

OUTLINE

MASSMAX[®]2400 Series is a Coriolis-type mass flowmeter specially developed for large pipes and flow rates.

Using a straight twin tube as the measuring pipe, which are generally difficult to manufacture for large-size pipes, it is designed to reduce pressure loss.

Also, thanks to the enhanced pressure resistance of the outer housing of the sensor, as well as the use of stainless steel for the wetted parts, it offers a pressure resistance of up to 10 MPa as standard, providing higher safety.

The meter is available in three sizes from 100 to 250 mm (400 mm will also be available).

It can support applications for controlling and transferring liquids with large flow rates.

FEATURES

- For low-cost applications requiring self-cleaning and low pressure loss
- High accuracy: $\pm 0.1\%$ of reading (+ zero stability)
- Secondary pressure container made of stainless steel (maximum working pressure: 10 MPa), can support chemical/petrochemical applications which require advanced safety
- Mass flow rate (instantaneous and total), density, and temperature can be measured by a single meter
- Available as a compact type and a remote type (sensor/converter)
- TIS-certified explosionproof

STANDARD SPECIFICATIONS

- Measuring principle : Coriolis force
- Meter size : 100, 150, 250 mm
- Measuring range

Meter size	Max. flow rate	Min. flow rate	Max. flow rate	Min. flow rate
	Kg/h		Kg/min	
100	420,000	1,560	7,000	26
150	900,000	4,000	15,000	66.7
250	2,300,000	11,000	38,333	183.3
*400	4,600,000	23,000	76,000	383.3

* Size 400 is currently in preparation

- Enclosure : IP67 (equivalent to NEMA4X)
- Ambient temperature : -40 to $+60^{\circ}\text{C}$ (compact type)
 -40 to $+65^{\circ}\text{C}$ (remote type sensor/converter)
* Refer to the "Explosionproof" section for the ambient temperature range.

Fluid specifications

- Fluid : Liquids
- Liquid temperature :

Sensor tube material	Temperature
Stainless steel (ASTM S31803)	-40 to $+130^{\circ}\text{C}$



- Liquid pressure

Certified by	Pressure
	Liquid temperature 20°C
PED 97/23/EC	15 MPa
FM	14 MPa
ASME B31.3	10 MPa

The above table shows the maximum working pressure of the sensor tube, which is less than the maximum working pressure of the flange or fitting.

- Density : 400 to 3000 kg/m³

Sensor specifications

- Process connection :
Flange : JIS10K, 20K R.F.
ASME Class 150 to 600 R.F. etc.

- Materials

Wetted parts:

Wetted-part	Materials
Sensor tube	Stainless steel (ASTM S31803) * Equivalent to JIS SUS329J3L
Flow splitter	Stainless steel (SS316L)
Flange	Stainless steel (SS316L)

Non-wetted parts:

- Outer housing : Stainless steel (SS304L, etc.)
- Converter mount/Front-end housing : Stainless steel (SS316L)
- Pressure rating of the outer housing : 10 MPa as standard
4 MPa PED-certified product (optional)

Converter specifications

- Housing material: Aluminum alloy (option: SS316L)
- Coating : Polyurethane resin
- Color : Silver (converter body), jade green (converter/terminal cover)
- Power supply : 100 V to 230 V (85 V to 250 V AC), or 24 V (9 V to 31 V DC) as optional
() shows the allowable voltage range.
- Supply frequency : 48 to 63 Hz
- Power consumption : Approx. 22 VA for AC, approx. 12 W for DC
- Grounding : Grounding resistance less than 100ΩG for non-explosionproof types (D-type), or less than 10ΩG for explosionproof types (A-type)
- Cable entry : G1/2 female adaptor × 2 or 1/2NPT female adaptor × 2 or G1/2 pressure resistance with a gasket adaptor × 2 (TIIS-certified, explosionproof)
Note: Up to 3 cable entries are supported.

Indication and outputs

- Display : Blue dot mArIx LCD (with backlight), 128 × 64 pixels (59 × 31 mm), up to 4 screens with 1 to 3 lines in each screen can be displayed. Data includes instantaneous mass flow rate (bar graph indication available), totalized mass flow rate, instantaneous volume flow rate, totalized volume flow rate, density, temperature, instantaneous flow rate trend graph (percentage indication), setting parameters, self-diagnosis, etc.
- Unit of instantaneous mass flow rate : kg/h, kg/min, kg/sec, t/h, etc.
Displays forward and reverse flowing direction with “+” and “-”
- Unit of totalized mass flow rate : kg, t, g, etc.
Totalization of forward and reverse flowing direction
- Units of density : g/cm³, kg/m³, etc.
- Units of temperature : °C, etc.
- Current output : 4-20 mA (max. 22 mA)
Internal power supply: Load resistance less than 1000Ω
External power supply: Voltage less than 32 V DC
Selectable from instantaneous mass flow rate, density and temperature.
- Pulse output : Open collector output
Load rating : 32 V DC, less than 20 mA (≤10 kHz), less than 100 mA (≤10 Hz)
Output frequency : Max. 10 kHz
Pulse rate : 2 to 36,000,000 pulses/h (0.00056 Hz to 10 kHz)
Pulse width : Selectable from:
(1) AutomAic: Pulse width becomes duty 50% at full frequency
(2) Fixed duty ratio: Always 1:1
(3) Arbitrary setting: 0.05 to 2000 ms
- Status output : Open collector output
Load rating : 32 V DC, less than 100 mA
Contents : Selectable from:
(1) No status output (default setting)
(2) Flow direction indication
(3) Flow over-range
(4) Totalization preset
(5) Range identification (when using double ranges)
(6) Errors and other measurement alarms for flow rate, density, temperature, etc.

- Control input
Voltage input : 0 to 2.5 V DC for low, or 19 to 32 V DC for high
Control target : Selectable from:
(1) No control input (default setting)
(2) Hold output
(3) Lock output at 0%
(4) Reset totalization counter
(5) Reset errors
(6) Range identification (when using double ranges)
(7) Others
- Communication : HART communication protocol (in preparation)
- Combination of outputs:
Standard : 4-20 mA output × 1, pulse output × 1, status output × 1, control input × 1 (total 4 points)
Option 1 : 4-20 mA × 2, pulse output × 1 (total 3 points)
Option 2 : 4-20 mA output × 3, pulse output × 1 (total 4 points)
Option 3 : 4-20 mA output × 2, pulse output × 1, status or pulse output (selectable) × 1 (total 4 points)
Refer to the “Converter specification code” section for details.
- Low cut-off:
Current output and pulse output (can be set separately for each indication)
Range: 0 to 20% FS
The standard setting values for current/pulse output are 1% for ON and 3% FS for OFF.
- Time constant:
Current output and pulse output (can be set separately for each indication)
Range: 0.0 to 100.0 seconds
Standard setting, current output, and indicator: 3 seconds
Pulse output: 0 second

Standard functions

- User-defined measuring units : Up to 7 characters can be set for mass/volume and time as a unit to display the flow rate.
- Bi-directional flow measurement : Measures flow in both forward and reverse directions and outputs the flow direction as status output.
- Self-diagnosis function : Displays errors and operation statuses via messages.
Function diagnosis : CPU, memory, software, hardware, output connection.
Status diagnosis : Over-range, count-range, power failure, etc.
Application diagnosis : Oscillating balance of the measuring tube, vibration energy, and other sensor circuits.
- Power failure compensation : EEPROM (non-volatile memory) function retains data for the function settings and totalization for more than 10 years.
- Testing : Built-in simulator of current/pulse output enables loop check without a calibrator.
- Infrared touch sensor : Four touch sensors enable data setting from the outside without needing to open the cover.

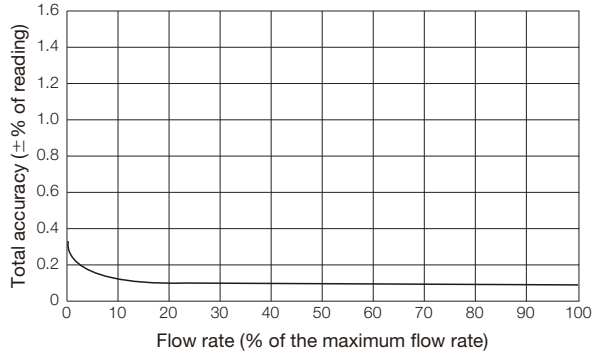
Accuracy (calibration at the factory)

- Mass flow rate (pulse output)

Accuracy	±0.1% of reading
Zero stability	S100 : 7 kg/h
	S150 : 18 kg/h
	S250 : 50 kg/h

Reference condition: Water at 20°C, 0.1 MPa

Total accuracy (Accuracy + zero stability)



		Total accuracy (±% of reading)
% of the maximum flow rate	100%	0.102
	50%	0.103
	20%	0.108
	10%	0.116
	5%	0.133
	1%	0.266

* The above value shows the total accuracy for S100, and it differs slightly for S150 or S250. Measurement of a flow rate lower than the minimum value is not reflected in the above values.

Effects of changes in process conditions:

Liquid temperature : ±0.0004% of the maximum flow rate per 1°C

Liquid pressure : ±0.0002% of the maximum flow rate per 0.1 MPa

The above effects need to be considered when the process condition changes after zero adjustment.

- Density (indicated value)

Meter size for density measurement	100, 150, 250
Measuring range	400 to 3000 kg/m ³
Accuracy (calibration at the factory) *	±2 kg/m ³

* Calibration at the factory is optional.

- Temperature (indicated value)

Measuring range for flange connection	-40 to +130°C
Measuring range for sanitary pipe, S100 only	-20 to +130°C
Accuracy	±1°C

Explosionproof

- ATEX (Europe, ATEX instructions (94/9/EC))

Compact type : II 2 G EEx d [ib] IIC T4 (PTB 06 ATEX 2037 X)

Temperature class	Max. liquid temperature	Ambient temperature
T4	70°C	+50°C
T3...T1	130°C	
T4 – T1	55°C	+55°C

Remote type sensor : II 2 G EEx ib IIC T4 (PTB 06 ATEX 2036 X)

Temperature class	Max. liquid temperature	Ambient temperature
T4	89°C	+65°C
T3...T1	130°C	

Remote type converter : II 2 G EEx d [ib] IIC T6 (PTB 06 ATEX 2038 X)

Temperature class	Ambient temperature
T4...T1	-40 to +60°C

- TIIS Technology Institute of Industrial Safety in Japan

(1) Compact type (Housing: aluminum)

Model: MMM2400C-JEx

- a) Type of protection and class : Sensor Ex ia IIC T4
 Converter Ex d[ia]IIC T4
 Terminal box Ex d IIC T4
 Ambient temperature : -20 to +50°C
 Liquid temperature : -45 to +90°C

- b) Type of protection and class : Sensor Ex ia IIC T3
 Converter Ex d[ia]IIC T3
 Terminal box Ex d IIC T3
 Ambient temperature : -20 to +50°C
 Liquid temperature : -45 to +130°C

2) Remote type sensor

Model: MMS2000F-JEx

- a) Type of protection and class : Ex ia IIC T3
 Ambient temperature : -20 to +60°C
 Liquid temperature : -50 to +130°C
- b) Type of protection and class : Ex ia IIC T2
 Ambient temperature : -20 to +50°C
 Liquid temperature : -50 to +90°C

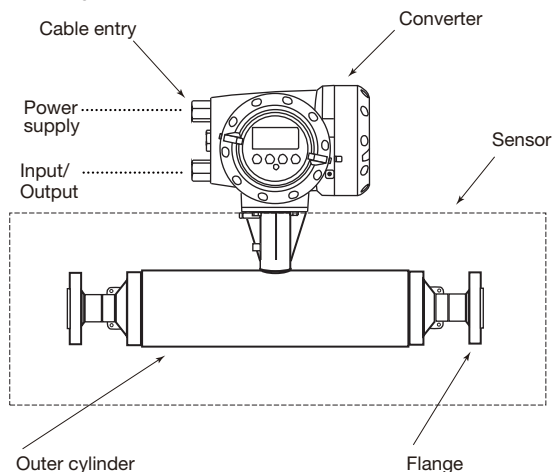
3) Remote type converter (Housing: aluminum)

Model: MMC400F-JEx

- Type of protection and class : Ex d[ia]IIC T6
 Ambient temperature : -20 to +60°C

NAMES OF PARTS

[Compact type]



FLOW RANGE

Meter size	Kg/h		Kg/min	
	Max. flow rate	Min. flow rate	Max. flow rate	Min. flow rate
100	420,000	1,560	7,000	26
150	900,000	4,000	15,000	66.7
250	2,300,000	11,000	38,333	183.3
*400	4,600,000	23,000	76,666	383.3

* Size 400 is currently in preparation.

PROCESS CONNECTION

- Flange connection

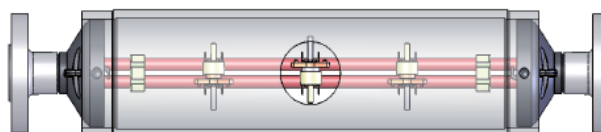
Meter size	Standard	Semi-standard	Option (1 rank larger)
	JIS	ASME	JIS/ASME
100	100A 10K	4" class 150	100A 20K 4"6" Class 150, 300, 600, 900, etc.
150	6" class 150		6"8" Class 150, 300, 600, 900, etc. Contact us for JIS flange.
250	10" class 150		10"12" Class 150, 300, 600, 900, etc. Contact us for JIS flange.
*400	14" class 150		12"14"16" Class 150, 300, 600, 900, etc. Contact us for JIS flange.

* Size 400 is currently in preparation.

SENSOR TUBE DIMENSIONS

Meter size	Material	Dimensions (mm)	
		Inside diameter	Wall thickness
100	S	46	1.3
150	S	69	2.11
250	S	108	3.05

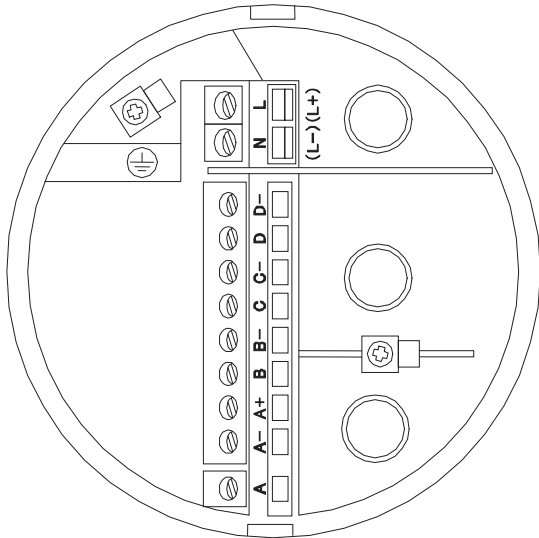
A straight twin tube with 2 measuring tubes is used for the sensor tube as shown below.



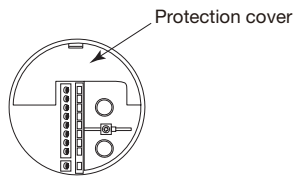
ELECTRICAL CONNECTION

Converter and I/O terminal for MMC400C/F

- Current output × 1, pulse output × 1, status output × 1, control input × 1 (as standard)



The power supply terminal has a protection cover.



Terminals	Description
L/L+	L/N for AC power supply
N/L-	L+/L- for DC power supply
⊕	Grounding

Terminals	Polarity	Description (standard)
D-	-	Pulse or status output
D	+	
C-	-	Status output
C	+	
B-	-	Control input or status output
B	+	
A+	+	Current output 4 to 20 mA/HART: Internal power supply
A-	-	Current output 4 to 20 mA/HART: External power supply
A	- +	Current output 4 to 20 mA/HART: Internal power supply

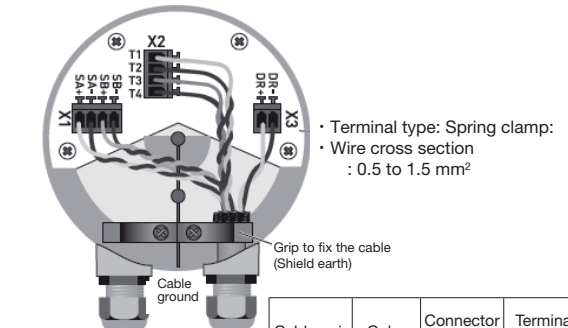
- Terminal type : Plug-in type screw terminal
- Wire cross section : 0.5 to 2.5 mm²
- Cable outside diameter : 7 to 12 mm

- Connection diagram for optional outputs (modular I/O print circuit)

Converter spec.	Polarity	Option 1: Current output × 2, pulse or status output × 1 (6A8)	Option 2: Current output × 3, pulse or status output × 1 (6AA)	Option 3: Current output × 2, pulse or status output × 2 (6AE)	
Terminals	D-	-	Pulse or status output	Pulse or status output	
	D	+	Pulse or status output	Pulse or status output No.1	
	C-	-	Current output No.1 (internal power supply)	Current output No.1 (internal power supply)	Current output No.1 (internal power supply)
	C	+			
	B-	-	Current output No.2 (internal power supply)	Current output No.2 (internal power supply)	Current output No.2 (internal power supply)
	B	+			
	A+	+			
	A-	-	Current output No.2 (internal power supply)	Current output No.3 (internal power supply)	Pulse or status output No.2
A	+				

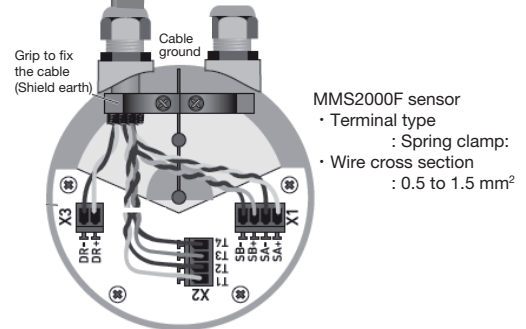
Cable for connecting the MMS1000F remote type sensor and MMC300F converter

MMS400F converter



Sensor cable (dedicated)
10-core compound cable
: 0.5 mm²
Outside diameter
: Approx. 15 mm
Maximum length
: 20 m

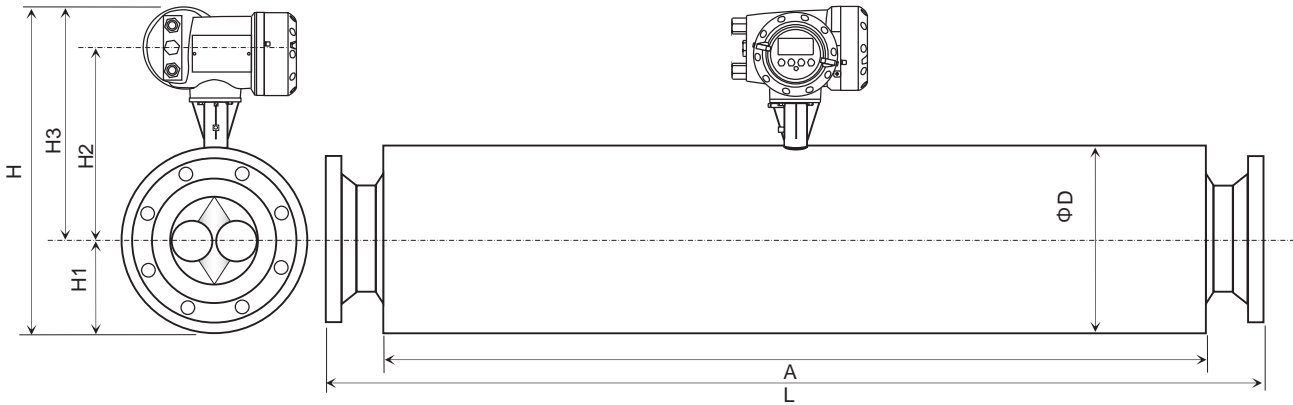
Cable pair	Color	Connector No.	Terminal No.
1	Yellow	X1	SA+
	Black		SA-
2	Green	X1	SB+
	Black		SB-
3	Blue	X2	T1
	Black		T2
4	Red	X2	T3
	Black		T4
5	White	X3	DR+
	Black		DR-



MMS2000F sensor
• Terminal type : Spring clamp:
• Wire cross section : 0.5 to 1.5 mm²

DIMENSIONS

MMM2400C compact type with flange connection



Meter size	Dimensions (mm)							Approx. mass (kg)
	L	A	H	H1	H2	H3	D	
100	1270	-	480 ±5	110 ±3	300 ±5	370 ±5	219 ±5	85
150	1649	-	584 ±5	162 ±3	352 ±5	422 ±5	323 ±5	212
250	2024	-	666 ±5	203 ±3	393 ±5	463 ±5	406 ±5	445
*400	2380	-	770 ±5	254 ±3	446 ±5	516 ±5	508 ±5	940

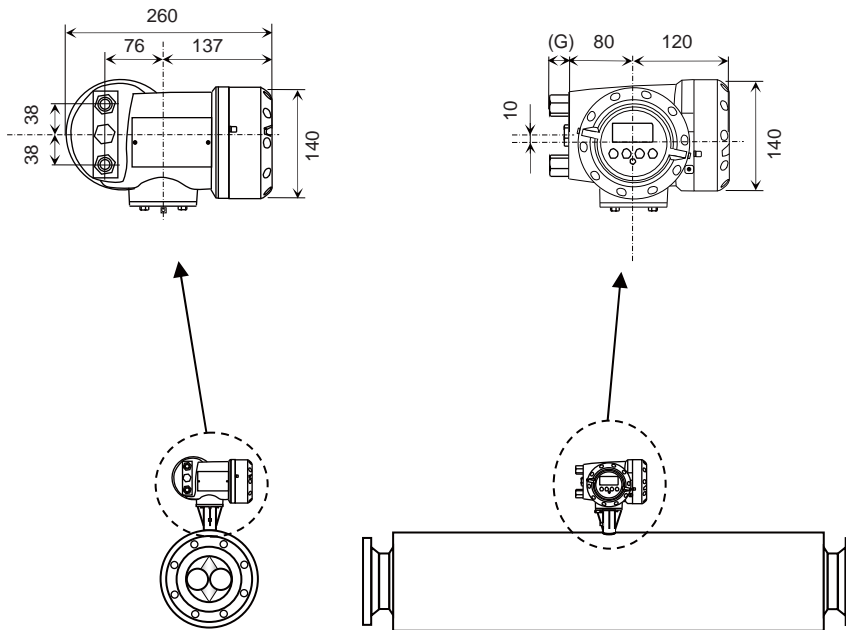
The face-to-face dimensions (L) above are for the standard flanges. For the optional flanges, refer to the table below.

* Size 400 is currently in preparation.

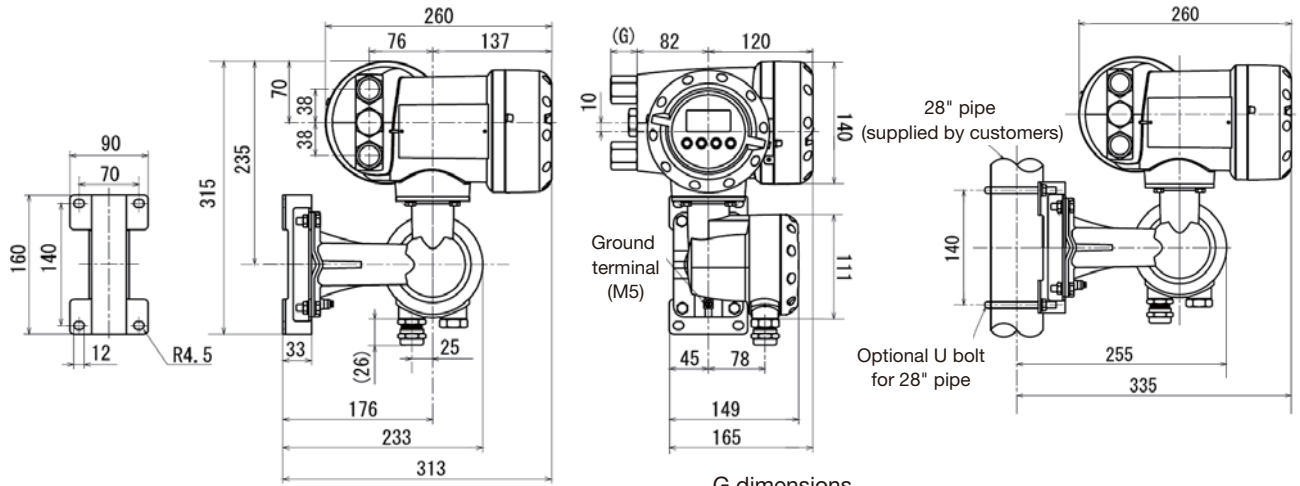
L (face-to-face dimension)

Meter size	Dimensions (mm)																				
	JIS 20K	ASME Class 150					ASME Class 300					ASME class 600					ASME class 900				
	100A	4"	6"	8"	10"	12"	4"	6"	8"	10"	12"	4"	6"	8"	10"	12"	4"	6"	8"	10"	12"
100	1296	1334	1358	-	-	-	1352	1378	-	-	-	1398	1428	-	-	-	1422	1474	-	-	-
150	-	-	1652	1678	-	-	-	1672	1698	-	-	-	1722	1754	-	-	-	1768	1812	-	-
250	-	-	-	-	2049	2075	-	-	-	2049	2075	-	-	-	2131	2139	-	-	-	2195	2227

The values in bold font show the face-to-face dimension (L) for standard flanges. Consult us for Class 1500.



● MMC400F remote type converter

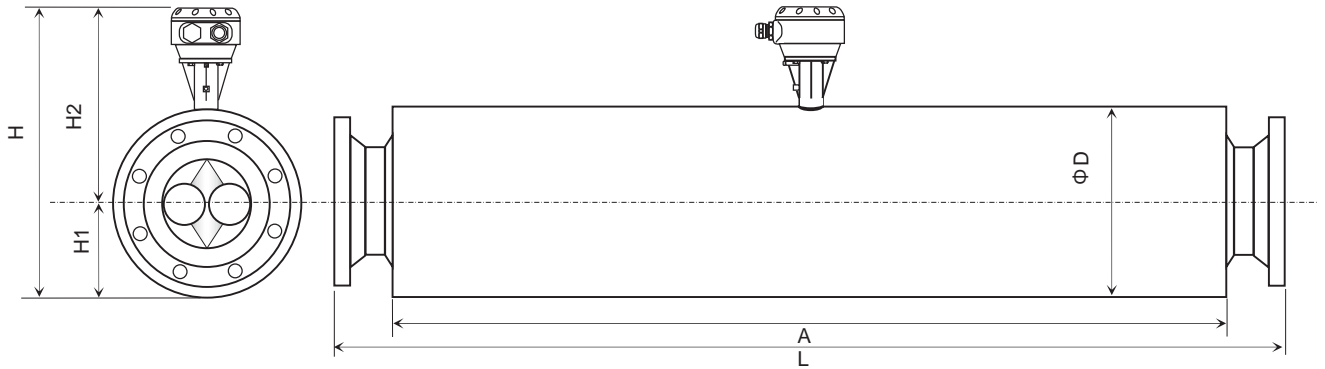


Converter mass: Approx. 5.8 kg

G dimensions

- G1/2 female adaptor: 26 mm
- 1/ 2NPT female adaptor: 26 mm
- TIIS-certified explosionproof: 74 mm (in preparation)

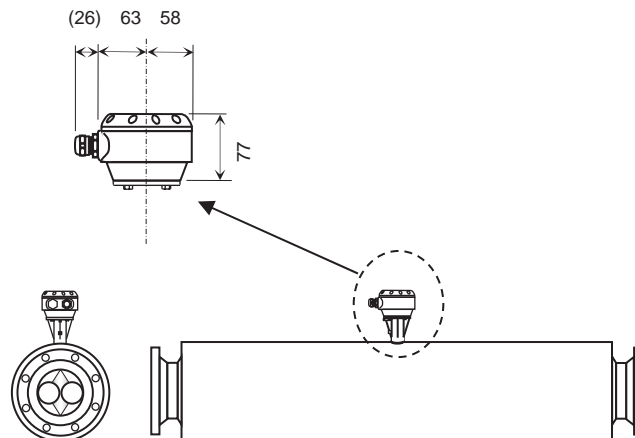
● MMS2000F remote type sensor with flange connection



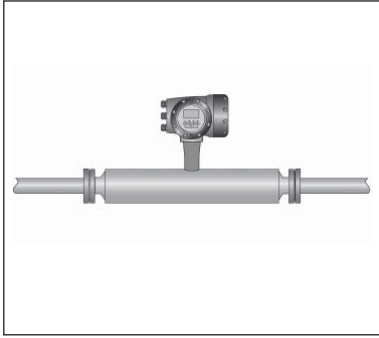
Meter size	Dimensions (mm)						Approx. mass (kg)
	L	A	H	H1	H2	D	
100	1270	-	417 ±5	110 ±3	307 ±5	219 ±5	81
150	1649	-	521 ±5	162 ±3	359 ±5	323 ±5	208
250	2024	-	603 ±5	203 ±3	400 ±5	406 ±5	441
*400	2380	-	707 ±5	254 ±3	453 ±5	508 ±5	936

The face-to-face dimensions (L) above are for the standard flanges. For the optional flanges, refer to the table below.

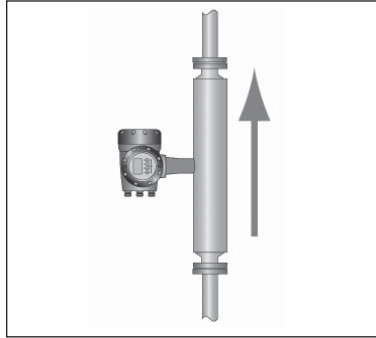
* Size 400 is currently in preparation.



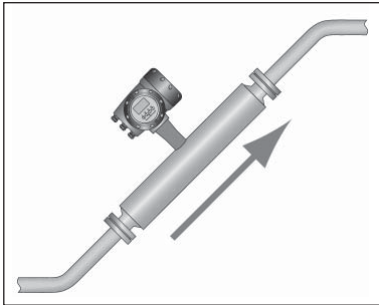
INSTALLATION NOTES



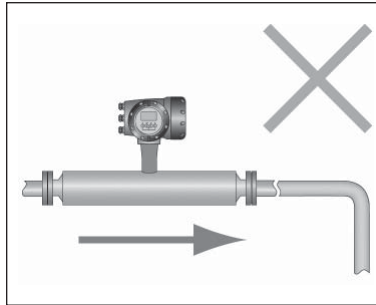
①When installing the flowmeter in the horizontal direction, place the converter (or the terminal box for the remote type) on the upper side of the measuring tube.



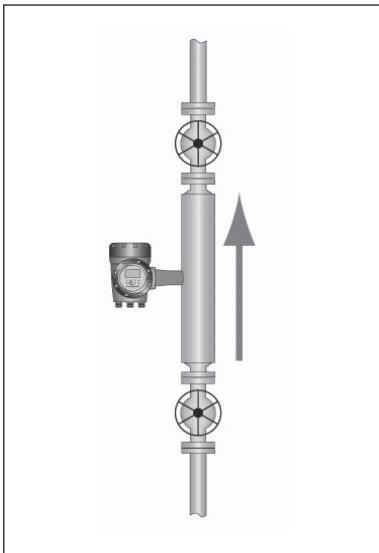
②When installing the flowmeter in the vertical direction, place it in the upward flow direction.



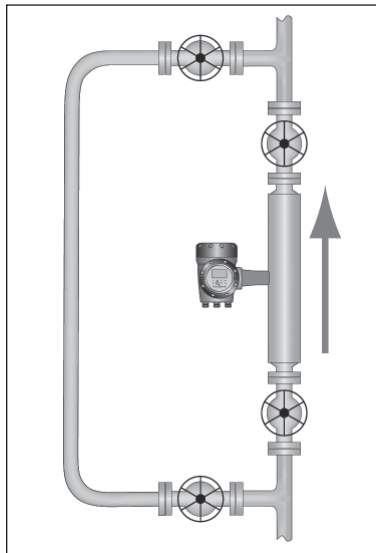
③When installing the flowmeter at an angle to the upward flow, place the converter (or the terminal box for the remote type) on the upper side of the measuring tube.



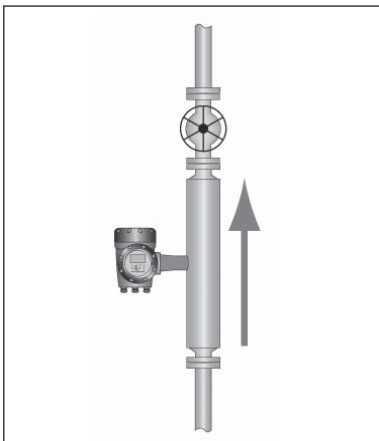
④When installing the flowmeter in the horizontal direction, do not place the upper and lower pipes near the flowmeter downwards such that the measuring tube of the flowmeter is always filled with liquid. Also, avoid setting it at the top of the process pipe where air or gas tends to be easily left over.



⑤When installing the flowmeter in the vertical direction, set the stop valve on the upper and lower sides and make sure to keep the flowmeter filled with liquid for zero adjustment.



⑥It is recommended to install a bypass pipe for maintenance.



⑦To avoid the influence of cavitation caused by the throttling structure of the valve, place the flow control valve on the lower side of the flowmeter.

