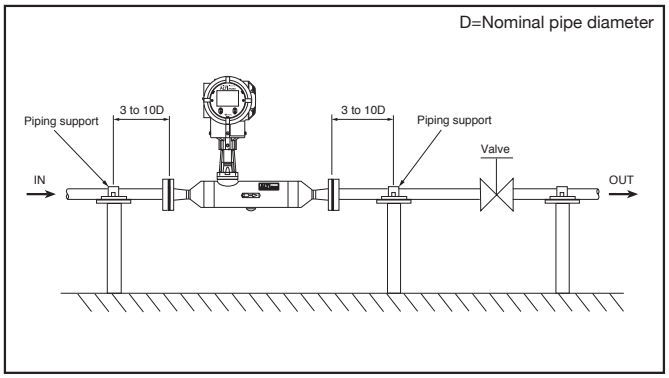


※: Use of a crimp pin terminal is not necessary.

■ 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℃. Explosionproof models require the temperature to be held below their maximum allowable levels.
3) The sensor unit has an airtight construction. To prevent inner dew condensation at low temperature operation, the casing is filled with argon gas. For this reason, please take extra caution not to drop or apply impact on the sensor.
4) In a horizontal run, install the sensor having the transmitter placed on top 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.

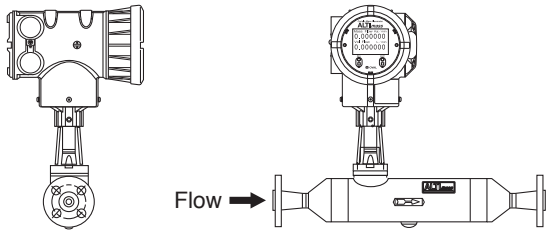
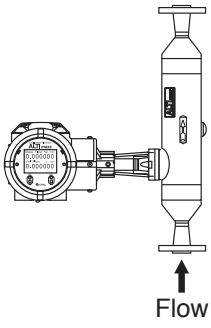
3. Prevention of Cavitation

Cavitation can cause a loss of meter accuracy in measurement. For this reason, maintain line pressure that will not cause cavitation upstream and downstream of the meter. Avoid pipe arrangements that will open to 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:

$Pd=3\Delta P+1.3Pv$ (MPa[absolute])
Pd: Downstream pressure (MPa[absolute])
ΔP: Pressure loss across the meter (MPa)
Pv: 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.

■ EXPLOSIONPROOF SPECIFICATION
(For the rack-mount transmitter, refer to GS No.GEJ516E.)

1. TIIS Explosionproof

● **Integral-mount type**
- Transmitter symbol: Ex d [ib] IIC T4 X
- Transmitter and sensor ambient temperature: –40°C to +55°C
- Explosionproof applied temperature: +59°C
- Sensor symbol: Ex ib IIB T4
- Communication: HART, Modbus, PROFIBUS and FOUNDATION fieldbus (FISCO)

● **Remote-mount type**
- Transmitter symbol: Ex d [ib] IIC T6 X
- Transmitter ambient temperature: –40°C to +55°C
- Sensor symbol: Ex ib IIB T3, T4
- Communication: HART, Modbus, PROFIBUS and FOUNDATION fieldbus (FISCO)

※ Explosion specifications such as, temperature class, ambient temperature, and fluid temperature vary depending on the combination of transmitter and sensor. Refer to the table below for the explosionproof specification of each combination.

	Temperature class (Xmtr-sensor: spec.)	T3 (Xmtr-sensor: separate type)	T4 (Xmtr-sensor: integral type)	T4 (Xmtr-sensor: separate type)
	Group	IIB	IIB	IIB
Model / Ambient temp./ Fluid temp.	CS010	–40°C to +60°C/ –40°C to +130°C	–40°C to +55°C/ –40°C to +80°C	–40°C to +60°C/ –40°C to +80°C
	CS015			
	CS025			
	CS040			
	CS050			
	CS080	–20°C to +60°C/ –20°C to +130°C	–20°C to +55°C/ –20°C to +80°C	–20°C to +60°C/ –20°C to +80°C

2. ATEX, IECEx Explosionproof

● **Integral-mount type**
- Transmitter symbol: II2G Ex d ib IIB T4 Gb
- Transmitter and sensor ambient temperature: –40°C to +55°C (Other than CS080)
  –20°C to +55°C (CS080)
- Fluid temperature: –40°C to +80°C (Other than CS080)
  –20°C to +80°C (CS080)
- Sensor symbol: II2G Ex ib IIB T4
- Sensor to be connected: CS010 to CS080
- Communication: HART, Modbus, PROFIBUS and FOUNDATION fieldbus (FISCO)

● **Remote-mount type**
- Transmitter symbol: II2G Ex d [ib] IIC T6 Gb
- Transmitter ambient temperature: –40°C to +55°C (Other than CS080)
  –20°C to +55°C (CS080)
- Sensor symbol: II2G Ex ib IIB T3, T4
- Sensor to be connected: CS010 to CS080
- Communication: HART, Modbus, PROFIBUS and FOUNDATION fieldbus (FISCO)

Sensor ambient temperature (Remote-mount type only)	–40°C to +60°C	Other than CS080
	–20°C to +60°C	CS080

Fluid temperature (Remote-mount type only)	Temperature class: T3	–40°C to +130°C (Other than CS080) –20°C to +130°C (CS080)
	Temperature class: T4	–40°C to +80°C (Other than CS080) –20°C to +80°C (CS080)

3. KOSHA/KTL Explosionproof

● **Integral-mount type**
- Transmitter symbol: Ex d IIC T4
- Transmitter and sensor ambient temperature: –40°C to +55°C (Other than CS080)
  –20°C to +55°C (CS080)
- Fluid temperature: –40°C to +80°C (Other than CS080)
  –20°C to +80°C (CS080)
- Sensor symbol: Ex ib IIB T4
- Sensor to be connected: CS010 to CS080
- Communication: HART, Modbus

● **Remote-mount type**
- Transmitter symbol: Ex d [ib] IIC T6
- Transmitter ambient temperature: –40°C to +55°C (Other than CS080)
  –20°C to +55°C (CS080)
- Sensor symbol: Ex ib IIB T3, T4
- Sensor to be connected: CS010 to CS080
- Communication: HART, Modbus

Sensor ambient temperature (Remote-mount type only)	–40°C to +60°C	Other than CS080
	–20°C to +60°C	CS080

Fluid temperature (Remote-mount type only)	Temperature class: T3	–40°C to +130°C (Other than CS080) –20°C to +130°C (CS080)
	Temperature class: T4	–40°C to +80°C (Other than CS080) –20°C to +80°C (CS080)

4. CSA Explosionproof

● **Integral-mount type**

- Transmitter symbol: Class I, Zone 1, Ex d ib IIB T4 Gb
  Class I, Zone 1, AEx d ib IIB T4 Gb
- Transmitter and sensor ambient temperature: –40°C to +55°C (Other than CS080)
  –20°C to +55°C (CS080)
- Fluid temperature: –40°C to +80°C (Other than CS080)
  –20°C to +80°C (CS080)
- Sensor symbol: Class I, Zone 1, Ex ib IIB T4 Gb
  Class I, Zone 1, AEx ib IIB T4 Gb
- Sensor to be connected: CS010 to CS080
- Communication: HART, Modbus

● **Remote-mount type**

- Transmitter symbol: Class I, Zone 1, Ex d [ib] IIB T6 Gb
  Class I, Zone 1, AEx d [ib] IIB T6 Gb
- Transmitter ambient temperature: –40°C to +55°C (Other than CS080)
  –20°C to +55°C (CS080)
- Sensor symbol: Class I, Zone 1, Ex ib IIB T3, T4 Gb
  Class I, Zone 1, AEx ib IIB T3, T4 Gb
- Sensor to be connected: CS010 to CS080
- Communication: HART, Modbus

Sensor ambient temperature (Remote-mount type only)	–40°C to +60°C	Other than CS080
	–20°C to +60°C	CS080

Fluid temperature (Remote-mount type only)	Temperature class: T3	–40°C to +130°C (Other than CS080) –20°C to +130°C (CS080)
	Temperature class: T4	–40°C to +80°C (Other than CS080) –20°C to +80°C (CS080)

5. GOST Explosionproof

● **Integral-mount type**

- Transmitter symbol: 1 Ex d ib IIB T4X
- Transmitter and sensor ambient temperature: –40°C to +55°C (Other than CS080)
  –20°C to +55°C (CS080)
- Fluid temperature: –40°C to +80°C (Other than CS080)
  –20°C to +80°C (CS080)
- Sensor symbol: 1 Ex ib IIB T4
- Sensor to be connected: CS010 to CS080
- Communication: HART, Modbus

● **Remote-mount type**

- Transmitter symbol: 1 Ex d [ib] IIC T6X
- Transmitter ambient temperature: –40°C to +55°C (Other than CS080)
  –20°C to +55°C (CS080)
- Sensor symbol: 1 Ex ib IIB T3, T4
- Sensor to be connected: CS010 to CS080
- Communication: HART, Modbus

Sensor ambient temperature (Remote-mount type only)	–40°C to +60°C	Other than CS080
	–20°C to +60°C	CS080

Fluid temperature (Remote-mount type only)	Temperature class: T3	–40°C to +130°C (Other than CS080) –20°C to +130°C (CS080)
	Temperature class: T4	–40°C to +80°C (Other than CS080) –20°C to +80°C (CS080)

6. NEPSI Explosionproof

● **Integral-mount type**

- Transmitter symbol: Ex d ib IIB T4 Gb
- Transmitter and sensor ambient temperature: –40°C to +55°C (Other than CS080)
  –20°C to +55°C (CS080)
- Fluid temperature: –40°C to +80°C (Other than CS080)
  –20°C to +80°C (CS080)
- Sensor symbol: Ex ib IIB T4 Gb
- Sensor to be connected: CS010 to CS080
- Communication: HART, Modbus

● **Remote-mount type**

- Transmitter symbol: Ex d [ib] IIC T6 Gb
- Transmitter ambient temperature: –40°C to +55°C (Other than CS080)
  –20°C to +55°C (CS080)
- Sensor symbol: Ex ib IIB T3, T4 Gb
- Sensor to be connected: CS010 to CS080
- Communication: HART, Modbus

Sensor ambient temperature (Remote-mount type only)	–40°C to +60°C	Other than CS080
	–20°C to +60°C	CS080

Fluid temperature (Remote-mount type only)	Temperature class: T3	–40°C to +130°C (Other than CS080) –20°C to +130°C (CS080)
	Temperature class: T4	–40°C to +80°C (Other than CS080) –20°C to +80°C (CS080)

7. ITRI Explosionproof

● **Integral-mount type**

- Transmitter symbol: Ex db ib IIB T4 Gb
- Transmitter and sensor ambient temperature: –40°C to +55°C (Other than CS080)
  –20°C to +55°C (CS080)
- Fluid temperature: –40°C to +80°C (Other than CS080)
  –20°C to +80°C (CS080)
- Sensor symbol: II2G Ex ib IIB T4
- Sensor to be connected: CS010 to CS080
- Communication: HART, Modbus

● **Remote-mount type**

- Transmitter symbol: Ex db [ib] IIC T6 Gb
- Transmitter ambient temperature: –40°C to +55°C (Other than CS080)
  –20°C to +55°C (CS080)
- Sensor symbol: II2G Ex ib IIB T3, T4
- Sensor to be connected: CS010 to CS080
- Communication: HART, Modbus

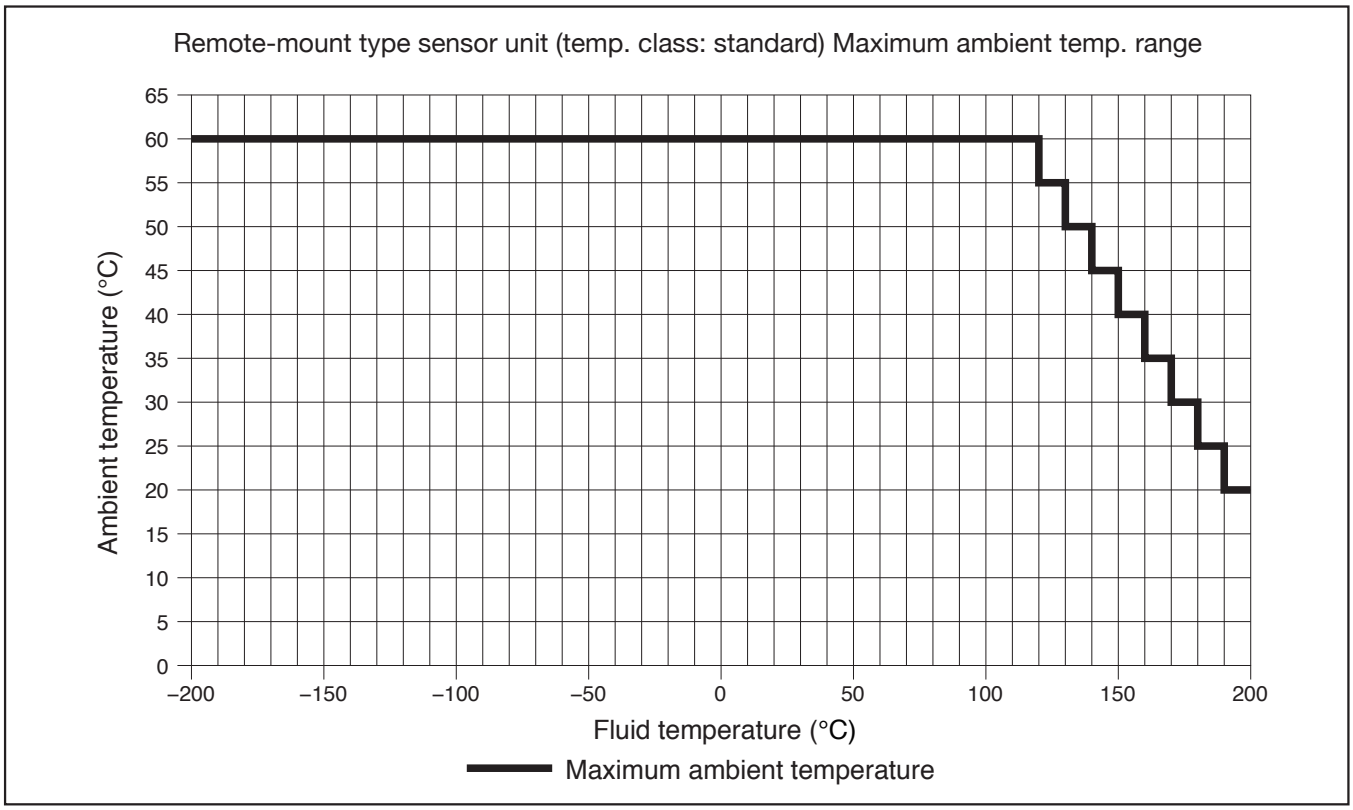
Sensor ambient temperature (Remote-mount type only)	–40°C to +60°C	Other than CS080
	–20°C to +60°C	CS080

Fluid temperature (Remote-mount type only)	Temperature class: T3	–40°C to +130°C (Other than CS080) –20°C to +130°C (CS080)
	Temperature class: T4	–40°C to +80°C (Other than CS080) –20°C to +80°C (CS080)

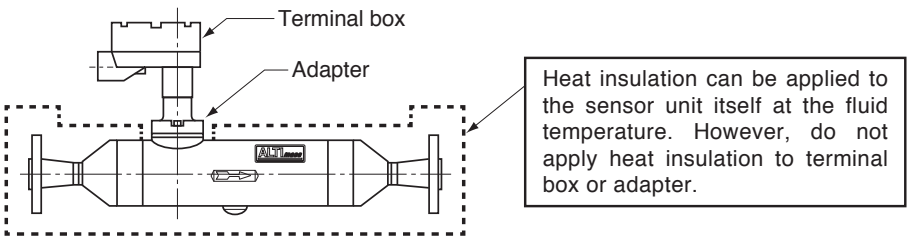
■ AMBIENT TEMPERATURE

Allowable ambient temperature permitted for the sensor unit is as described in the table below.
(The following table describes the condition for the non-explosionproof models. For the explosionproof models, make sure to satisfy the temperature conditions described in "Explosionproof Specification" as well as the condition described below.)

Transmitter construction	
Integral-mount type	Remote-mount type
[Fluid temperature] +130°C and below [Ambient temperature] −40 to +55°C	[Sensor unit ambient temp.] −40°C to maximum ambient temp. in the graph below



※Please contact us in the case the ambient temperature exceeds maximum ambient temperature in the graph.



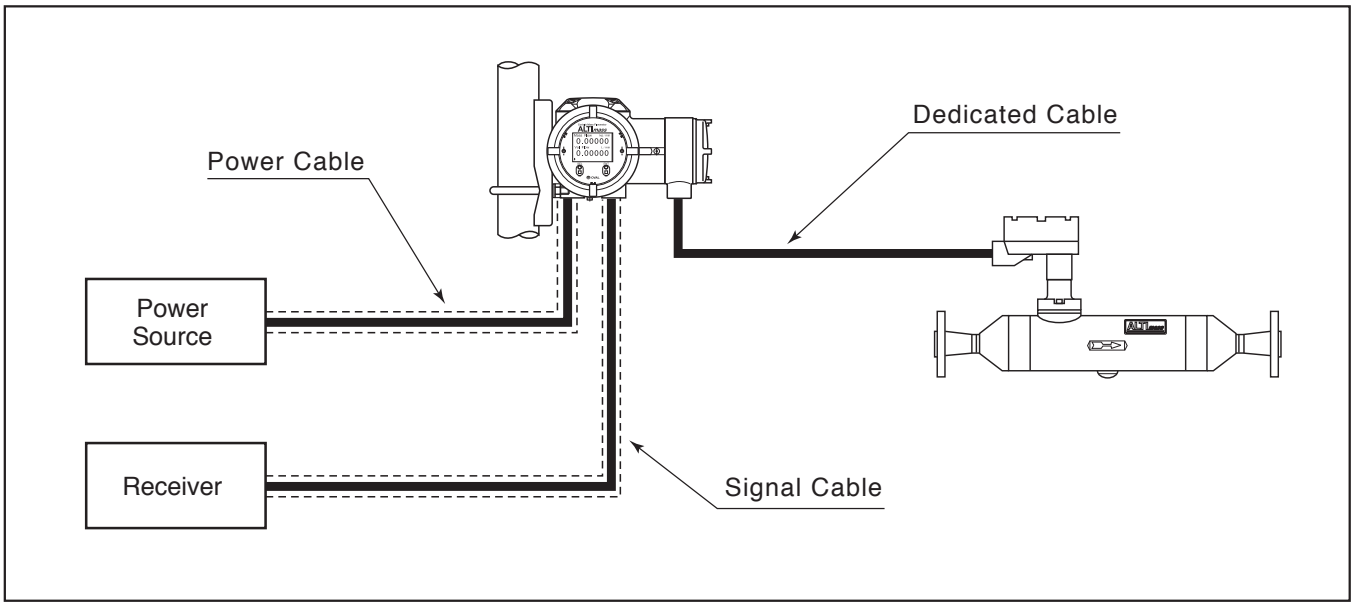
■ ABOUT MARITIME CERTIFICATION

The product is approved for the ship classification under the conditions below.

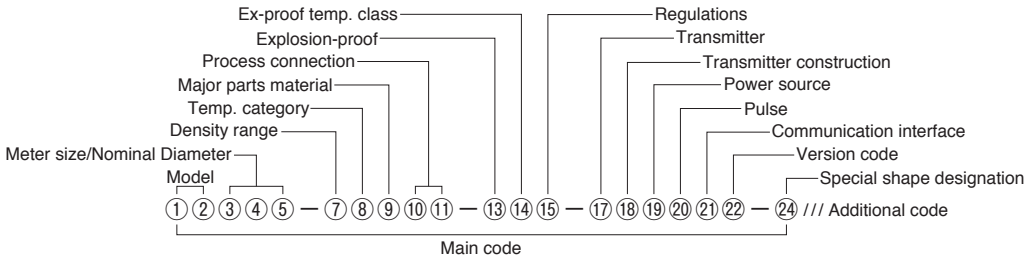
Item	Contents
Classification Society	DNV GL
Location Classes	Temperature D (–25°C to +55°C) Humidity B (Relative Humidity: less than 100%) Vibration A (2 to 13.2Hz with 1mm amplitude, 13.2 to 100Hz with 0.7g acceleration) ※ Install at the place where mechanical vibration from engine, compressor, pump and so on is not introduced into transmitter directly. EMC A (All locations except bridge and open deck) Enclosure C (IP56)

■ REGARDING CABLE WIRING

If using ALTImass as certified equipment for maritime applications, use metal conduit tube, marine cable (with shield), etc. for the power and signal cables and connect shielded sections to the transmitter housing.
Be sure to use the dedicated cable for the connection between the sensor and the transmitter, and implement waterproofing treatment which satisfies IP56.



■ PRODUCT CODE EXPLANATION



●Main code

①	②	**Model**		
C	S	ALTI*mass* Type S		
③	④	⑤	**Meter size/Nominal Diameter**	
			JIS flange	**ASME·JPI flange**	**Ferrule**
0	1	0	15mm	1/2″	15A
0	1	5	15mm	1/2″	15A
0	2	5	25mm	1″	38 (ISO), IDF 1.5S
0	4	0	40mm	1·1/2″	51 (ISO), IDF 2S
0	5	0	50mm	2″	63.5 (ISO), IDF 2.5S
0	8	0	80mm	3″	※Consult with OVAL

⑥	—
⑦	**Density range**
1	Low density liquids (0.5 to 1.0g/mL)
2	Ordinary density liquid (0.7 to 1.3g/mL)
3	High density liquid (1.0 to1.5g/mL)
⑧	**Temp. category ※1**
1	Standard (130°C and lower)
⑨	**Major parts material**
S	SUS316L

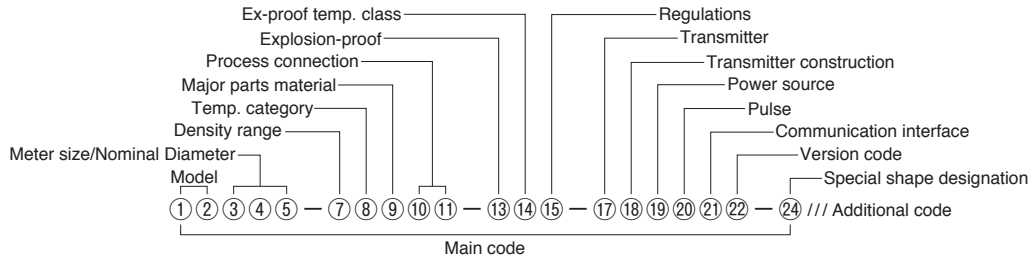
⑩	⑪	**Process connection**
J	1	JIS10K
J	2	JIS20K
A	1	ASME150
P	1	JPI150
H	S	ISO Ferrule
Z	9	Special

⑫	—
⑬	**Explosion-proof**
0	Non-explosionproof
1	TIIS ※2
2	ATEX/IECEx
3	KOSHA/KTL ※2
4	CSA (C-US) ※2
5	EAC ※2
7	NEPSI ※2
T	ITRI ※2
⑭	**Ex-proof temp. class**
0	Non-explosionproof
3	T3
4	T4

⑮	**Regulations**	
0	Standard	
G	High Pressure Gas Safety Act (Approved product) ※3	※w/Material test certificate
H	High Pressure Gas Safety Act (Individual test) ※3	※w/Material test certificate (Designed on PO issued)
J	High Pressure Gas Safety Act (Completion inspection) ※3	※w/Material test certificate
T	Fire Service Act	※w/Material test certificate
S	Ship Classification Society Pattern Approval	
P	Ship Classification Society Pattern Approval + w/Material test certificate	
F	w/Material test certificate	
⑯	—	
⑰	**Transmitter ※4**	
1	ALTI*mass*	
3	Rack-mount transmitter (Refer to GS No.GEJ516E.)	
⑱	**Transmitter construction ※5**	
1	Integral-mount	
2	Remote-mount (Terminal box materials: ADC12)	
3	Remote-mount (Terminal box materials: SCS13A)	
⑲	**Power source**	
1	20 to 30VDC	
2	85 to 264VAC (Safety rated 100 to 240VAC 50/60Hz)	
⑳	**Pulse output type**	
0	When "2, 3" are chosen for "Communication interface ㉑ "	
B	Voltage pulse	
G	Open drain pulse (equivalent to open collector pulse) (standard)	
㉑	**Communication interface**	
1	HART communication (HART protocol version 7, Bell202)	
2	FOUNDATION Fieldbus H1communication (ITK version6)	
3	PROFIBUS PA communication (Profile version3.02)	
4	Modbus communication (RS-485 Modbus protocol)	
㉒	**Version code**	
B	Version code: B	
㉓	—	
㉔	**Special shape designation**	
0	Standard	
Z	Special shape (including polishing)	

※1: Explosionproof specifications are restricted based on temperature class.
※2: "2, 3" for "Communication interface ㉑ " are in preparation and is not available yet.
※3: CS080 is not conform to (the Japan) High Pressure Gas Act.
※4: Applicable specifications differ with the rack-mount transmitter.
For detailed product code explanation, refer to GS No.GEJ516E.
※5: If temperature of the fluid exceeds 80°C for explosionproof types, only "Remote-mount" type is available for the transmitter construction.
In case of non-explosionproof, Integral-mount type can be used up to 130°C by restricting the transmitter ambient temp. to 45°C at maximum.
When "3" is chosen for "Transmitter construction ⑱ " following limitations apply:
Code ⑧ Only "Standard" available
Code ⑰ Only "Rack-mount transmitter" available

■ PRODUCT CODE EXPLANATION



●Additional code

Category of High Pressure Gas				
H	P	0	Other than High Pressure Gas	
H	P	1	Toxic gas and flammable gas	
H	P	2	Toxic gas	
H	P	3	Flammable gas	
H	P	4	Other than toxic or flammable gas	
Special test (instrumental error)				
A	2	0	By certified measurer	
A	9	9	Designation of instrumental error test method	Addition of one (1) test point, etc.
Flow direction				
F	L	0	Left to right	
F	R	0	Right to left	
F	D	0	Bottom to top	Electric conduit must face bottom
Designated special paint on body				
B	X	0	Customer designation	
Designated special paint on transmmiter				
S	F	0	Corrosion proof	Special treatment
S	D	0	Salinity tolerance	
S	E	0	Acid tolerance	Special treatment
S	X	0	Customer designated paint	Special treatment
Cleansing				
T	W	0	Oil free and Water free treatment	
T	F	0	Food cleansing	

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

■ FORMER PRODUCT CODE EXPLANATION

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 ① ② ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ ⑩ ⑪ ⑫ ⑬ ⑭ ⑮ ⑯ ⑰ ⑱	Description
Model	C S	ALTI*mass* Type S
Nominal size	0 1 0	15mm connection (1/2")
	0 1 5	15mm connection (1/2")
	0 2 5	25mm connection (1")
	0 4 0	40mm connection (1•1/2")
	0 5 0	50mm connection (2")
	0 8 0	80mm connection (3")
Fluid category	H	High density liquid (1.0 to1.5g/ml)
	M	Ordinary density liquid (0.7 to 1.3g/ml)
	L	Low density liquids (0.5 to 1.0g/ml)
Temp. category (※1)	1	Standard (below 130°C)
Pressure category	1	Standard
Major parts material	S	SUS316L
Process connection	B	Ferrule
	C	JIS 10K
	D	JIS 20K
	H	ASME 150
	L	JPI 150
	Z	Other than above
Transmitter construction (※2)	1	Integral-mount
	2	Remote-mount
Power source	1	20 to 30VDC
	2	85 to 264VAC (Safety rated 100 to 240VAC), 50/60Hz
Analog output (※3, 4, 5)	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)
	X	Non-output / In the case of FOUNDATION fieldbus,PROFIBUS communication
Pulse output (※3, 4, 5)	A	Output 1: Mass flow — Single pulse
	C	Output 1: Volume flow (fixed density) — Single pulse
	D	Output 1: Mass flow Output 2: Mass flow — Double pulse
	F	Output 1: Mass flow Output 2: Volume flow (fixed density) — Double pulse
	H	Output 1: Volume flow (fixed dens.) Output 2: Volume flow (fixed dens.) — Double pulse
	K	Output 1: Volume flow (fixed density) Output 2: Mass flow — Double pulse
	X	Non-output / In the case of FOUNDATION fieldbus, PROFIBUS communication
Pulse output type (※3)	0	Non-output / In the case of FOUNDATION fieldbus, PROFIBUS communication
	1	Open drain pulse (equivalent to open collector pulse) (standard)
	2	Voltage pulse
Communication interface	1	HART communication / HART protocol version7, Bell202
	2	FOUNDATION fieldbus H1 communication (※3) / ITK version6
	3	PROFIBUS PA communication (※3) / Profile version3.02
	4	Modbus communication / RS-485 Modbus protocol
Explosionproof rating	0	Non-explosionproof
	1	TIIS
	2	ATEX, IECEx
	3	KOSHA/KTL (※6)
	4	CSA
	5	GOST (※6)
	7	NEPSI (※6)
Explosionproof temperature class	0	Non-explosionproof
	3	Sensor unit: Temp. class T3, separate transmitter only
	4	Sensor unit: Temp. class T4

※1: Explosionproof specification has restrictions on temperature class.
※2: If temperature of the fluid exceeds 80°C, only "Separately mounted" type is available for the transmitter construction.
※3: When FOUNDATION fieldbus, PROFIBUS is selected for communication interface, product code categories of analog output is "X" and pulse output is "X" (pulse output type:"0").
※4: When "Volume flow (fixed density)" is selected for analog output or pulse output, fixed density will be applied.
※5: Simultaneous output of both "Volume flow (fixed density)" and "Volume flow (true density)" for analog output and pulse output is not available.
※6: "2" and "3" for the product code ⑯ are not available. (in preparation)

■ 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	
2. Process fluid (※1)	Name:_____ SP. gr :_____ Viscosity :_____ Concentration :_____%	
3. Flow range	Maximum_____ Normal_____ Full scale_____ ☐kg/h ☐Others_____	
4. Fluid temperature	Maximum_____°C Normal_____°C Minimum_____°C	
5. Operating pressure	Maximum_____MPa Normal_____MPa Minimum_____MPa	
6. Ambient temperature	Maximum_____°C Minimum_____°C	
7. Fluid flow direction	☐Left to right ☐Right to left ☐Bottom to top (☐Top to bottom) Orientation: See sketch on page 8. No._____	
8. Nominal size	_____mm or _____inch	
9. Required accuracy	±_____% of reading ±_____% of full scale	
10. Process connection	☐Flanged connection (Flange rating)_____ ☐Ferrule connection ☐Screw connection	
11. Explosionproof	☐Not required ☐TIIS ☐ATEX ☐IECEx ☐KOSHA ☐CSA ☐GOST ☐NEPSI ☐ITRI	
12. Power supply	_____V ☐AC ☐DC	
13. Output specifications ※ The I/O functions listed on the right are unavailable with communication protocols FOUNDATION fieldbus, PROFIBUS.	Pulse output	☐ Volt. pulse: [0]: 1.5V [1]: 15VDC minimum Out. impedance: 2.2kΩ
		☐ Open drain (equivalent to open collector) [Minimum 10V to Maximum 30V, 50mADC, ON resiatance 0.6Ω or less]
		☐ Output frequency: Any point from 0.1 to 10000Hz at full scale
		Two outputs from flow rate (mass or volume).
	Analog output	4 to 20mADC Maximum load: 600Ω
		2 outputs from instant. flow rate (mass, volume), temperature
	Additional damping	0 to 200s. (variable)
	Alarm output	Slug flow High_____g/mL Low_____g/mL
14. Communication protocol	☐ HART ☐ FOUNDATION fieldbus ☐ PROFIBUS ☐ Modbus (Address:)	
15. Receiver	☐ Totalizer ☐ Indicator ☐ Recorder ☐ Flow controller ☐ Batch controller	
	☐ Density computer ☐ Computer ☐ Others	
16. Transmission length	Sensor unit (→) m Transmitter (→) m Receiving instrument	
17. Exclusive cable length	In case of Remote-mount type_____m	
18. In case of Remote-mount type transmitter	☐ Stanchion type w/bracket and 2″ U bolts	
19. No. of units required		
20. Application		
21. Other considerations		
22. Pressure-resistant packing	☐ Standard ☐ ATEX directive compliant ☐ ATEX directive compliant for earthed cable	
23. Maritime certification	☐ Not required ☐ DNV GL	

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

The specification as of November, 2019 is stated in this GS Sheet. Specifications and design are subject to change without notice.

Sales Representative:

GS.No.GBN122E

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