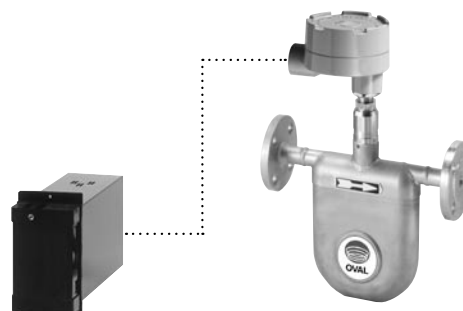


■ GENERAL

The know-how and experience gained in our specialized domain of manufacturing flowmeters have been used in the development of a new general-purpose Coriolis flowmeter, the ULTRAmass MKII, which is characterized by ease of operation, increased performance and safety for the plant operator.

■ FEATURES

1. Exceptional accuracy ($\pm 0.1\%$ \pm zero stability error of reading for liquid service) and high sensitivity (measuring range 1 to 200).
2. Accepts both liquid and gas. Measures accurately with small pressure loss over a broad flow range.
3. Measures density and temperature accurately in addition to mass flowrate.
4. Minimum pockets for the process fluid to stay (in vertical installation) offers ease of cleaning.
5. Applicable to a widely varying kinds of process fluid thanks to stainless steel or Alloy C components.
6. Lightweight and compactly built, yet exceptionally high mechanical strength. The result is ease of handling, installation space saving, and increased process safety.



Transmitter
Rack mount Type
MT9411

7. Explosionproof configuration permits meter installation in a hazardous location.

■ GENERAL SPECIFICATIONS

1. Standard sensor unit

Item		Description							
Model		CN003	CN006	CN010	CN015	CN025	CN050	CN080	
Nominal size		10mm or 3/8" (*1)		15mm or 1/2"		25mm or 1"	40mm or 1-1/2"	50mm or 2"	80mm or 3"
Materials	Wetted	SUS316L, SUS316L +Alloy C, Alloy C							
	Housing	SUS304							
Process connection		JIS 10, 20, 30, 40, 63K RF, ASME/JPI 150, 300, 600RF, IDF ferrule (*2), Screw							
Applicable fluids		Liquids and gases							
Density range		0 to 2.0 g/mL							
Temperature range		-200 to +200°C (*3)							
Tube withstand (at 20°C)		9.4MPa (*4)							
Max. operating pressure		Max. 9.4 MPa (Depends on flange rating) (*4)							
Sensor housing withstand (MPa) (*5)		7.2	3.8	3.0	2.2	1.6	1.8	1.4	
Flow direction		Forward and reverse, both available							
Explosionproof symbol		See the explosionproof specifications for sensor unit (table below and page 2).							

*1 : 1/2" for ASME and JPI flanged sensors.

*2 : For IDF ferrule connection, there are no CE Mark compliant products available.

*3 : If fluid temperature and ambient temperature exceed 130°C, select a sensor for high temperature service (see Product Code Explanation on page 15).

*4 : High pressure service models (CN010: 36MPa and CN015: 43MPa) available only for CN010 and CN015. For details, see Product GS sheet for high pressure service models.

*5 : This pressure does not represent the maximum working pressure in the pressure vessel ratings. It represents, based upon comparison between the results of breakdown test conducted at OVAL (distorted enclosures are permissible) and the breakdown pressure in the FEM analysis, the one quarter (1/4) of the pressure obtained, whichever is lower (safer).

* : Miscellaneous: For products conforming to the high pressure gas safety regulations and CE marking, consult our representative.

● Explosionproof Specifications for Sensor Unit

(1) TIIS Explosionproof

Explosionproof codes : Exib ① ② (① : Gas class, ② : Temperature class) (Example : Exib IIB T2)

Item		CN003	CN006	CN010	CN015	CN025	CN050	CN080
①	Gas class	IIB						IIA
②	Temp. class (Metered fluid temperature)							
	T2 (*2)		-20 to +200°C	-20 to +200°C	-20 to +200°C	-20 to +200°C	-20 to +200°C	-20 to +200°C (*1)
	T3	-20 to +165°C	-20 to +165°C	-20 to +165°C	-20 to +165°C	-20 to +170°C	-20 to +170°C	-20 to +170°C

*1 : CN080 meets gas class "IIB" only in temperature class "T2".

*2 : Applies only to the sensor for high temperature service.

2. Rack mount transmitter (MT9411)

Item	Description
Power supply	85 to 264VAC 50/60Hz or 20 to 30VDC
Power consumption	Max. 25VA or Max. 10W
Temperature	-200 to +200°C
Ambient temperature	-10 to +50°C (without dew condensation)
Transmission length (separate type)	Max. 200m (Exclusive cable used) (*1)
Explosionproof enclosure TIS	See the explosionproof specifications for rack mount transmitter (table below).
Mounting	Rack-mount typy
Finish	Munsell N6.0 (grey)
Weight	1.8kg approx.
Communication interface	Bell 202 (HART protocol) (*2)
Pulse output (*3)	Open collector output (10V min. to 30Vmax., 50mA DC) , FS:0.1 to 10000Hz, or Voltage pulse (option) "0": 1.5V max. "1": 15V min., Output impedance 2.2kΩ
Analog output (*3)	4 to 20mADC (max. load 600Ω) Two outputs from instantaneous flow rate (mass, volume) temperature or density. Additional damping: flow 1sec, density 4sec, temperature 2.5sec.
Status output	Open collector output Normal: ON; Abnormal : OFF (Max.30V, 50mADC) Select one from Error (std.), flow direction, Hi/Lo alarm
Status input	Contact-closure input (Form "a" contact) Close: 200Ω max., Open: 100kΩ min. Select one from Function OFF (default), remote zero, total reset, and 0% signal lock.
Output to density computer	Natural frequency output (EL4001 series)

*1 : If it exceeds 200 meters, consult the factory.

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

*3 : Flow signal is cutoff below 0.3% of the maximum permissible flowrate.

*4 : 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.

* : CE-marking compliant products are not available.

● Explosionproof Specifications for Rack Mount Transmitter

(1) TIS Explosionproof

Sensor type	Explosionproof code
CN003, CN006, CN010, CN015, CN025, CN050 (*1)	[Exia] IIB
CN080 (*1)	[Exia] IIA

*1: If a high temperature service sensor (sensor unit temp. class "T2") is combined, an explosionproof rating "[Exib] IIC" applies.

■ GENERAL PERFORMANCE

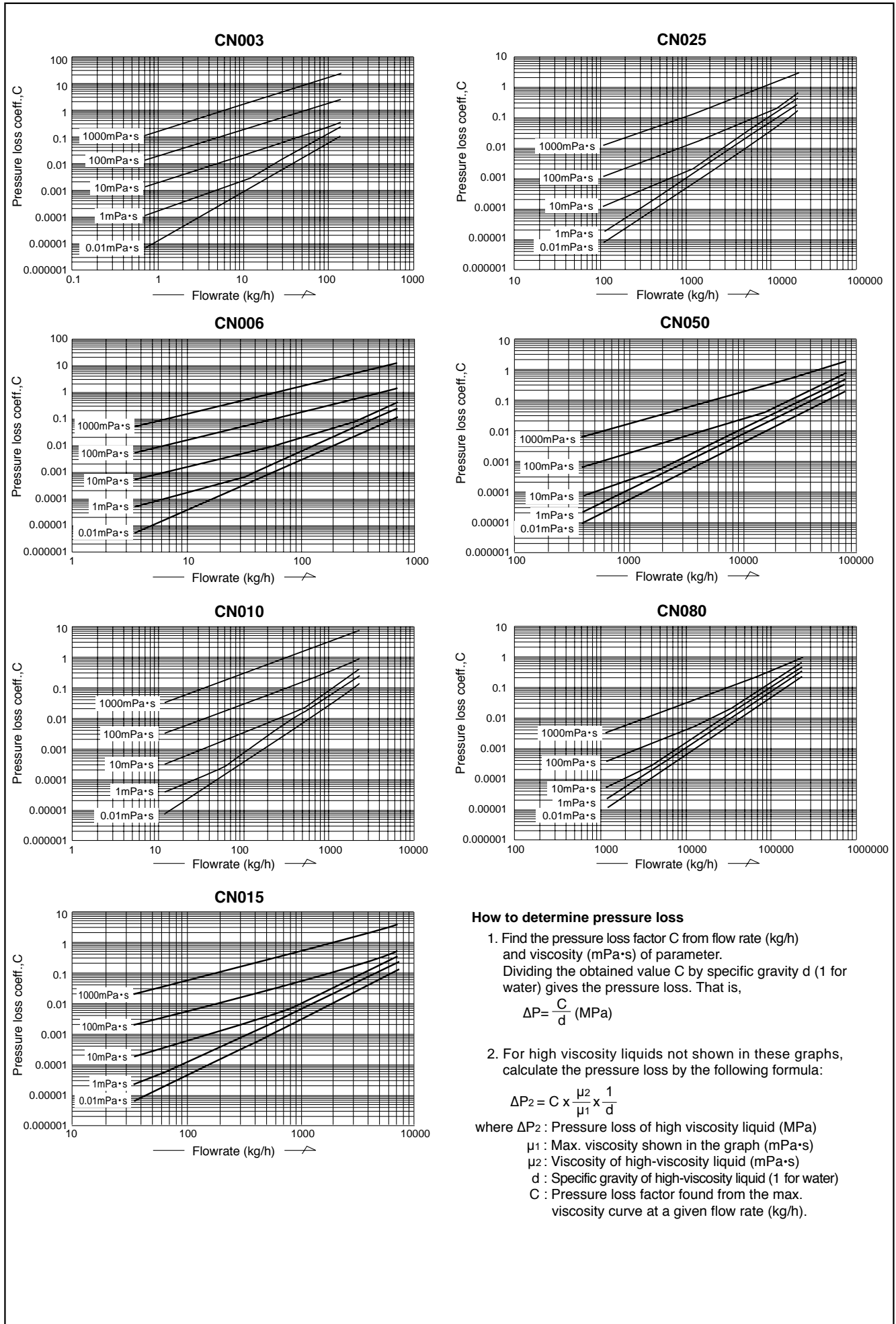
Item		Description							
Model		CN003	CN006	CN010	CN015	CN025	CN050	CN080	
Flowrate	Normal flow range (kg/h)	0 to 72	0 to 360	0 to 1200	0 to 3600	0 to 10800	0 to 39000	0 to 120000	
	Allowable flow range (kg/h)	0 to 144	0 to 720	0 to 2400	0 to 7200	0 to 21600	0 to 78000	0 to 240000	
	Min. range (kg/h)	0 to 3.6	0 to 18	0 to 60	0 to 180	0 to 540	0 to 1950	0 to 6000	
	Accuracy in factory calibration	Liquids	[±0.1% ± zero stability error] of RD						
		Gases	[±0.5% ± zero stability error] of RD						
	Repeatability	Liquids	[±0.05% ± 1/2 zero stability error] of RD						
Gases		[±0.25% ± 1/2 zero stability error] of RD							
Zero stability (kg/h)		0.0072	0.036	0.12	0.36	1.08	3.9	12	
Density (Liquids)	Measuring range	0.3 to 2g/mL							
	Accuracy in factory calibration (option)	±0.001g/mL							
Analog accuracy		±0.1% of FS added to each accuracy							

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

* : For volume fowrate measurement in custom or custody transfer application, contact us.

* : In gas measurement, the max. permissible flow velocity varies with the type of gas and some may be beyond the bounds of measurement. If such is the case, seek our technical assistance.

■ PRESSURE LOSSES



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,

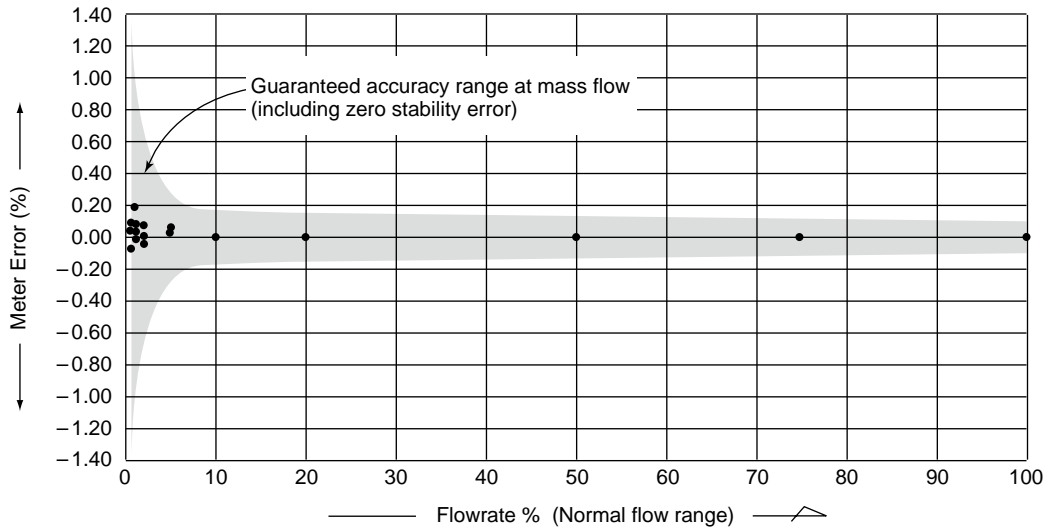
$$\Delta P = \frac{C}{d} \text{ (MPa)}$$

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_1 : Max. 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 factor found from the max. viscosity curve at a given flow rate (kg/h).

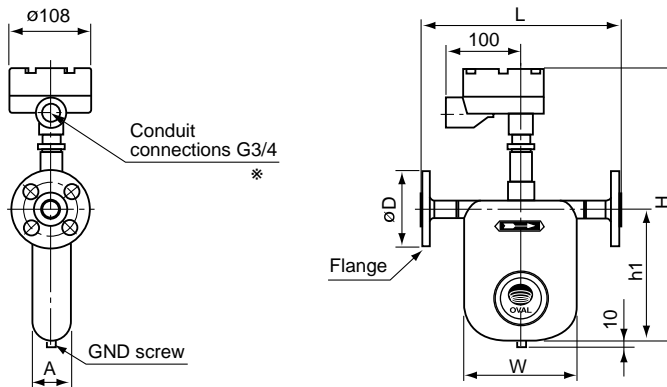
METER ERROR



● mark: Actual error in factory calibration of CN025 Model.

SEPARATED TYPE / DIMENSIONS [Unit in mm]

● Transmitter separately mounted / flange connection type (SUS316L, SUS316L+Alloy C)

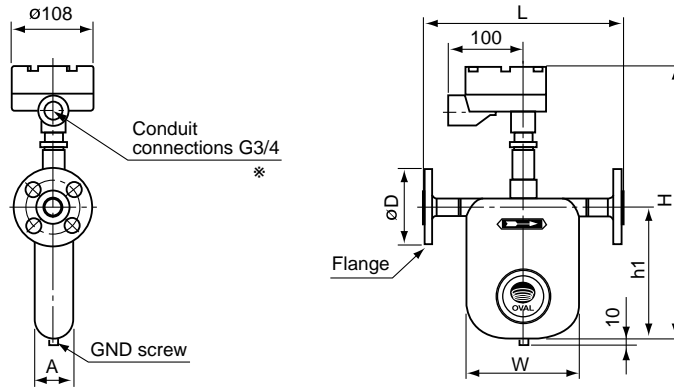


*:ATEX compliant products are provided with G1/2 adapter (fixed at cable entry).

Model	Nominal size	JIS					ASME, JPI			H	h1	A	W	Approx. Weight kg (JIS 10K)
		10K	20K	30K	40K	63K	150	300	600					
		L	L	L	L	L	L	L	L					
CN003	10(3/8")	275	275	293	239	313	301	310	322	388	186	49	179	6
CN006	10(3/8")	242	242	260	260	280	267	276	289	368	180	53	148	5
CN010	15(1/2")	256	256	276	276	294	282	291	303	406	218	53	163	6
CN015	15(1/2")	299	299	319	319	343	325	334	347	456	268	65	205	7
CN025	25(1")	380	380	400	400	422	411	424	437	524	329	83	262	11
CN050	40(1 1/2")	513	513	541	541	585	547	560	575	654	452	121	385	21
	50(2")	513	523	561	561	595	550	563	582					22
CN080	80(3")	657	675	725	725	771	698	717	737	824	602	174	510	57

* : This table is applied to material code "SS", "SH".
 * : Flange size for model CN006 is 1/2" in case of ASME or JPI.
 * : If flange O.D. and bolt hole dimensions remain the same, a flange thickness with a rating of one rank above is used, irrespective of flange rating. (e.g., JIS 10K specifications with flanges of JIS 20K dimensions or ASME 300 specifications with flanges of ASME 600 dimensions)

● Transmitter separately mounted / flange connection type (Alloy C)

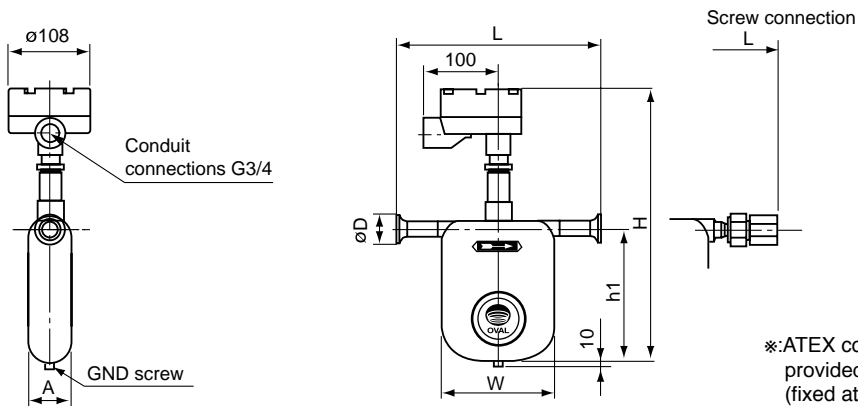


※:ATEX compliant products are provided with G1/2 adapter (fixed at cable entry).

Model	Nominal size	JIS					ASME, JPI			H	h1	A	W	Approx. Weight (kg) (JIS 10K)
		10K	20K	30K	40K	63K	150	300	600					
		L	L	L	L	L	L	L	L					
CN006	10(3/8")	271	271	316	316	316	286	286	286	368	180	53	148	5
CN010	10(3/8")	300	300	330	330	330	300	300	300	406	218	53	163	6
CN015	15(1/2")	344	344	374	374	374	344	344	344	456	268	65	205	7
CN025	25(1")	444	444	444	444	444	444	444	444	524	329	83	262	11
CN050	40(1 1/2")	587	587	587	587	587	587	587	587	654	452	121	385	21
	50(2")	587	587	587	587	587	587	587	587					22
CN080	80(3")	756	756	756	756	756	756	756	756	824	602	174	510	57

※ : This table is applied to material code "HY".
 ※ : Flange size for model CN006 is 1/2" in case of ASME or JPI.
 ※ : If flange O.D. and bolt hole dimensions remain the same, a flange thickness with a rating of one rank above is used, irrespective of flange rating. (e.g., JIS 10K specifications with flanges of JIS 20K dimensions or ASME 300 specifications with flanges of ASME 600 dimensions)

● Transmitter separately mounted / ferrule or screw connection type

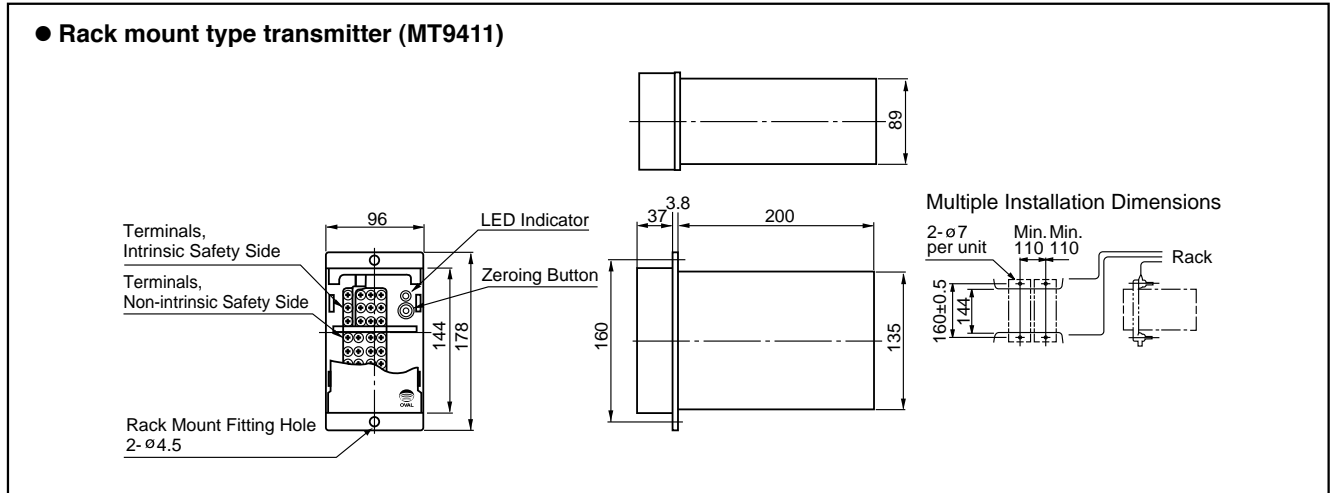


※:ATEX compliant products are provided with G1/2 adapter (fixed at cable entry).

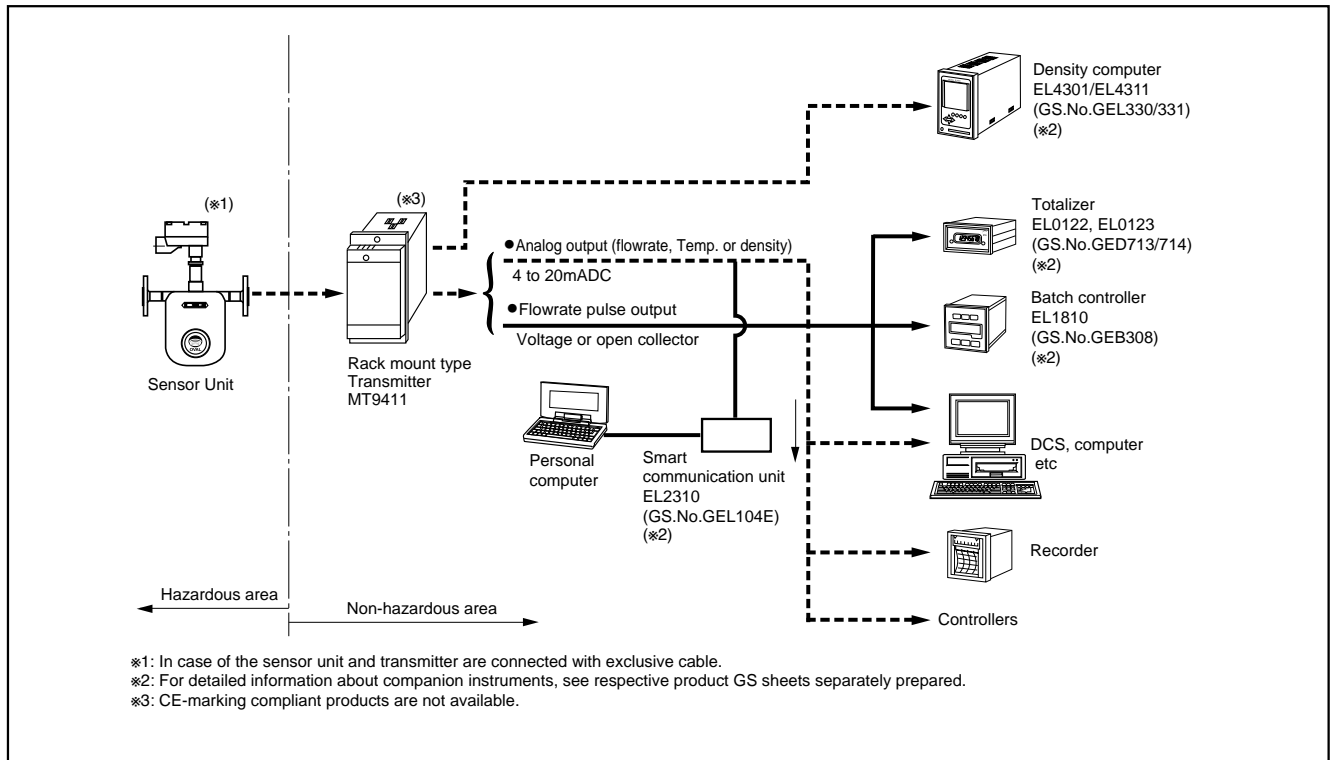
Model	Ferrule		L	H	h1	A	W	φD	Approx. Weight (kg)
	Nom. size	Connection							
CN003	10	Ferrule 10A	265	388	186	49	179	34	5
CN006	10	Ferrule 10A	232	368	180	53	148	34	4
CN010	15	Ferrule 15A	256	406	218	53	163	34	4
CN015	15	Ferrule 15A	289	456	268	65	205	34	5
CN025	25	Ferrule 25 (ISO), IDF 1S	370	524	329	83	262	50.5	8
CN050	40	Ferrule 38 (ISO), IDF 1.5S	493	654	452	121	385	50.5	17
	50	Ferrule 51 (ISO), IDF 2S						64	
CN080	80	Ferrule 76.1 (ISO), IDF 3S	659	824	602	174	510	91	50

Model	Screw		L	Approx. Weight (kg)
	Connection			
CN003	Rc 3/8		332	5
CN006	Rc 3/8		296	4
CN010	Rc 3/8		312	4
CN015	Rc 3/4		382	5

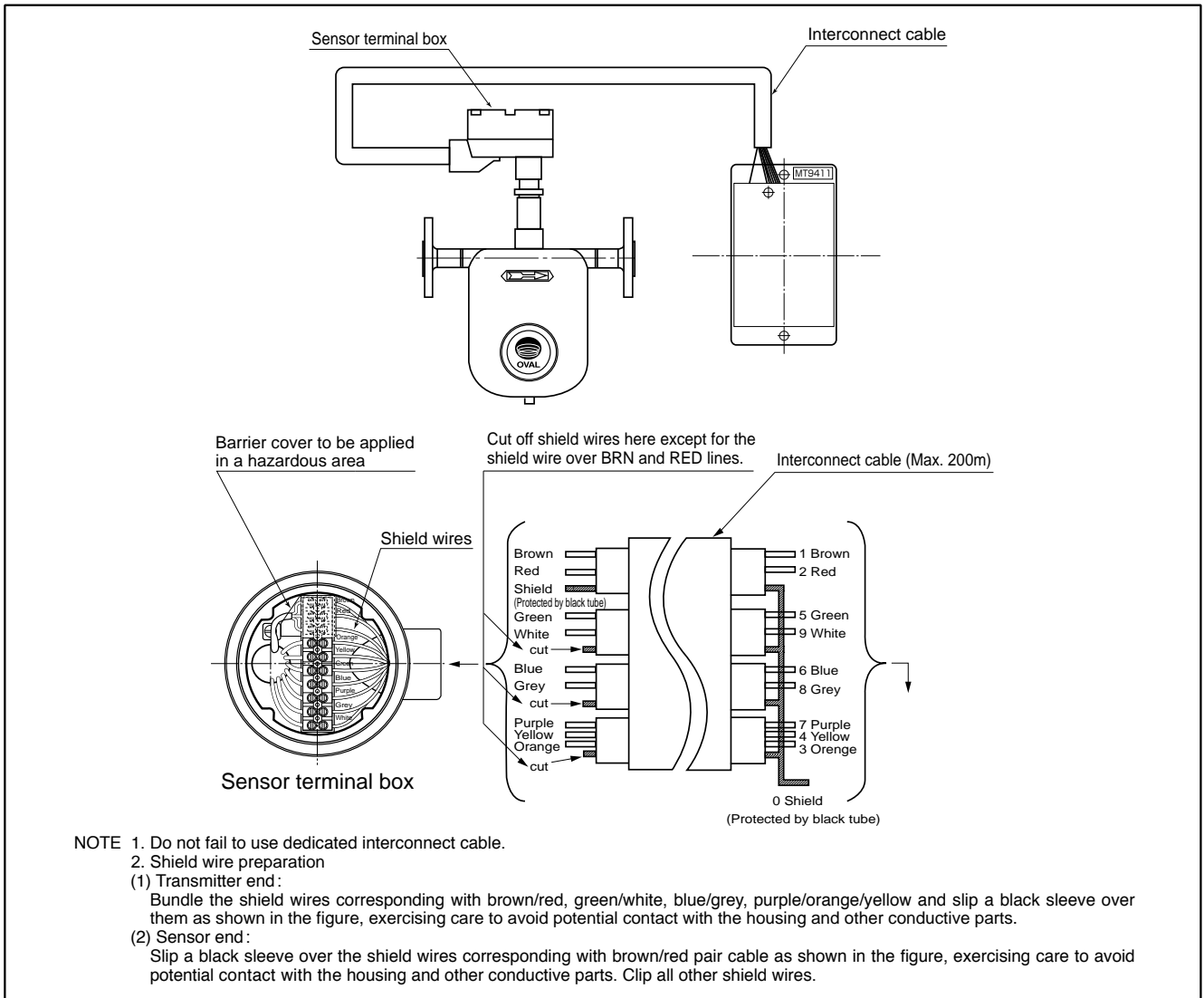
■ DIMENSIONS [Unit in mm]



■ REMOTE MEASURING SYSTEM

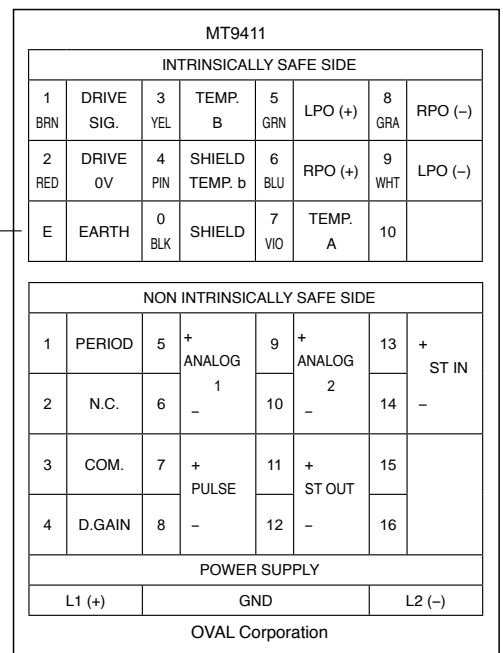


WIRING



Terminal Identification (MT9411)

Item	Terminal No.	Label	Description	Cable Color
Intrinsically Safe Side	1	DRIVE SIG.	Drive output to flow tube	BRN
	2	DRIVE 0V		RED
	E	EARTH	Kind A ground work	
	3	TEMP. B		ORD
	4	SHIELD TEMP. b	Common	YEL
	0	SHIELD	Shield	BLK
	5	(+) LPO	L. pos. pickoff sensor input	GRN
	6	(+) RPO	R. pos. pickoff sensor input	BLU
	7	TEMP. A	Temperature input	PUR
	8	(-) RPO	R. pos. pickoff sensor input	GRY
9	(-) LPO	L. pos. pickoff sensor input	WHT	
10				
Nonintrinsically Safe Side	1	PERIOD	Flow computer combination	Tube frequency output
	2	N.C.		
	3	COM.		Common
	4	D.GAIN	Drive gain output : Common terminal : 3	
	5	(+) ANALOG 1	Analog output 1	
	6	(-) ANALOG 1	Analog output 1	
	7	(+) PULSE	Frequency output :	
	8	(-) PULSE	Voltage pulse or open collector pulse	
	9	(+) ANALOG 2	Analog output 2	
	10	(-) ANALOG 2	Analog output 2	
	11	(+) STATUS OUT	Error, flow direction, zeroing during adjustment, or hi/low alarm output	
	12	(-) STATUS OUT	Error, flow direction, zeroing during adjustment, or hi/low alarm output	
	13	(+) STATUS IN	Remote zero input (From "a" contact)	
	14	(-) STATUS IN	Remote zero input (From "a" contact)	
15				
16				
Power	L1	(+) POWER	Power supply	
	L2	(-) POWER	Power supply	
	G	GND	Kind D ground work	

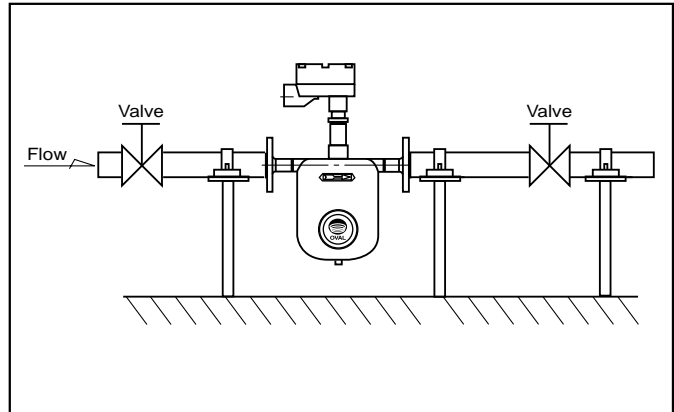


Do not fail to connect EARTH terminal to the ground earth of kind A (explosionproof) or kind D (Non-explosionproof).

STANDARD INSTALLATION

1. Typical Installation (See figure at right.)

- 1) Avoid pipeline stresses on the ULTRA^{mass} MKII.
- 2) The ULTRA^{mass} MKII should be supported near and between connections to the process pipelines.
- 3) Avoid supporting the ULTRA^{mass} MKII body directly.
- 4) Pipeline should be arranged such that the ULTRA^{mass} 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 ULTRA^{mass} 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 200°C. Explosionproof models require the temperature to be held below their maximum allowable levels.
- 3) To ensure consistent volume flow and density measurements, heat retention is suggested.
- 4) 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.
- 5) In a horizontal run, install the sensor unit with the terminal box up as shown in the figure.
- 6) A control valve should be located downstream of the ULTRA^{mass} MK II. In an arrangement where cavitation may possibly take place, locate it at least 5 meters away.

- 7) To ensure consistent and accurate measurement, the Coriolis flowmeter should be placed in an environment where pipeline oscillation is held below 0.3G.

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

Recommended physical orientation varies with the type of process fluid. No. 2 in the figure below shows the representative orientation for liquid service.

	Horizontal run		Vertical run
	No.1	No.2	No.3
Orientation			
Fluids	<ul style="list-style-type: none"> • Gases • Slurries 	<ul style="list-style-type: none"> • Liquids 	<ul style="list-style-type: none"> • Slurries (requiring cleaning) • Liquids • Gases

* : 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	C	N											ULTRA mass MK II
Nominal size	0 0 3												10mm (3/8") 1/2" In case of ASME or JPI (Transmitter separate type only)
	0 0 6												10mm (3/8") 1/2" In case of ASME or JPI
	0 1 0												15mm (1/2")
	0 1 5												15mm (1/2")
	0 2 5												25mm (1")
	0 5 0												40mm (1 1/2"), 50mm (2")
Construction	0 8 0												80mm (3")
	C -												CN003 to CN025, CN080 (*1)
	A -												CN050 (40mm) (*1)
	B -												CN050 (50mm) (*1)
	D -												CN003 to CN025, CN080 (high temp. service) (*2)
	E -												CN050 (40mm) (high temp. service) (*2)
Material	F -												CN050 (50mm) (high temp. service) (*2)
	S S -												SUS316L
	S H -												SUS316L+Alloy C (Tube only)
Connection type	H Y -												Alloy C (Applied to CN003 screw connection, CN006 to CN080 flange connection)
	2												Screw connection (CN003 through CN015 only)
	3												Flange connection
Connection standard	4												Ferrule connection (Material "SS" or "SH" only)
	0												Other than flanged connection
	1												JIS
	2												ASME
	3												JPI
Pressure rating	4												IDF
	0												Other than flanged connection
	1												10K
	2												20K, ASME 150, JPI 150
Transmitter Mounting Construction	3												30K, ASME 300, JPI 300
	4												40K
	6												63K, ASME 600, JPI 600
	R												MT9411(rack-mount transmitter)

*1 : Structural codes C, A, and B apply to fluid and atmospheric temperatures below 130°C.

*2 : Structural codes D, E, and F (high temp. service) apply to fluid and atmospheric temperatures above 130°C.

● Rack-mount type transmitter (MT9411)

Item	Code No.												Description
	①	②	③	④	⑤	⑥	⑦	⑧	⑨	⑩	⑪	⑫	
Model	M	T	9	4	1	1	-						Rack-mount Transmitter MT9411
Power Source	6												20 to 30VDC
	7												85 to 264VAC 50Hz/60Hz
Analog Output (*1)	M M												2 mass flow outputs (same for single output)
	M D												Mass flow + density
	M T												Mass flow + temperature
	M V												Mass flow + volume flow
	D T												Density + temperature
	V D												Volume flow + density
	V T												Volume flow + temperature
Pulse Output	1												Mass flow voltage pulse
	2												Volume flow voltage pulse
	3												Mass flow open collector pulse
	4												Volume flow open collector pulse
Status Output	1												Error output
	2												Flow direction
	3												Auto zero in progress
	4												Hi/Low alarm
Explosionproof	0												Non-explosionproof
	1												TIIS (domestic explosionproof) Temperature Class T3
	8												TIIS (domestic explosionproof) Temperature Class T2 (*1)

*1 : "8" in the ⑫ applies to high pressure service only (except for CN003).

* : "0" or "1" character of the product code ⑫ applies to CN003 for high pressure service.

* : Sensor units rated T4 in temperature class are not compatible with MT9411.

■ 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	CN□□□□-□□-□□□□
2. Transmitter	MT9411-□□□□□□
3. Process fluid (*1)	Name:_____ SP. gr:_____ Viscosity:_____ Concentration:_____ %
4. Flow range	Max._____ Normal_____ Full scale_____ <input type="checkbox"/> kg/min <input type="checkbox"/> kg/h <input type="checkbox"/> Others_____
5. Fluid temperature	Max._____°C Normal_____°C Min._____°C
6. Operating pressure	Max._____MPa Normal_____MPa Min._____MPa
7. Ambient temperature	Max._____°C Min._____°C
8. 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 12. _____
9. Nominal size	Nominal size_____mm or_____inch
10. Required accuracy	±_____ % of reading ±_____ % of full scale
11. Process connection	<input type="checkbox"/> Flanged connection (Flange rating)_____ <input type="checkbox"/> Ferrule connection <input type="checkbox"/> Screw connection
12. Explosionproof	<input type="checkbox"/> Not required <input type="checkbox"/> TIIS
13. Power supply	Power supply_____V <input type="checkbox"/> AC <input type="checkbox"/> DC
14. 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 4 to 20mA DC Max. load: 600Ω
	2 outputs from instant. flow rate (mass, volume), temp. or density (option)
Additional damping	0 to 200s. (variable)
Alarm output	Slug flow (*2) High_____g/mL Low_____g/mL
15. 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
16. Transmission length	Sensor unit (_____→) m Transmitter (_____→) m Receiving instrument
17. Exclusive cable length	_____m (Max. 200m)
18. No. of units required	
19. Application	
20. Other considerations	

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

*2: Option

The specification as of Feb., 2013 is stated in this GS Sheet. Specifications and design are subject to change without notice.