

GENERAL

The Coriolis mass flowmeter **MASSMAX®** 3400 series consists of the single Z-shaped measuring tube which is well-accepted as very small flow measurement, and newly-developed high performance converter MMC400.

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®** MMC400 is suitable for the accurate measurement of very small flow rate as low as 1 kg/h or less.

FEATURES

- ❑ Single Z-shaped measuring tube
- ❑ Maximum pressure rating 30 MPa
- ❑ High accuracy : $\pm 0.1\%$ 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
- ❑ Certified explosionproof by ATEX and TIIS
 - ATEX : Equipment intended for use in potentially explosive atmosphere in Europe
 - TIIS : Technology Institute of Industrial Safety in Japan
- ❑ CE Marking

STANDARD SPECIFICATIONS

- Measuring Principle: Coriolis force
- Meter Size : 01, 03, 04 mm
- Measuring Range :

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

- Enclosure : IP66/67 (IEC 60529)
- Ambient Temperature : -40 to +55°C (Compact version)
-40 to +60°C
(Separate Sensor and Converter)
*Refer to [Explosion Proof] for the ambient temperature range of Ex type.



Fluid Specifications

- Fluid : Liquid
- Fluid Temperature and Pressure :

	Measuring Tube	Temperature *1	Pressure *2
S	Stainless steel 316L	-40 to +150°C	0 to 15 MPa (abs)
H	Hastelloy® C-22		0 to 30 MPa (abs)

*1 Refer to [Explosion Proof] for fluid temperature range of Ex type
*2 "Temperature" and "Pressure" in this table means allowable temperature and pressure range of the measuring tube. Besides, the maximum operating condition of the process must be within "Pressure and temperature rating table" shown in this Technical Guidance.

- Density : 400 to 3000 kg/m³

Sensor

- Process Connection : 1/4" NPT Male
- Materials :

Wetted Part :

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 : Grey (Converter housing), Jade green
(Converter cover / Terminal box 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 () are acceptable.
- Supply Frequency : 48 to 63 Hz
- Power Consumption : AC; approx. 22 VA, DC; approx. 12 W
- Grounding : Grounding resistance must be less than
100Ω for Non-Ex version
10Ω for Ex version
- Cable Entry : 2×G1/2 Female adapter or
2×1/2 NPT Female adapter or
2×M20×1.5 Female thread or
2×G1/2 Flame proof adapter for TUIS-Ex
Note Maximum 3 cable entries can be
provided.

Indication and outputs

- Indicator : Blue dot matrix LCD with back light
128×64 pixels, or 59×31 mm
Presentation : Changeable from 4 screens. Each
screen shows maximum 3 lines of data.
The data include instantaneous mass
flow rate capable bar graph indication,
totalizing mass flow, instantaneous
volume flow rate, totalizing volume flow,
density, temperature, and flow trend
graph in %.
The setting data and self-diagnosis data
are also presented.
- Instantaneous mass flow rate units
: kg/h, kg/min, kg/sec, t/h or others. Flow
direction is indicated as "+" and "-" for
forward and reverse flow respectively.
- Totalizing mass flow units: kg, t, g or others, in forward and re-
verse flow
Density units : g/cm³, kg/m³, others
Temperature units : °C or others
- Current output : 4 to 20 mA, max. 22 mA HART pending
Active (powered internally) : Load resistance Max. 1000Ω
Passive (powered externally) : Voltage Max. 32 V DC
Either flow rate, density or temperature is selectable.
- Pulse output : Open collector output
Load rating : Max. 32 V DC,
20 mA or less (100 Hz < f ≤ 10 kHz)
Residual voltage at close
<1.5 V when load current ≤ 1 mA
<2.5 V when load current ≤ 10 mA
<5 V when load current ≤ 20 mA
100 mA or less (f ≤ 100 Hz)
Residual voltage at close
<0.2 V when load current ≤ 10 mA
<2 V when load current ≤ 100 mA
Output frequency : Max. 10 kHz
Pulse rate : 2 to 36,000,000 pulse/h, or 0.01 Hz to
10 kHz
Pulse width : Selectable from:
(1) Automatic : the 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 : Max. 32 V DC, 100 mA
Residual voltage at close
<0.2 V when load current ≤ 10 mA
<2 V when load current ≤ 100 mA
Contents : Selectable from :
(1) No status output, set as default
on deliver at factory
(2) Flow direction identification
(3) flow over range
(4) Totalizing preset
(5) Identification of range when dou-
ble ranges are used.
(6) Errors and measurement alarms of
flow, density, temperature and others
- Control input Input voltage : 8 to 32 V DC
Max. current : 6.5 mA at 24 V DC
Control target : Selectable from :
(1) No control input, set as default
on delivery at factory
(2) to hold output
(3) to lock output to 0%
(4) to reset totalized counter
(5) to reset errors
(6) to identify range while double rang-
es are used
(7) Others
- Combination of output types
Standard : 1×4 to 20 mA output, 1×pulse output,
1×status output, 1×control input total 4
Option 1 : 2×4 to 20 mA output, 1×pulse output,
total 3
Option 2 : 3×4 to 20 mA output, 1×pulse output,
total 4
Option 3 : 2×4 to 20 mA output, 2×status or
pulse output selectable total 4
Note See "Converter code" table for details.
- Low cut-off : Current output and pulse output can be
set separately per each indication.
Set point : 0 to 20% F.S. at 0.1% step
Hysteresis : 0 to 5% F.S. at 0.1% step
- Time constant : Current output and pulse output can be
set separately per each indication.
Set point : 0 to 100.0 seconds at 0.1second step

Standard functions

- Arbitrary measuring units can be set freely
: Mass or volume flow rate, and per time
is prescribed freely in maximum 7 let-
ters.
- Bi-directional flow measuring
: Forward or reverse flow is measurable.
Flow direction is output as status out-
put.
- Self-diagnosis : Error and status messages are present-
ed.
Functioning : 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 current and pulse simulation out-
puts allow loop check without calibrator.
- Data setting with infra-red touch sensors
: 4 touch sensors allow to set data from
outside without opening cover.
While the cover is opened the keys are
used as push buttons.

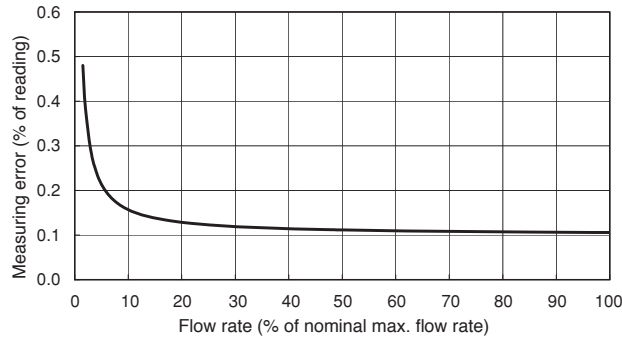
Accuracy calibrated at the factory

- Mass Flow (Pulse output)

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

Note : The figures of accuracy and zero stability above are based on the conditions that measured fluid is water with 20°C and 0.2 MPa.

[Measuring error] (Accuracy + Zero stability)



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

Note : The measured flow rate less than 1% of the nominal maximum flow rate, i.e. less than lower flow limit is out of the guaranteed accuracy.

Influences of process condition changes

Temperature : ±0.0056%/°C of nominal maximum flow rate

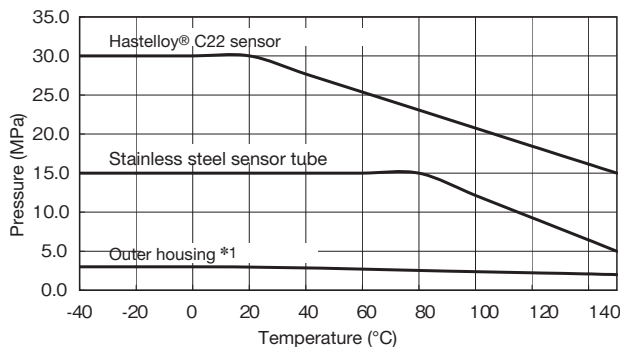
Pressure : ±0.013%/0.1 MPa of nominal maximum flow rate

Above figures show the influences of process condition changes after zero adjustment.

- Temperature (Indicated value)

Measuring range	-40 to +150°C
Accuracy	±1°C

Pressure and temperature rating table



*1 Specify the bursting disc when the process pressure is more than the limitation.

Explosion Proof

- TIIS Technology Institute of Industrial Safety in Japan

(1) Compact type (Sensor-converter integrally mounted compact type)

Model: MMM3400C-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
 Fluid temperature : -40 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 +40°C
 Fluid temperature : -40 to +150°C

(2) Remote type sensor

Model: MMS3000F-JEx

a) Type of protection and class : Ex ia IIC T4
 Ambient temperature : -20 to +60°C
 Fluid temperature : -40 to +90°C

b) Type of protection and class : Ex ia IIC T3
 Ambient temperature : -20 to +60°C
 Fluid temperature : -40 to +130°C

(3) Remote type converter

Model: MMC400F-JEx

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

- ATEX

(1) Compact type (Sensor-converter integrally mounted compact type)

Model : MMM3400C-Ex

Type of protection and class : Ex d ia [ia Ga] IIC T6...T1 Ga/Gb others

Temperature class	Max. Fluid temperature	Ambient temperature
T6	-40°C to +40°C	-40°C to +40°C
T5	-40°C to +70°C	
T4	-40°C to +90°C	
T3...T1	-40°C to +150°C	-40°C to +50°C
T4	-40°C to +90°C	
T3...T1	-40°C to +145°C	-40°C to +65°C
T6...T1	-40°C to +65°C	

(2) Remote type sensor

Model : MMS3000F-Ex

Type of protection and class: Ex ia IIC T6...T1 Ga others

Temperature class	Max. Fluid temperature	Ambient temperature
T6	-40°C to +40°C	-40°C to +40°C
T5	-40°C to +70°C	
T4	-40°C to +90°C	
T3...T1	-40°C to +150°C	-40°C to +50°C
T5	-40°C to +70°C	
T4	-40°C to +90°C	-40°C to +65°C
T3...T1	-40°C to +150°C	
T4	-40°C to +90°C	
T3...T1	-40°C to +130°C	

(3) Remote type converter

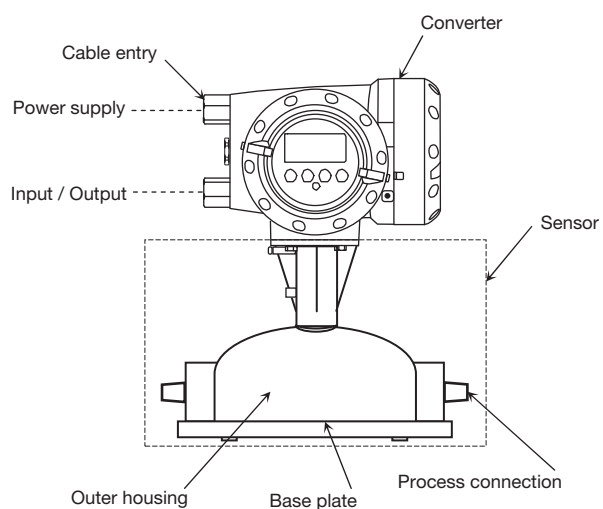
Model : MMC400F-Ex

Type of protection and class: Ex d [ia Ga] IIC T6 Gb others

Temperature class	Ambient temperature
T6	-40°C to +65°C

NAME OF EACH PART

Compact Version



MEASURING TUBE DIMENSIONS

Meter size	Material	Measuring tube 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

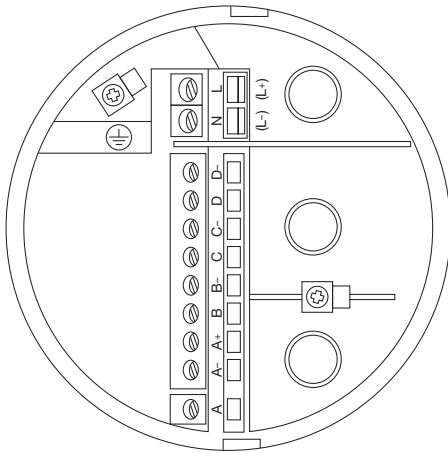
FLOW RANGE

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

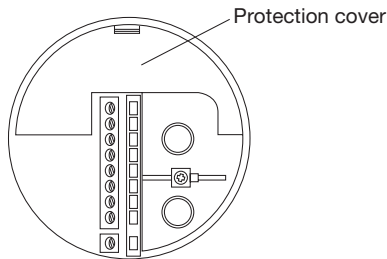
ELECTRICAL CONNECTION

[Input and output terminals] MMC400C/F

- 1×current output, 1×pulse output, 1×status output, 1×control input, as standard input and outputs



The power supply terminal block has a protection cover.



Terminals	Description
L/L+	AC Power or DC power, "L+" for plus and "L-" for minus in DC power
N/L-	
⊕	Earth

Terminals	Polarity	Description of standard outputs
D-	-	Pulse or status output
D	+	
C-	-	Status output
C	+	
B-	-	Control input or status output
B	+	
A+	+	Current output 4 to 20 mA (internal power supply)
A-	-	
A	-	

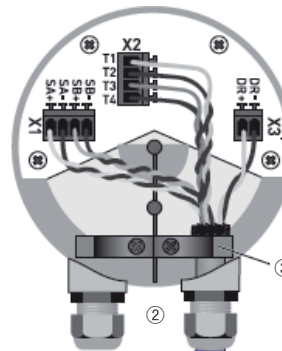
- Terminal type : Plug-in type screw terminal
- Cross section of Conductor : 0.5 to 2.5 mm²
- Cable outside diameter : 7 to 12 mm

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

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

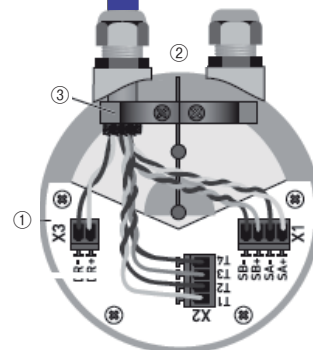
[Remote type sensor cable] MMS3000F + MMC400F

- Converter MMC400F side
- Terminals: Spring clamp type
 - Exclusive use cable to be connected



- Terminal connector
- Cable gland
- Cable fastening grip for shield earth

- Sensor cable for exclusive use
- 10-core compound cable with 0.5 mm² conductor
 - Cable outside diameter : Approx. 11 mm
 - Maximum length : 20 m

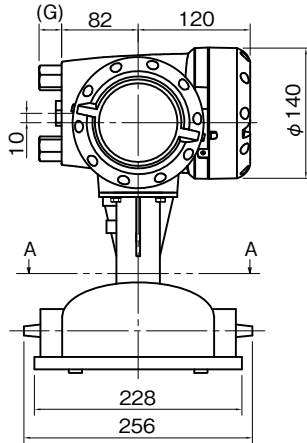
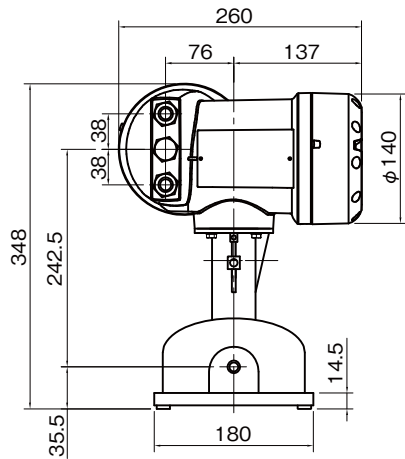


- Sensor MMS3000F side
- Terminals: Spring clamp type
 - Exclusive use cable to be connected

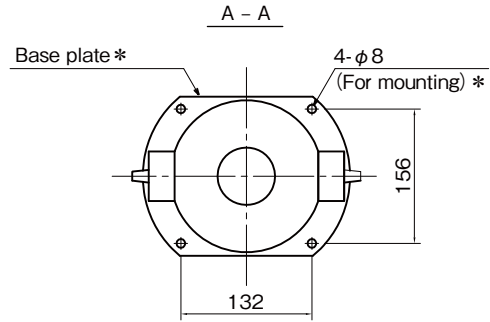
DIMENSIONS

Compact version [MMM3400C]

Mass : approx.12 kg



Length "G"
 · 26 mm with a G1/2 female adapter
 · 26 mm with a 1/2 NPT female adapter
 · 85 mm with a TIIS explosionproof type adapter

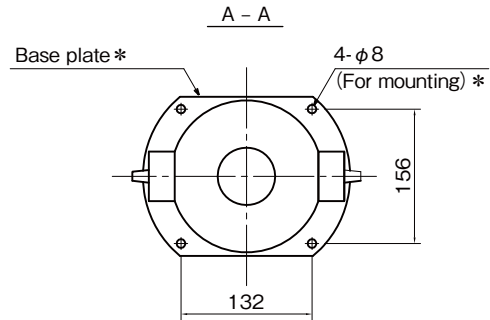
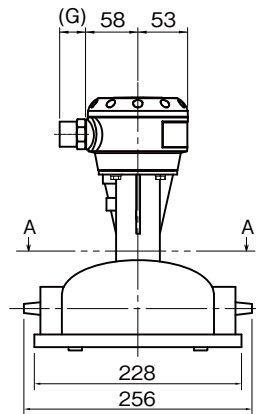
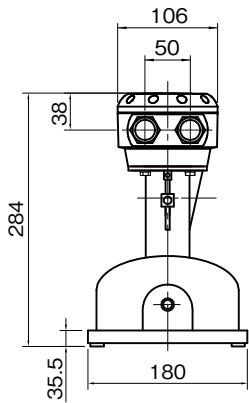


➔ Flow direction (Standard)

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

Sensor of remote type [MMS3000F]

Mass : approx.10 kg

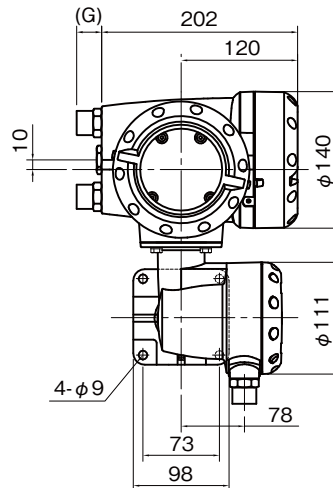
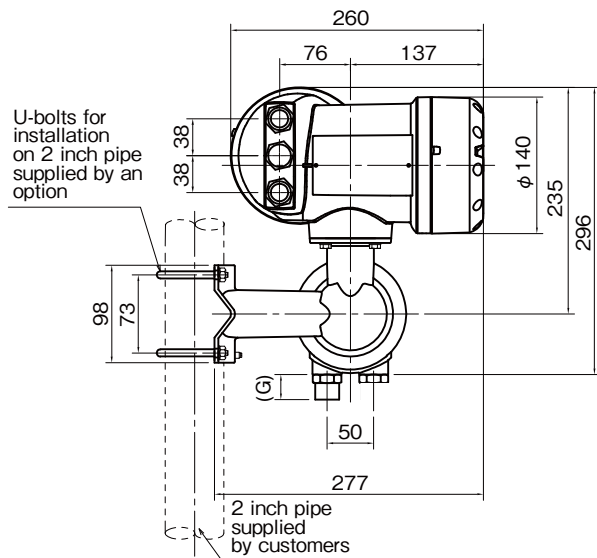


➔ Flow direction (Standard)

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

Converter of remote type [MMC400F]

Mass : approx.5.8 kg

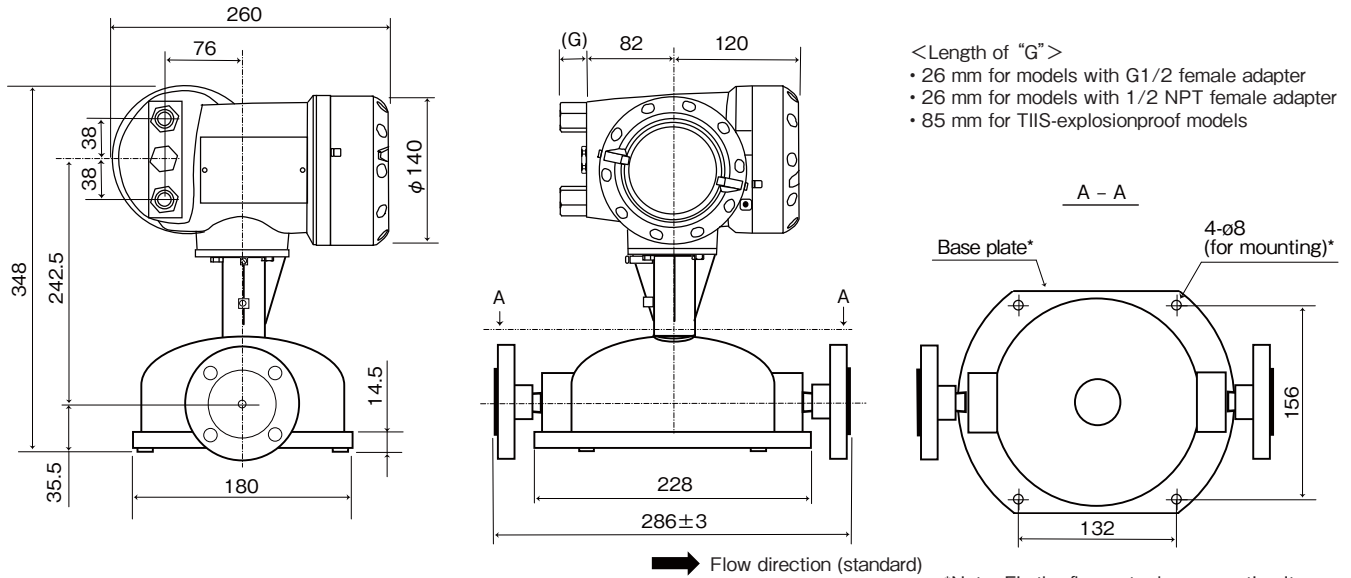


Length "G"
 · 26 mm with a G1/2 female adapter
 · 26 mm with a 1/2 NPT female adapter
 · 85 mm with a TIIS explosionproof type adapter

DIMENSIONS (option)

- Compact type (MMM3400C) with flange fitting
15A JIS20K, 1/2" ASME150lb, 1/2" ASME300lb

Mass: Approx. 12 kg

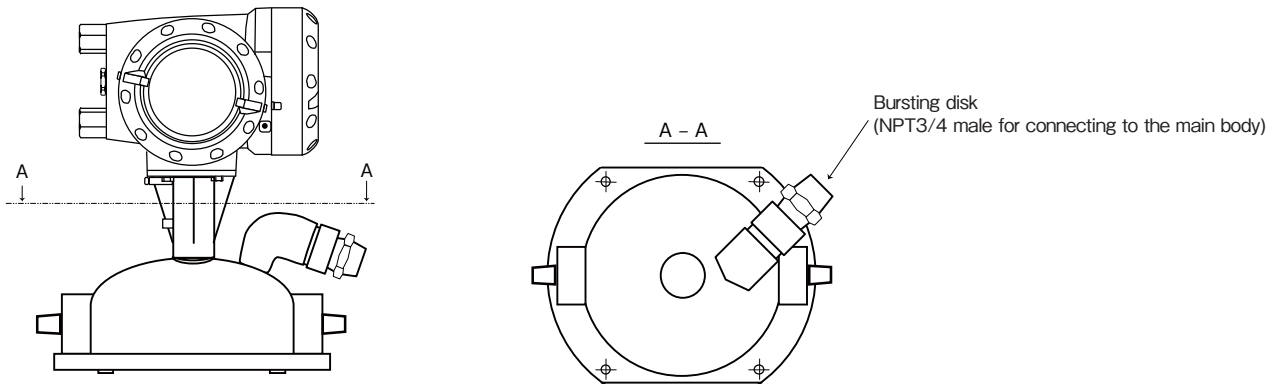


- <Length of "G">
- 26 mm for models with G1/2 female adapter
 - 26 mm for models with 1/2 NPT female adapter
 - 85 mm for TIS-explosionproof models

*Note: Fix the flowmeter by connecting its base plate to a structure. Connecting a flowmeter to piping alone does not provide sufficient support.

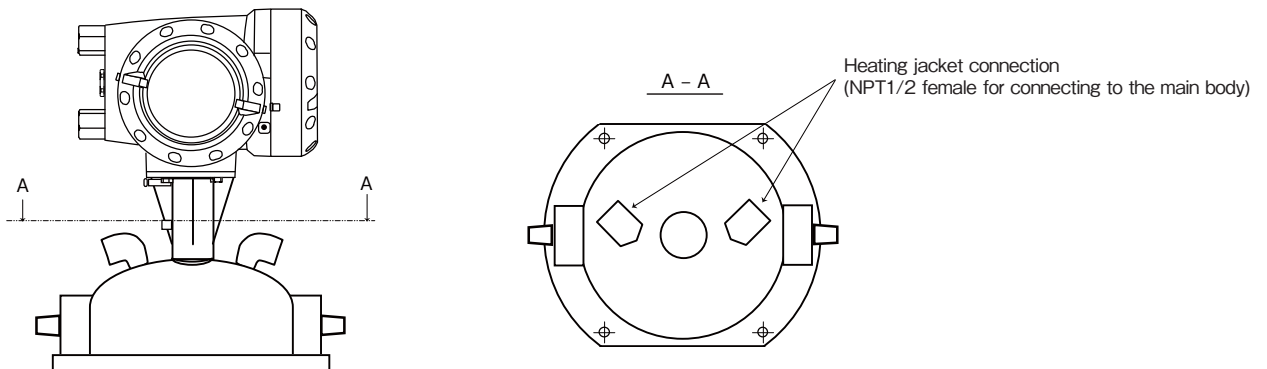
- With a bursting disk (for illustration purposes)

When fluid pressure exceeds 3 MPa, a bursting disk is added to the outer housing for releasing pressure.



- Heating jacket (for illustration purposes)

A heating jacket cannot be used with a bursting disk.



MODEL AND SPECIFICATION CODE

Measuring Tube Material : S (Stainless Steel 316L) [Standard] / H (Hastelloy® C22) [Option]

Product specifications	Sensor and converter integrally mounted compact type	Sensor and converter separately mounted remote type	
		Sensor	Converter
General purpose, non explosionproof	MMM3400C-■□□	MMS3000F-■□□	MMC400F
TIIS explosionproof	MMM3400C-JEx-■□□	MMS3000F-JEx-■□□	MMC400F-JEx
ATEX explosionproof	MMM3400C-Ex-■□□	MMS3000F-Ex-■□□	MMC400F-Ex

Note : TIIS explosionproof version is certified by Technology Institute of Industrial Safety in Japan.

Material code either S or H is designated in ■.

Size code either 01 or 03 or 04 is designated in □□.

[Sensor code]

Sensor Spec. Code	TK	4	0	HK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	Description	Std.	
Sensor code	TK																				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	○	
(Fixed Code)						0															always 0	○	
Outer Housing Pressure Rating								A													3 MPa (Operating pressure < 3 MPa at 20°C)	○	
								C													6.3 MPa (Operating pressure < 6.3 MPa at 20°C)		
Heating jacket and air purge										0											Without	○	
										2											Heating jacket (1/4 NPT Female)		
										3											Air purge connection (1/2 NPT Female)		
Explosion Proof Approvals										0											Without		
										1											ATEX explosionproof	○	
										9											TIIS explosionproof		
Hygienic / Sanitary Approvals									0												Without	○	
Version										0											Compact version (Integral)	○	
										1											Separate version (Remote)		
Calibration																					0	○	
																					1		
																					A		
																					B		
Degreasing										0											Without	○	
										1											Degreasing wetted parts		
Special Feature																					(Blank)	Without	○
																					/Z	Involved	

[Converter Code]

[Converter Code]													Description	Std.				
Converter spec. code	TK	53	4					2	0	0	2	0	0			MMC400 converter	○	
Converter Code	TK	53														always 4	○	
(Fixed code)			4													Compact version (Integral)	○	
Version			H													Remote version		
Power supply			A													100 to 230 V AC	○	
			1													12 to 24 V DC		
Explosionproof Approval			0													Without	○	
			1													ATEX explosionproof		
			9													TIIS explosionproof		
Cable entries for input and output, and power supply			0													M20×1.5 Female thread for ATEX Ex		
			4													With 1/2 NPT female adapter		
			5													With G1/2 female adapter	○	
			6													With waterproof cable gland		
			9													With G1/2 flameproof packing adapter for TIIS explosionproof		
Language for indication			2													English	○	
(Fixed code)								0	0							always 00	○	
Converter housing								1								Aluminum alloy	○	
								2								Stainless steel SS316L (for compact type)		
								3								Stainless steel SS316L (for remote type)		
(Fixed code)								2								always 2		
Output and input								1	0	0						1×4 to 20 mA, 1×pulse, 1×status, 1×control input	○	
								6	A	8						2×4 to 20 mA, 1×pulse or state selectable		
								6	A	A						3×4 to 20 mA, 1×pulse or state selectable		
								6	A	E						2×4 to 20 mA, 2×pulse or status output selectable		
Measuring valuables															0	Mass ow rate, density, temperature as standard	○	
(Fixed code)																always 0	○	
Sensor cables																0	Without	○
																4	5 meter cable delivered only for remote type	
																1	10 meter cable delivered only for remote type	
																5	20 meter cable delivered only for remote type	
Special requirements														(vacant)		Without		
														/Z		Required		

Note Special requirements not designated above coding system should be described with mark "/Z" at the end of a series of coding. Consult TOKYO KEISO for such requirements before ordering.

STANDARD ACCESSORIES

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

OPTIONS

- Water-proof cable gland for cable connection "G1/2", Model code "WG"
- Numbers of cable entries for external connection "3", Model code "3G"
- Metal fixtures for 2" pipe mount, Model code "PM"

SPECIFICATION CODES WHEN ORDERING

1. Model and specifications

Examples

Model : MMM3400C
 Sensor Code : TK014S0HK0A000000
 Converter Code : TK5344A0520012100000

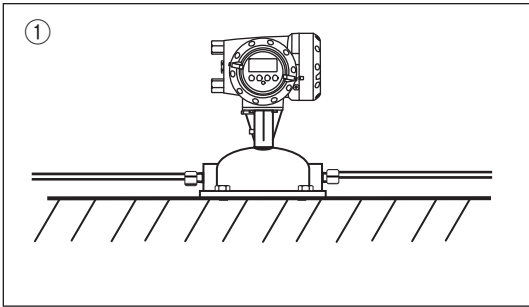
2. Options as requested.

Specify them with their codes.

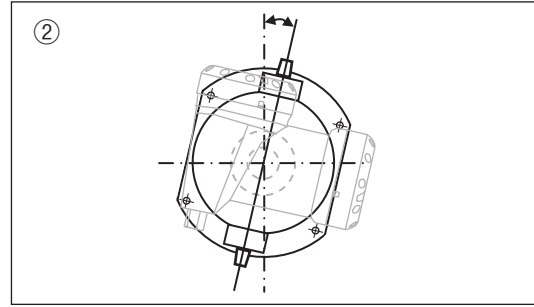
INSTALLATION NOTES

Observe followings for the installation of **MASSMAX®** 3400 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.

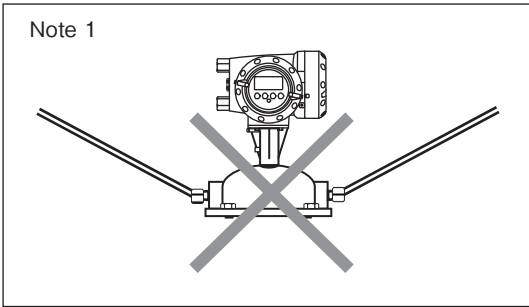


① Install the flowmeter on the flat surface.

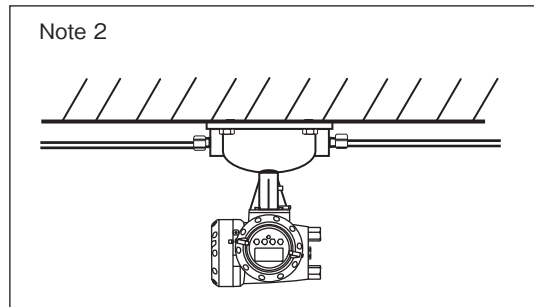


② When installing the flowmeter on the vertical lines, install it within the following inclination to make draining and venting easy during the stoppage of fluid.

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.

TOKYO KEISO CO., LTD.

Head Office : Shiba Toho Building, 1-7-24 Shibakoen, Minato-ku, Tokyo 105-8558
 Tel : +81-3-3431-1625 (KEY) ; Fax : +81-3-3433-4922
 e-mail : overseas.sales@tokyokeiso.co.jp ; URL : <http://www.tokyokeiso.co.jp>