TECHNICAL GUIDANCE

MASSMAX 3400R Series

Coriolis Mass Flowmeter with Single Measuring Tube for Small Flow

OUTLINE

The Coriolis mass flowmeter **MASSMAX** 3400R series consists of the single Z-shaped measuring tube which is well-accepted as very small flow measurement, and newly-developed high performance converter MMC400R.
The epoch-making sensing technologies have achieved the accurate flow measurement of very small flow rate with a wide rangeability.
Stainless steel 316L as standard and Hastelloy® C22 as an option are used for the wetted parts of the flowmeter. With 3 sizes of 1, 3 and 4mm **MASSMAX** MMC400R is suitable for the accurate measurement of very small flow rate as low as 1 kg/h or less.

FEATURES

- ❏ High accuracy measurement of very small flow rate down to 5 g/min
- ❏ Maximum pressure rating 30 MPa
- ❏ High accuracy: ±0.1% of reading (+ Zero stability)
- ❏ Excellent zero stability and high vibration proof
- ❏ Duplicated protection with outer housing made of stainless steel
- ❏ Available both sensor-converter integrally mounted compact type, and separately mounted remote type
- ❏ Compliant with Japanese standard explosionproof

STANDARD SPECIFICATIONS

- Measuring principle : Coriolis force
- Meter size : 01, 03, 04 (mm)
- Measuring range :

Meter size	kg/h		kg/min	
	Max. flow rate	Min. flow rate	Max. flow rate	Min. flow rate
01	20	0.3	0.333	0.005
03	130	2	2.166	0.033
04	450	7	7.5	0.1166

- Enclosure : IP67 (IEC 60529)
- Ambient temperature: –40 to +60°C
  (compact type: Aluminum alloy converter)
  –40 to +65°C
  (compact type: Stainless steel converter)
  –40 to +65°C (remote type)
  See [Explosionproof] for the ambient temperature range of Ex types.

Fluid specifications

- Fluid : Liquids
- Fluid temperature and pressure:

Measuring Tube		Temperature *	Pressure
S	Stainless steel 316L	–40 to +150°C	0 to 15 MPa (abs)
H	Hastelloy® C-22		0 to 30 MPa (abs)

Note: Pressure in this table means the allowable pressure range of the measuring tube. See [Pressure and temperature rating table] for details.
* See [Explosionproof] for the ambient temperature range of Ex types.

- Density : 400 to 3000 kg/m^3

Sensor specifications

- Process connection: 1/4" NPT Male
- Materials:
  Wetted parts:

Material symbol	S	H (Option)
Measuring Tube	Stainless steel 316L	Hastelloy® C22
Fittings	Stainless steel 316L	Hastelloy® C22

Non Wetted Part:
Outer housing; Stainless steel 316L
Base plate; Stainless steel 316L

- Outer housing protection:
  3 MPa (abs) or less in fluid pressure
  : Standard
  More than 3 MPa (abs) in fluid pressure
  : With a bursting disc

Converter

- Housing material : Aluminum alloy, SS316L as an option
- Painting : Siloxane coating
- Color : Gray for converter housing, jade green for converter cover and terminal cover
- Power supply : 100 V to 230 V AC (85 V to 253 V AC)
  Option; 24 V DC (11 to 31 V DC)
  Voltages in parentheses indicate the acceptable voltage range.
- Supply frequency : 50/60Hz AC
- Power consumption : AC; approx. 22 VA, DC; approx. 12 W
- Grounding : Grounding resistance must be less than 100Ω for Non-ex types (Q-type), less than 10Ω for Ex types
- Cable Entry : G1/2 Female adapter × 2
  or 1/2 NPT Female adapter × 2
  or M20 × 1.5 Female thread × 2
  or G1/2 Flame proof adapter × 2
  (Japanese standard explosionproof)
  Note: Up to 3 cable entries can be provided.

Indication and outputs

- Display : Blue dot matrix LCD with backlight 128 × 64 pixels (59 × 31 mm) Each of 4 screens shows data in up to 3 lines. Data include instantaneous mass flow rate (bar graph indication available), totalized mass flow, instantaneous volume flow rate, totalized volume flow rate, density, temperature, and instantaneous flow rate trend graph (percentage indication). Setting parameters and self-diagnosis results are also displayed.

  Units of instantaneous mass flow rate
  : kg/h, kg/min, kg/sec, t/h, and others
  Forward and reverse flow directions are indicated with "+" or "−".

  Units of totalized mass flow rate
  : kg, t, g, and others
  Totalization of flow rates in forward and reverse directions is possible.

  Units of density : g/cm^3, kg/m^3, and others

  Units of temperature : °C, and others
- Current output : 4 to 20 mA (max. 22 mA)
  *Preparing for HART communication
  Load resistance is less than 1000Ω.±5μA
  Select from among instantaneous mass flow rate, density, and temperature.
- Pulse output : Open collector output

  Load rating: 32 V DC

  20 mA or less (100 Hz < f ≤ 10 kHz)

  Residual voltage at close <1.5 V (load current ≤ 1 mA)
  <2.5 V (load current ≤ 10 mA)
  <5 V (load current ≤ 20 mA)

  100 mA or less (f ≤ 100 Hz)

  Residual voltage at close <0.2 V (load current ≤ 10 mA)
  <2 V (load current ≤ 100 mA)

  Output frequency : Max. 10 kHz

  Pulse rate : 36 to 36,000,000 pulse/h (0.01 Hz to 10 kHz)

  Pulse width : Selectable from:
  (1) Automatic: Pulse width which makes duty 50% at full scale 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, 100 mA or less

  Residual voltage at close <0.2 V (load current ≤ 10 mA)
  <2 V (load current ≤ 100 mA)

  Contents : Selectable from:
  (1) No status output (default setting)
  (2) Flow direction identification
  (3) Flow over-range
  (4) Totalization preset
  (5) Range identification (when double ranges are used)
  (6) Errors and measurement alarms for flow rate, density, temperature, and others
- Control input

  Input voltage : 8 to 32 V DC (ON)/2.5 V DC, 0.4 mA or less (OFF)

  Max. current : 6.5 mA (input voltage ≤ 24 V DC)

  Max. current : 8.2 mA (input voltage ≤ 32 V DC)

  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 double ranges are used)
  (7) Others
- Combination of outputs

  Standard : 4 to 20 mA output × 1, pulse output × 1, status output × 1, control input × 1 (total 4 points)

  Option 1 : 4 to 20 mA output × 2, pulse output × 1 (total 3 points)

  Option 2 : 4 to 20 mA output × 3, pulse output × 1 (total 4 points)

  Option 3 : 4 to 20 mA output × 2, status output or pulse output (selectable) × 2 (total 4 points)
  See "Converter code" on page 11 for details.
- Low cut-off : Current output and pulse output (can be set separately for each indication)

  Range : 0 to 20% F.S. (0.1% step)

  Hysteresis : 0 to 5% F.S. (0.1% step)
- Time constant : Current output and pulse output (can be set separately for each indication)

  Range : 0.0 to 100.0 sec (0.1 sec step)

Standard functions

- User-defined measuring units
  : Units for mass, volume, and time can be defined (max. 7 letters).
- Bi-directional flow measurement
  : Flow rates in both directions can be measured.
  Flow direction is output as status output.
- Self-diagnosis : Error messages and status messages are displayed.

  Function : CPU, memory, software, hardware, output connection

  Status : Over-range, count-over, power failure

  Application : Oscillating balance of measuring tube, vibration energy, other sensor circuit diagnosis
- Testing : Built-in simulator of current and pulse outputs
  Allows for loop check without calibrator.
- Touch sensor (optical key)
  : Four touch sensors enable data to be set from outside without the need for opening the cover.
  These serve as push buttons while the cover is opened.

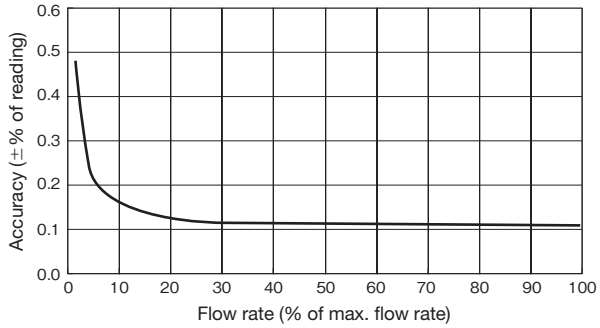
Accuracy (calibrated at the factory)

• Mass flow rate (pulse output)

Accuracy	±0.1% of reading
Zero stability	±0.0057% of max. flow rate

• Reference conditions: Water at 20°C, 0.2 MPa

Measurement error (accuracy + zero stability)



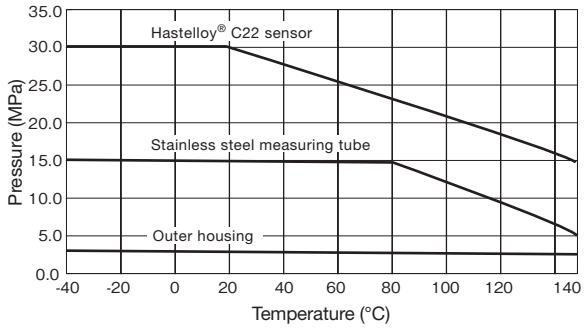
Flow rate		Measurement error (± % of reading)
% of max. flow rate	100%	0.106
	50%	0.111
	20%	0.129
	10%	0.157
	5%	0.214
	1.5%	0.48

Note: Accuracy is not assured for flow rates less than 1.5% of max. flow rate.

Effects of changes in process conditions:
Fluid temperature: ±0.0056% of max. flow rate for each 1°C
Example
When the size changes by 1°C with size S01: 20 kg/h × 0.000056 = 0.00112 kg/h
Fluid pressure: ±0.013% of max. flow rate for each 0.1 MPa
These effects should be considered when process conditions change after zero adjustment.

• Temperature (indicated value)

Measuring range	–40 to + 150℃
Accuracy	±1℃



Note: Specify the bursting disc when the process pressure is more than the limitation.

Explosion Proof

- Japanese standard explosionproof
  Type of protection and class:
  Compact type MMM3400RC-JEx
  (Certificate number: CML21JPN1739X, CML21JPN21175X)
  Ex db ia IIC T6...T1 Ga/Gb
  Ex db eb ia IIC T6...T1 Ga/Gb
  Ex tb IIIC T165°C Db

  Remote type sensor MMS3000RF-JEx
  (Certificate number: CML21JPN2904X, CML21JPN21181X)
  Ex ia IIC T6...T1 Ga
  Ex ia IIIC T165°C Da

  Remote type converter MMC400RF-JEx
  (Certificate number: CML21JPN1740X, CML21JPN21182X)
  Ex db [ia] IIC T6 Gb
  Ex db eb [ia] IIC T6.Gb
  Ex tb IIIC T75°C Db

  Compact type MMM3400RC-JEx
  (Japanese standard explosionproof)
  Compact type MMM3400C-Ex (ATEX/IECEx explosionproof)
  Aluminum alloy converter housing (standard)

Ambient temperature °C	Fluid temperature °C	Temperature class	Max. surface temperature °C
−40 to +40	65	T6–T1	T80
	80	T5–T1	T95
	115	T4–T1	T130
	150	T3–T1	T165
−40 to +50	65	T6–T1	T80
	80	T5–T1	T95
	115	T4–T1	T130
	130	T3–T1	T165
−40 to +65	65	T6–T1	T80

  Stainless steel converter housing (optional)

Ambient temperature °C	Fluid temperature °C	Temperature class	Max. surface temperature °C
−40 to +40	65	T6–T1	T80
	80	T5–T1	T95
	115	T4–T1	T130
	150	T3–T1	T165
−40 to +50	65	T6–T1	T80
	80	T5–T1	T95
	115	T4–T1	T130
	130	T3–T1	T145
−40 to +65	60	T6–T1	T75

  Remote type MMS3000RF-JEx
  (Japanese standard explosionproof)
  Remote type MMS3000F-Ex (ATEX/IECEx explosionproof)

Ambient temperature °C	Fluid temperature °C	Temperature class	Max. surface temperature °C
−40 to +40	65	T6–T1	T80
	80	T5–T1	T95
	115	T4–T1	T130
	150	T3–T1	T165
−40 to +50	65	T6–T1	T80
	80	T5–T1	T95
	115	T4–T1	T130
	150	T3–T1	T165
−40 to +65	65	T6–T1	T80
	80	T5–T1	T95
	115	T4–T1	T130
	130	T3–T1	T145

- ATEX explosionproof
  Type of protection and class:
  Compact type MMM3400C-Ex
  (Certificate number: PTB17 ATEX 2008 X)
  II 1/2(1)G Ex db ia [ia Ga] IIC T6...T1 Ga/Gb or
  II 1/2(1)G Ex db eb ia [ia Ga] IIC T6...T1 Ga/Gb or
  II 1/2 G Ex db ia IIC T6...T1 Ga/Gb
  II 1/2 G Ex db ea ia IIC T6...T1 Ga/Gb
  II 2(1)D Ex tb [ia Da] IIIC Txxx°C Db or
  II 2D Ex tb IIIC Txxx°C Db

  Remote type sensor MMS3000F-Ex
  (Certificate number: PTB17 ATEX 2007 X)
  II 1 G Ex ia IIC T6...T1 Ga or II 1 D Ex ia IIIC Txxx°C Da

  Remote type converter MMC400F-Ex
  (Certificate number: PTB17 ATEX 2009 X)
  II 2(1) G Ex db [ia Ga] IIC T6 Gb
  II 2(1)G Ex db eb [ia Ga] IIC T6 Gb or
  II 2 G Ex db[ia] IIC T6 Gb or
  II 2 G Ex db eb [ia] IIC T6 Gb or
  II 2(1)D Ex tb [ia Da] IIIC T75°C Db or
  II 2D Ex tb IIIC T75°C Db

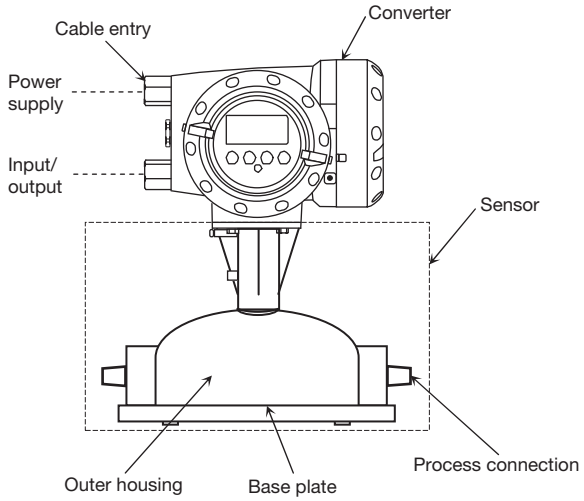
- IECEx explosionproof
  Type of protection and class:
  Compact type MMM3400C-Ex
  (Certificate number: IECEx PTB17.0029X)
  Ex db ia [ia Ga] IIC T6...T1 Ga/Gb or
  Ex db eb ia [ia Ga] IIC T6...T1 Ga/Gb or
  Ex ia IIC T6...T1 Ga/Gb or
  Ex eb ia IIC T6...T1 Ga/Gb or
  Ex tb [ia Da] IIIC Txxx°C Db or
  Ex tb IIIC Txxx°C Db

  Remote type sensor MMS3000F-Ex
  (Certificate number: IECEx PTB17.0028X)
  Ex ia IIC T6...T1 Ga or II 1 D Ex ia IIIC Txxx°C Da

  Remote type converter MMC400F-Ex
  (Certificate number: IECEx PTB17.0030X)
  Ex db [ia Ga] IIC T6 Gb
  Ex db eb [ia Ga] IIC T6 Gb or
  Ex db[ia] IIC T6 Gb or
  Ex db eb [ia] IIC T6 Gb or
  Ex tb [ia Da] IIIC T75°C Db or
  Ex tb IIIC T75°C Db

NAMES OF PARTS

[Compact type]



FLOW RANGE

Meter size	Max. flow rate	
	kg/h	Kg/min
01	20	0.333
03	130	2.166
04	450	7.5

MEASURING TUBE DIMENSIONS

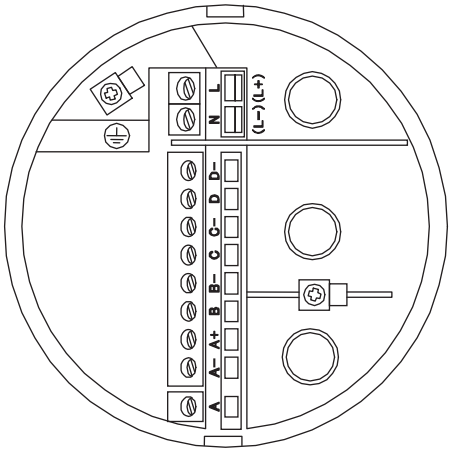
Meter size	Materials	Dimensions (mm)	
		Inside diameter	Wall thickness
01	S	1.20	0.20
	H		
03	S	2.58	0.30
	H		
04	S	3.94	0.41
	H		

Material S: Stainless steel 316L
H: Hastelloy® C22

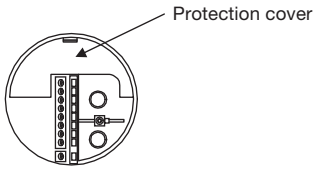
ELECTRICAL CONNECTION

[I/O terminals of MMC400RC/F converters]

- Two terminals for current output and pulse or status output (standard output)
  When other inputs/outputs are required, select them from the options.



The power supply terminal block has a protection cover.



Terminals	Description
L/L+	L and N for AC power supply L+ and L– for DC power supply
N/L–	
⏚	Grounding

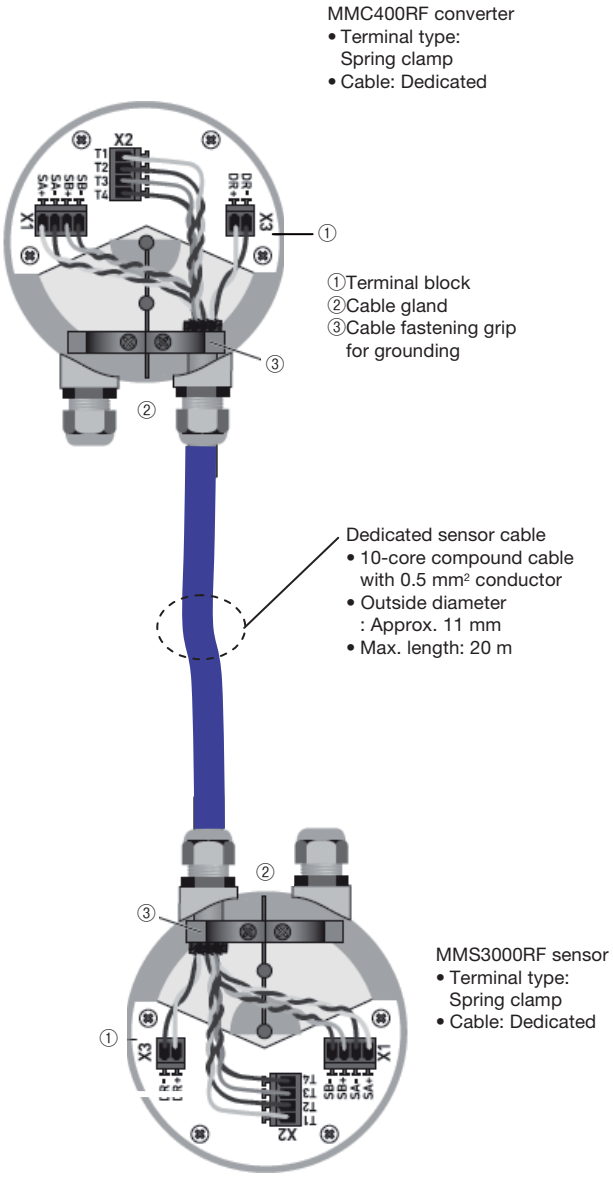
Terminals	Polarity	Description (Standard: Code 600)
D–	–	Pulse or status output, frequency pulse, alarm output
D	+	
C–	–	Current output (4 to 20 mA/internal power supply)
C	+	
B–		
B		
A+		
A–		
A		

- 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 specifications		Polarity	Option 1 Current output, pulse or status output, control input (6EK)	Option 2 Current output × 2, pulse or status output (6A8)	Option 3 Current output × 3, pulse or status output (6AA)	Option 4 Current output × 2, pulse or status output × 2 (6AE)
Terminal	D–	–	Pulse or status output, frequency pulse, alarm output	Pulse or status output	Pulse or status output	Pulse or status output No. 1
	D	+				
	C–	–	Current output	Current output No. 1	Current output No. 1	Current output No. 1
	C	+				
	B–	–	Control input		Current output No. 2	Pulse or status output No. 2
	B	+				
	A+					
	A–	–	Status output or pulse, frequency pulse, alarm output	Current output No. 2	Current output No. 3	Current output No. 2
	A	+				

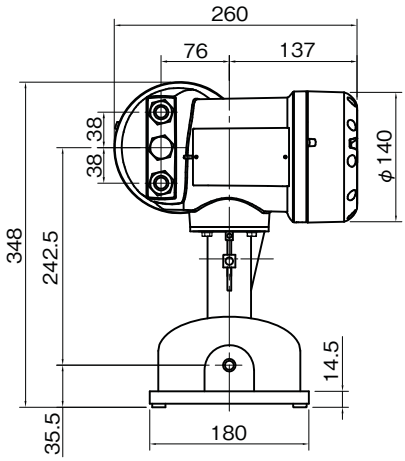
[Remote type sensor cable MMS3000RF + MMC400RF]



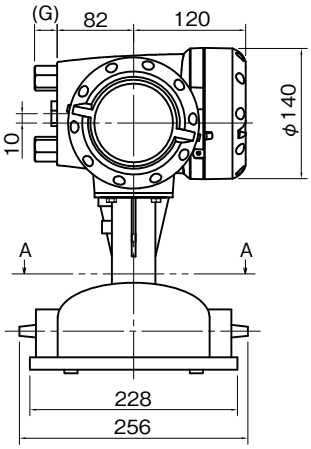
DIMENSIONS

●MMM3400RC compact type

Mass: Approx.12 kg

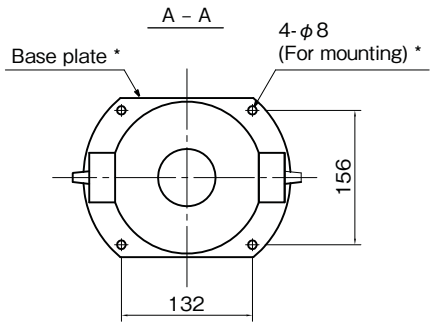


Outer housing protection
Standard



Flow direction as standard

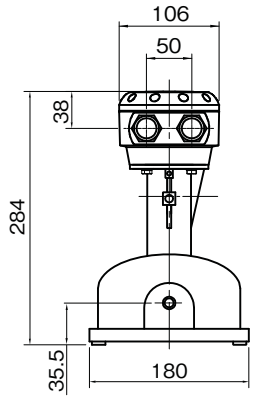
Length "G": 26 mm for G1/2 female adapter, 1/2 NPT female adapter and Water-Proof gland. 85 mm for Japanese standard explosionproof construction.

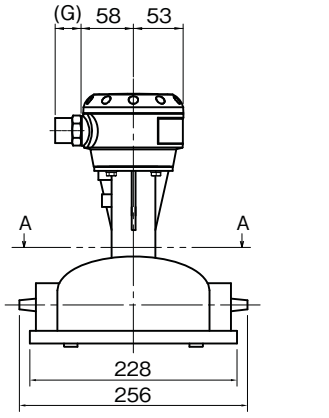


* The base plate of flowmeter shall be fixed firmly on a pedestal or the like. Do not support flowmeters by piping or piping fittings.

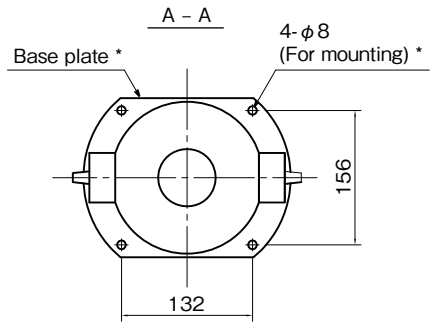
●MMS3000RF remote type sensor

Mass: Approx.10 kg





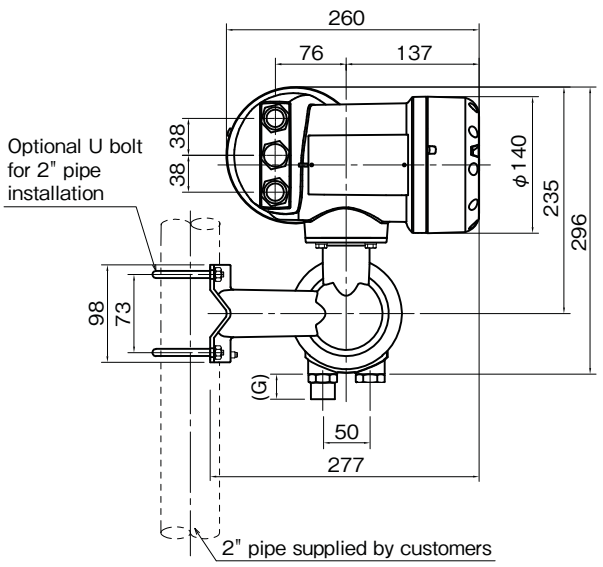
Flow direction as standard

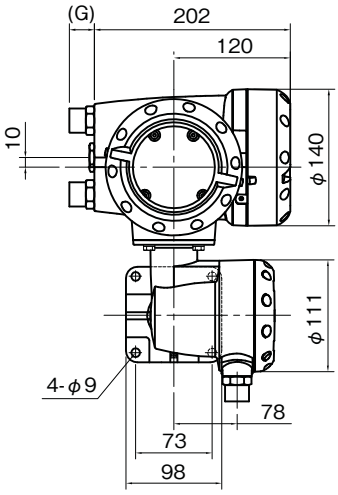


* The base plate of flowmeter shall be fixed firmly on a pedestal or the like. Do not support flowmeters by piping or piping fittings.

●MMC400RF remote type converter

Mass: Approx. 5.8 kg



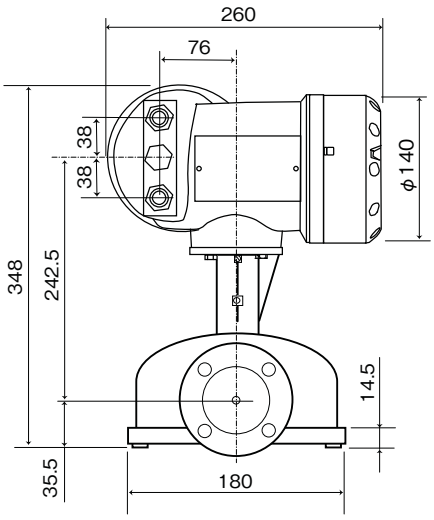


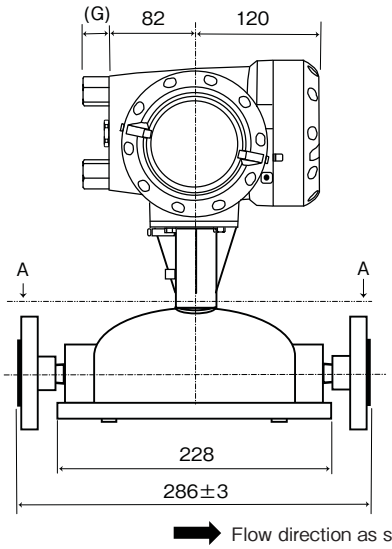
Length "G": 26 mm for G1/2 female adapter, 1/2 NPT female adapter and Water-Proof gland.
85 mm for Japanese standard explosionproof construction.

DIMENSIONS (optional)

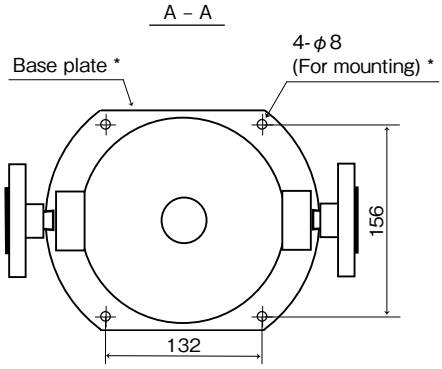
●MMM3400RC compact type with flange fitting
15A JIS20K, 1/2" ASME150lb, 1/2" ASME300lb

Mass: Approx. 12 kg





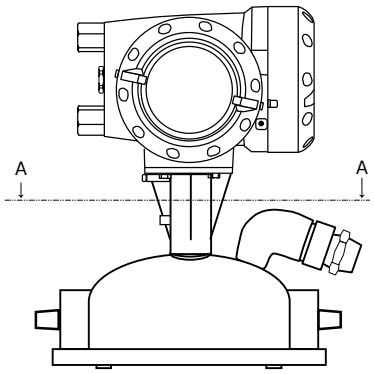
Length "G": 26 mm for G1/2 female adapter, 1/2 NPT female adapter and Water-Proof gland. 85 mm for Japanese standard explosionproof construction.

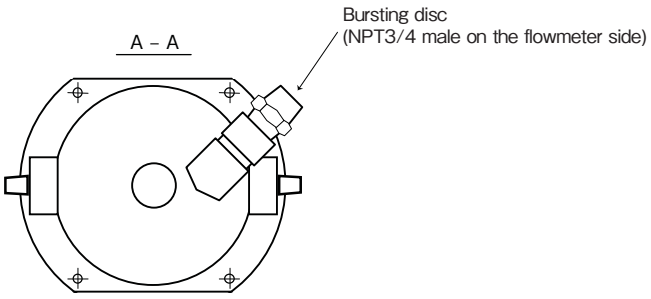


Flow direction as standard

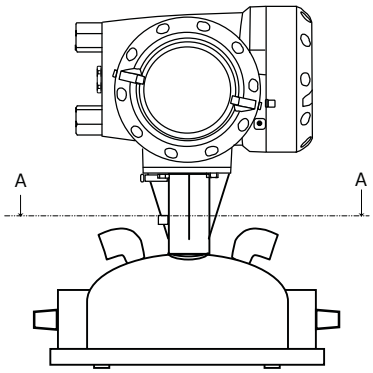
* The base plate of flowmeter shall be fixed firmly on a pedestal or the like. Do not support flowmeters by piping or piping fittings.

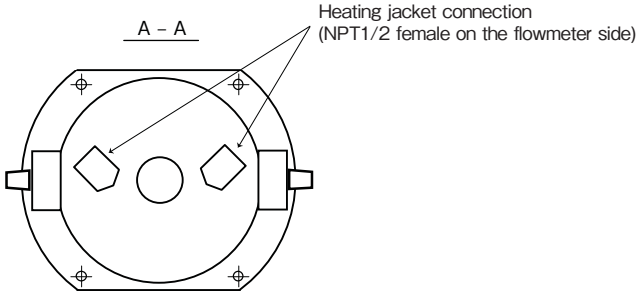
● With bursting disc (for illustration purposes)
When fluid pressure exceeds 3 MPa,
a bursting disc is added to the outer housing for releasing pressure.





● Heating jacket (for illustration purposes)
Heating jacket cannot be used with a bursting disc.





MODEL AND SPECIFICATION CODES

Measuring tube material: "S" Stainless Steel 316L (standard) / "H" Hastelloy® C22 (optional)

[Model code]

Specifications	Compact type (Sensor + Converter)	Remote type	
		Sensor	Converter
General purpose (non explosionproof)	MMM3400RC-■□□	MMS3000RF-■□□	MMC400RF
Japanese standard explosionproof	MMM3400RC-JEx-■□□	MMS3000RF-JEx-■□□	MMC400RF-JEx
ATEX / IECEx explosionproof	MMM3400C-Ex-■□□	MMS3000F-Ex-■□□	MMC400F-Ex

Note: ■: S or H are assigned material codes. □□: 01 or 03 or 04 are assigned as size codes.

[Sensor code]

Sensor Spec. Code	VE		4		0		0				0			0			Description	Std.
Sensor Code	VE																MMS3000 Sensor (Single Z-shaped Measuring Tube)	○
Meter Size		01															Meter Size 01	○
		03															Meter Size 03	○
		04															Meter Size 04	○
(Fixed Code)			4														Always 4	○
Measuring Tube Material				S													Stainless steel 316L	○
				H													Hastelloy® C22	
Measuring Tube Surface Finish					0												Standard	○
Process Connection						HK											1/4" NPT male	○
						UH											15A JIS20K	
						KD											1/2" ASME class150	
						KE											1/2" ASME class300	
(Fixed Code)							0										Always 0	○
Outer Housing Pressure Rating								A									When the fluid pressure is 3 MPa at 20°C or less (standard)	○
								C									When the fluid pressure is 3 MPa at 20°C or higher with bursting disc	
Heating Jacket									0								Without	○
									2								Heating jacket (1/4NPT female)	
Explosionproof Approvals										0							Without	
										1							ATEX explosionproof (Ex)	
										R							IECEx explosionproof (Ex)	
										9							Japanese standard explosionproof (JEx)	○
Sanitary Approvals											0						Without	○
Type												0					Compact type	○
												1					Remote type with aluminum terminal box	
												2					Remote type with Stainless Steel terminal box	
Calibration													0				Standard 3-point flow calibration	○
													1				5-point fow calibration	
Degreasing														0			Without	○
														1			Degreasing wetted parts	
(Fixed Code)															0		Always 0	
Converter type																6	Compact type	
																7	Remote type	
Special specifications																	00 Without	○
																	00/Z Special	

[Converter code]

MMC400RC/RF

																							Description	Std.
Converter Spec. Code	VE	54	4				2	0	0		2				0	0								
Converter code	VE	54																					MMC400R converter	○
(Fixed code)			4																				Always 4	○
Type				4																			Compact type	○
				H																			Remote type (mandatory for ship class, high temperature, and low temperature models)	
Power supply					A																		100 to 230 V AC	○
					1																		12 to 24 V DC	
Explosionproof Approval						0																	Without	○
						1																	ATEX explosionproof (Ex)	
						F																	IECEx explosionproof (Ex)	
						9																	Japanese standard explosionproof (JEx)	
Cable entries for input, output, and power supply							0																M20 × 1.5 female for ATEX explosionproof	
							4																1/2NPT female adapter	
							5																G1/2 female adapter	○
							6																Waterproof gland	
							9																G1/2 flameproof gasket adapter for Japanese standard explosionproof	
Language for indication								2															English	○
(Fixed code)									0	0													Always 00	○
Converter housing											1												Aluminum alloy	○
											2												SS316L (compact type)	
											3												SS316L (remote type)	
(Fixed code)												2											Always 2	○
Output													6	0	0								4 to 20 mA × 1, pulse or status × 1, total 2	○
													6	E	K								4 to 20 mA × 1, pulse × 1, status × 1, control input × 1	
													6	A	8								4 to 20 mA × 2, pulse or status × 1 (selectable)	
													6	A	A								4 to 20 mA × 3, pulse or status × 1 (selectable)	
													6	A	E								4 to 20 mA × 2, pulse × 1, pulse or status × 1 (selectable)	
Measurement																0							Mass flow rate, density, temperature as standard	○
(Fixed code)																	0						Always 0	○
Sensor cable																		0					Without (compact type)	○
																		4					5 m cable (only for remote type)	
																		1					10 m cable (only for remote type)	
																		5					20 m cable (only for remote type)	
Special specifications																			00				Without	
																			00/Z				Special	

Note: Special requirements not included in the above coding system should be designated by adding "/Z" at the end of the code. Consult us for the availability of such requirements before ordering.

STANDARD ACCESSORIES

- Data sheet for setting : 1 set
- Instruction manual : 1 set

OPTIONS

- Waterproof cable gland for G1/2 cable connection (code: WG)
- Number of cable entries for external connection: 3 (code: 3G)
- U bolt for 2" pipe installation (code: PM)

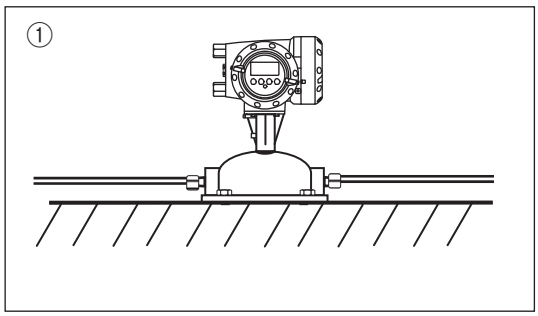
SPECIFICATION CODES WHEN ORDERING

1. Model and specifications
   Examples
   Model: MMM3400RC
   Sensor Code : VE014S0HK0A0000000600
   Converter Code : VE5444A052001260000000
2. Options as requested
   Specify them with their codes.

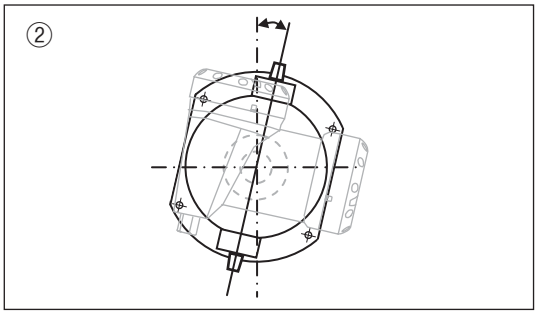
INSTALLATION NOTES

Observe followings for the installation of **MASSMAX** 3400R on the piping.

- In both cases of horizontal and vertical installation, the base plate of flowmeter shall be fixed firmly on a pedestal or the like by using 4 mounting holes located on the base plate as shown in figure ① below. Do not support the flowmeter by piping or piping fittings.
- Install the flowmeter on the vertical piping within the allowable inclination as shown in drawings ②. Do not install the flowmeter on the inclined piping.
- Do not install the flowmeter as note 1 and note 2 below.
- Arrange the piping so that the measuring tube is filled with fully liquid.
- Install the control valve at the downstream side of the flowmeter, if required, to avoid possible cavitation caused by throttling of upstream control valve.

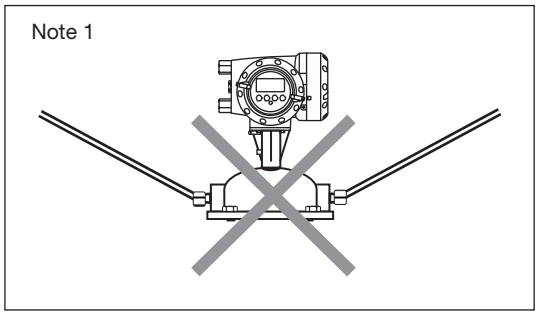


① Install the flowmeter on the flat surface.

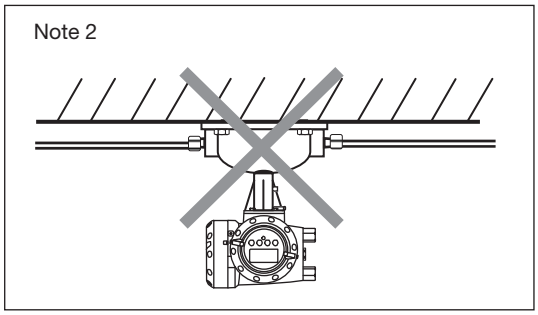


② When installing the flowmeter on the vertical lines, install it within the following inclination to make draining and venting easy during the stoppage of fluid.

<Inclination angle>
S01: less than 7 degrees
S03 and S04: less than 13 degrees



Note 1: Avoid too much stress to the flowmeter from the installed piping. Eliminate any distortion or centering deviation of piping before installation.



Note 2 : Do not install the flowmeter upside down.

* Specification is subject to change without notice.

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