TECHNICAL GUIDANCE

UP GRADED WITH WIDER LINEUP

FM MAG GAUGE

METAL TUBE LEVEL GAUGE

GENERAL

FM Mag Gauge is a float type metal tube level gauge. Liquid level is indicated by clear and visible color flappers. This eliminates problems likely in indication by existing glass gauges.

In addition, special material of PVC, Fluorocarbon resin, Glass lining etc. are ready to cover very corrosive liquid level measurement.

Alarm contacts and / or analog output unit can be additionally provided for remote monitoring and control purpose.

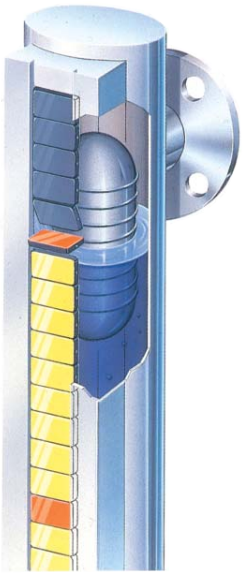
The certified High Pressure Gas Equipment Testing and Manufacturing Plant guarantees high quality and reliability of FM Mag Gauges.

OPERATION PRINCIPLE

A float, in which a rounded shape magnet is integrated, is located in a non-magnetic tube (called Chamber). This float moves up and down depending on the liquid level in chamber with specified draft line. Outside of the chamber, an indicator unit is installed, in which plastic magnet rotating flappers are provided. The front surfaces of such flappers are black and the other sides of flappers are coloured in yellow for every 10mm and red for every 100mm. Then these flappers are rotated by movement of float to indicate liquid level in colour flappers.

FM Mag Gauge can be provided with alarm contacts and/or analog output (DC4~20mA) unit additionally onto this level indicator.

A reed switch in aluminum case at the setting point is actuated by the magnet in moving float. Water-tight construction, intrinsically safe system with the safety relay,and flameproof enclosure are available.
The 4 to 20 mA output type has the detection mechanism of float location (liquid level) along chamber.
The detector consists of a series of reed switches and precision type resistances which are actuated by the magnet inside float. The voltage signal of liquid level is converted to 4 to 20 mA signal for transmitting.
Water-tight construction and flameproof enclosure are available.



FM-3100
Compact type

FEATURES

- Metal tube
  Free from breakage and leakage.

- Clear and visible indication
  By colour flappers, Liquid level in tanks is easily observed even from a distance. Free from blurs and smudges which are common for Glass Gauges.

- Covering high pressure and temperature
  HPGSL*1 approved version is also available.
  *1 High Pressure Gas Safety Law

- Wide selection of material
  Standard stainless steel, PVC, Fluorocarbon resin, Glass lining .....
  Wide selection range is ready to meet corrosive liquid level measurement.
  Special material of MA276 and Titanium are also available.

- Full function
  Indication, alarm contacts as well as analog output.
  One unit of FM Mag Gauge covers all necessary functions of level monitoring and control.

TOKYO KEISO CO.,LTD.

TG-L381-14E
Revised Jul 2015 K
9th edition Jul 2006 K

STANDARD SPECIFICATION

Measuring object	:	Max. viscosity 600mPa·s and without sticking and crystallization.
Available range	:	Refer to pages of subject models.
Maximum OP. Press.	:	Refer to pages of subject models.
Temp. range	:	Refer to pages of subject models.
Level indication	:	By colour flappers
Interval of flappers	:	Standard version FM 10mm Fine version FMS *1 5mm
Indication accuracy	:	Standard version FM ±15mm Fine version FMS* ±10mm
Process connection.	:	Standard; Tank side through 1"(25mm) flanges Details are to be referred to pages of subject models.
Material	:	To be referred to pages of subject models.

*1 FMS type is applicable for FM-1200 type made of stainless steel.

❇ The indication can follow up to 2cm/s in liquid level changing speed.

Consult factory for jacket type.

Consult factory for the direction of the connection nozzle other than “side – side”.

DESCRIPTION OF MODEL CODE

Model code of FM Mag Gauge is described as follows;

1) Only for local indicator

FM-□□□-□

2) Local indicator+Alarm contacts

FM-□□□-□□□□

3) Local indicator+Analog output

FM-□□□-□/□□□

4) Local indicator+Alarm contacts+Analog output

FM-□□□-□□□□/□□□

/□□□ to be added to the end of code indication 2)

1	Indicator	Press., Temp. class (2 digit)
2		Chamber, Nozzle material
3		Float material and density range
4		Conn. flange rating
5	Alarm	Enclosure of alarm (Water-tight, intrinsic safety, flameproof)
6		No. of contact
7		No. of terminal box
8	Analog output	Enclosure of analog unit (Water-tight, intrinsic safety, flameproof)
9		Direction of sensor
10		Direction of convertor

Refer to pages of subject models for details of model code.

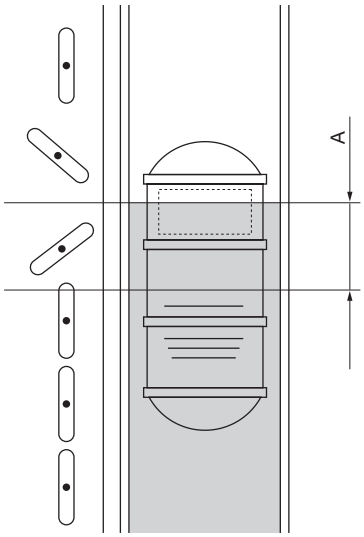
SUGGESTIONS

● On liquid level indication

The indicator flappers are actuated by magnet in float. There are different types of float for models, but the position of magnet and actual liquid level (Draft line to float) are different depending on the liquid density. Thus, the position where specific indicator flapper rotates and the position of actual liquid level are different slightly. This gap is fixed and shifted upward in fixed value. This gap (A) is indicated in Approval drawing. The zero line of indicator is to be located above actual liquid zero point by distance of A. Refer to instruction manual for details.

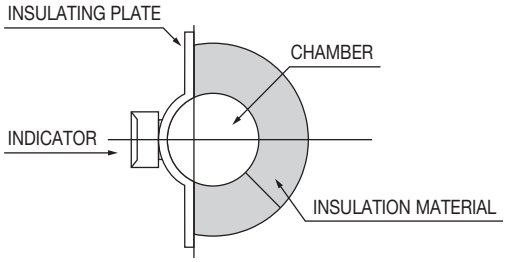
Also, be careful for minimum density for the float. Operation problem may occur in case of lower density than designed density.

Interface measurement and / or extreme low and high density liquid measurement are available on request. Consult factory for details.



● Heating and heat insulation

In case of necessity of heating and thermal insulation for sticky liquids etc., thermal insulation is to be provided only for chamber portion as shown below. Do not cover indicator, alarm and analog unit by thermal insulation material. The heating or insulation on these parts might causes damages or malfuntioning of indication, alarm or transmitting mechanism.



MODEL SELECTION GUIDANCE

Different types and materials are available for FM Mag Gauge. Refer to the following table for selection.
(The floats made of titanium alloy may have different shape and dimensions from values in this guidance. Consult Tokyo Keiso before ordering.)

● FOR MODERATE TEMPERATURE

(Up to 120°C. The some gauges made of plastics like PVC have limited upper temperature as mentioned below.)

MODEL	CHAMBER MATERIAL	FLOAT MATERIAL	TEMP. RANGE	MAX. OP. PRESS.*1	AVAILABLE RANGE (mm)	
				MPa	Min.	Max.
FM-121□	SUS304	SUS316,SUS316L or Titanium (TP340)	*2 -10℃≦t≦120℃	*6 3	0~250	0~4380
2□	SUS316					
3□	SUS316L					
Z□	Special metallic material	To be consulted				
FM-124□	PVC(HPVC)	PVC(HPVC)	0℃≦t≦60℃ (80℃)	0.2	0~250	0~2000
5□	Stainless steel+PVC lining					0~4000
FM-126□	Stainless steel+ETFE lining	NBR balloon + PFA lining	0℃≦t≦100℃	*3 0.2	0~250	*4 0~3500
7□	Stainless steel+PFA lining					
FM-128□	Stainless steel+PTFE lining					
FM-129□	Stainless steel+Glass lining	Glass	-30℃≦t≦120℃	0.2	0~250	0~3000
FM-131□	SUS304	*5 Titanium (TP340) or Titanium alloy	*2 -10℃≦t≦120℃	5	0~250	0~4380
2□	SUS316					
3□	SUS316L					
Z□	Special metallic material					
FM-141□	SUS304	*5 Glass epoxy balloon or Titanium alloy	*8 0℃≦t≦120℃	7.3	0~250	0~4380
2□	SUS316					
3□	SUS316L					
Z□	Special metallic material					
FM-311□	SUS304	SUS316	-5℃≦t≦120℃	1	0~250	0~2000
2□	SUS316					
3□	SUS316L					

● FOR HIGH TEMPERATURE

(121~300°C. Use MODERATE TEMPERATURE version for up to 120°C.)

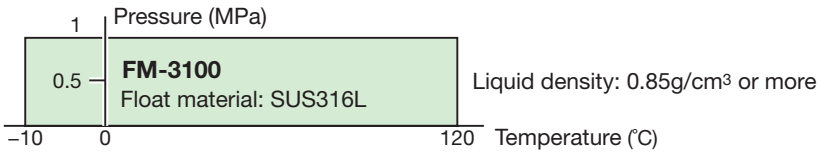
MODEL	CHAMBER MATERIAL	FLOAT MATERIAL	TEMP. RANGE	MAX. OP. PRESS.*1	AVAILABLE RANGE (mm)	
				MPa	Min.	Max.
FM-161□	SUS304	SUS316,SUS316L *5 Or Titanium (TP340)	*7 120℃<t≦300℃	2	0~250	0~4380
2□	SUS316					
3□	SUS316L					
Z□	Special metallic material	To be consulted				
FM-169□	Stainless steel+Glass lining	Glass	120℃<t≦150℃	0.2	0~250	0~3000
FM-171□	SUS304	*5 Titanium (TP340) or Titanium alloy	120℃<t≦285℃	*9 3.9	0~250	0~4380
2□	SUS316					
3□	SUS316L					
Z□	Special metallic material					
FM-181□	SUS304	*5 Titanium alloy	120℃<t≦285℃	7	0~250	0~4380
2□	SUS316					
3□	SUS316L					
9□	Special metallic material					

*1 : Subject to flange connection rating
*2 : For the services lower than –10°C, the indicator with non-frost acrylic resin plate will be provided. Consult factory for details.
*3 : Upto 0.75MPa on request as option.
*4 : Max. 2400mm for ETFE lining, and Max. 2500mm for PTFE lining for the vacuum service.
*5 : TP340, Titanium alloy, and Glass epoxy balloon may cause hydrogen embrittlement.
*6 : The maximum operating pressure of titanium float is 2.5 MPa.
*7 : The maximum operating temperature of titanium float is 250°C.
*8 : The maximum operating temperature of glass epoxy float is 100°C.
*9 : The maximum operating pressure of floats made of some materials is 4.4 MPa.

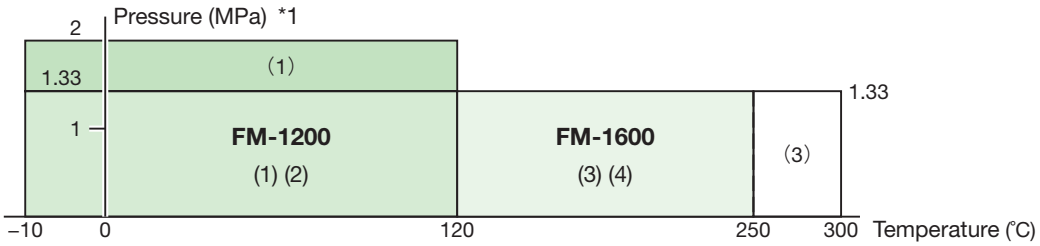
PRESSURE AND TEMPERATURE LIMITATION

Following graph shows the pressure and temperature limitation for each type of FM MAG GAUGEs excluding the limitation subject to the connection flange rating. The colored or gray area shows the applicable range of each type.

● FM-3100 (SUS, Chamber size: 1 inch)



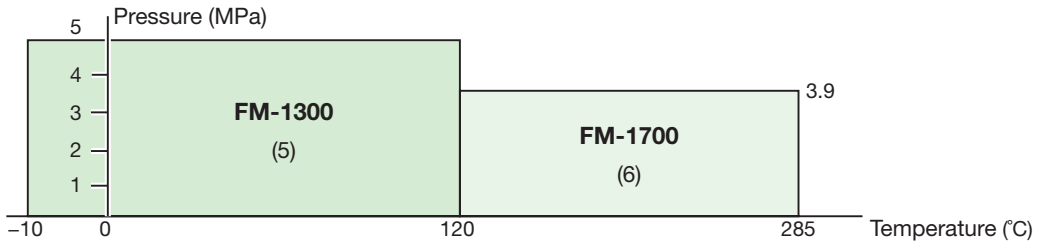
● FM-1200, FM-1600 (SUS, Chamber size 2 inches)



(1) FM-1200	Float material	SUS316	Liquid density 0.6g/cm3 or more
(2) FM-1200	Float material	Titanium (TP340)	Liquid density 0.39g/cm3 or more
(3) FM-1600	Float material	SUS316	Liquid density 0.65g/cm3 or more
(4) FM-1600	Float material	Titanium (TP340)	Liquid density 0.39g/cm3 or more

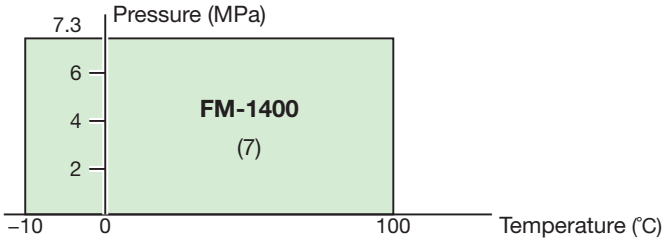
*1: Negative pressure is available up to Full Vacuum, but it may be unavailable, depending on the specification. Consult Tokyo Keiso for availability.

● FM-1300, FM-1700 (SUS, Chamber size 2 inches)



(5) FM-1300	Float material	Titanium (TP340)	Liquid density 0.6g/cm3 or more
(6) FM-1700	Float material	Titanium (TP340)	Liquid density 0.68g/cm3 or more

● FM-1400 (SUS, Chamber size 2 inches)



(7) FM-1400	Float material	Glass epoxy	Liquid density 0.8g/cm3 or more

FM-1210,1220,1230,12Z0

Standard metallic type for low pressure and moderate temperature

FM-12$^{1}_{2}_{3}$0 series are standard type Mag gauge with SUS304, SUS316, or SUS316L material. (titanium float is used for some ranges.)

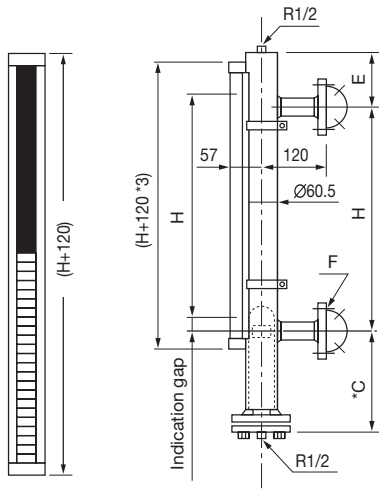
AVAILABLE RANGES OF PRODUCTS

Range : Min. 0~250mm
Max. 0~4380mm (3420mm for FMS)

Max. Op. Press.: 3MPa
(Max. 2.5MPa for titanium float)
(Subject to connection flange rating)
Negative pressure is available up to Full Vacuum, but it may be unavailable, depending on the specification. Consult Tokyo Keiso for availability.

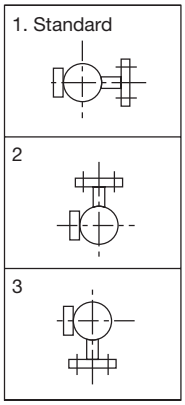
Temp. range : · FM-1200
–10˚C≦t≦120˚C
(Down to –60˚C available on request. The indicator with non-frost acrylic resin plate is available. *1)
· FMS-1200
–5˚C≦t≦80˚C *2

DIMENSIONS



* Actual length "C" may be extended depending on the float type as is the case of gas filled type. Consult factory for details.

INDICATOR INSTALLATION ANGLE

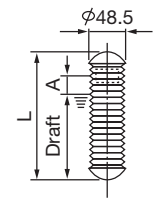


MODEL CODE

		—	12			—		Description	
Flapper pitch	FM							10mm(Accuracy ±15mm)	
	FMS							5mm (Accuracy ±10mm)	
Chamber material				1				SUS304	
				2				SUS316	
				3				SUS316L	
				Z				Other	
Density range (g/cm^3) Float material					A			0.39~0.45	TP340 Titanium
					0			0.44~0.52	
					1			0.5~0.6	
					2			0.55~0.7	
					3			0.62~0.8	
					N			0.6~0.7	SUS316 or SUS316L
					P			0.65~0.8	
					5			0.7~0.9	
					6			0.8~1.0	
					7			0.9~1.4	
					8			1.0~1.5	
					9			1.25~2.0	
Connection flange rating							0	25A JIS 10KFF	
							1	25A JIS 10KRF	
							2	1" JPI 150#RF	
							3	1" ANSI 150#RF	
							4	25A JIS 20KRF	
							5	1" JPI 300#RF	
							6	1" ANS I300#RF	
							7	25A JIS 5KFF	
							8	Other 1" (25A) flanges	
							9	Special	

*1 The indicator has a non-frost acrylic resin plate.(FM-1200)
*2 The indicator cannot have a non-frost acrylic resin plate. (FMS-1200)
*3 The dimension of FMS-1200 is not same as 120 mm.

FLOAT AVAILABILITY AND SIZES

No.	Density (g/cm^3)	Design C	Design E	Float Material	Float L	
A	0.39~0.45	450	200	TP340 Titanium	470	
0	0.44~0.52	350	200		380	
1	0.5~0.6	280	200		300	
2	0.55~0.7	250	200		270	
3	0.62~0.8	210	200		220	
N	0.6~0.7	485	160	SUS316 or SUS316L	520	
P	0.65~0.8	385	150		410	
5	0.7~0.9	305	130		320	
6	0.8~1.0	235	110		250	
7	0.9~1.4	195	110		200	
8	1.0~1.5	165	100		170	
9	1.25~2.0	165	100		170	

Max. operating press. is 1.33MPa for float No. A to 3.
Max. operating press. is 2.0MPa for float No. N to 9.
Consult factory for details when max. press. exceeds these values.

FM-121Z0,122Z0,123Z0,12ZZ0

Double tube type for liquefied gas

FM-12 $\begin{smallmatrix}1Z\\2Z\\3Z\end{smallmatrix}$ 0 are metal tube level gauge for liquefied gas with SUS304, SUS316, or SUS316L material.

A double tube type has the effectiveness that inhibits the sudden rise and dive of a float by boiling and bumping of liquefied gas.

And use an orifice plate in flange connection part (upper) according to operational situation.

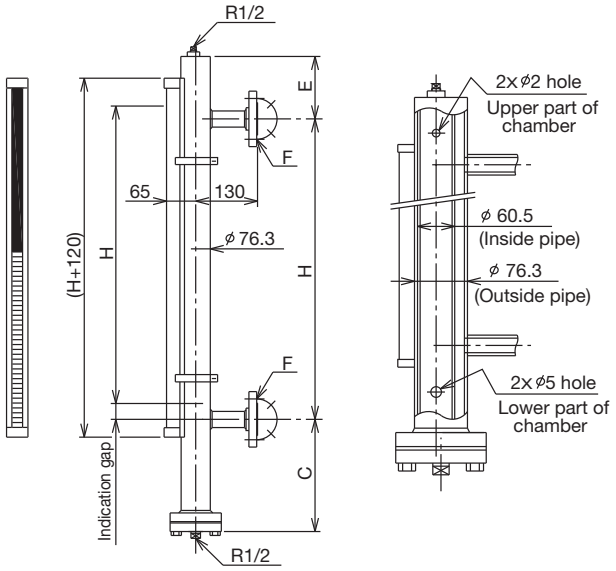
AVAILABLE RANGES OF PRODUCTS

Range : Min. 0~250mm
Max. 0~4380mm

Max. Op. Press. : 2.5MPa
(Subject to connection flange rating)

Temp. range : –10°C≦t≦120°C
(Down to –60°C available on request. The indica tor with non-frost acrylic resin plate is available.)

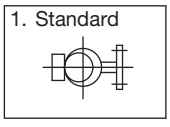
DIMENSIONS



MODEL CODE

FM-12			—		Description	
Chamber material	1Z				SUS304	
	2Z				SUS316	
	3Z				SUS316L	
	4Z				Other	
Densitiy range (g/cm³) Float material		A			0.39~0.45	TP340 Titanium
		0			0.44~0.52	
		1			0.5~0.6	
		2			0.55~0.7	
		3			0.62~0.8	
		Z			Special	
Connection flange rating				0	25A JIS 10KFF	
				1	25A JIS 10KRF	
				2	1" JPI 150#RF	
				3	1" ANSI 150#RF	
				4	25A JIS 20KRF	
				5	1" JPI 300#RF	
				6	1" ANSI 300#RF	
				7	25A JIS 5KFF	
				8	Other 1" (25A) flanges	
				9	Special	

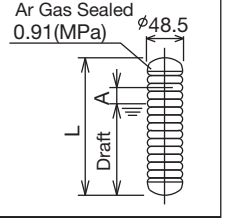
INDICATOR INSTALLATION ANGLE



The direction to install indicator can not be changed at site.

FLOAT AVAILABILITY AND SIZES

No.	Densitiy (g/cm³)	Design C	Design E	Float Material	Float L
A	0.39 ~ 0.45	780	200	TP340 Titanium	790
0	0.44 ~ 0.52	580	200		610
1	0.5 ~ 0.6	450	200		470
2	0.55 ~ 0.7	380	200		400
3	0.62 ~ 0.8	320	200		330



Max. operating press. is 1.96MPa.
Consult factory for details when max. press. exceeds this value.

FM-1240,1250

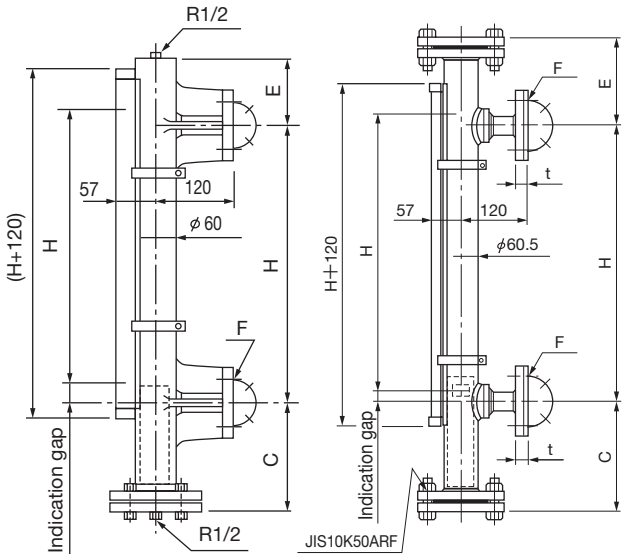
Made of PVC for low pressure and moderate temperature

FM-1240 series are level gauge with PVC material for both chamber and float to cover corrosive liquids.
FM-1250 has a PVC lined stainless steel chamber which offers better mechanical durability than pure PVC chambers.

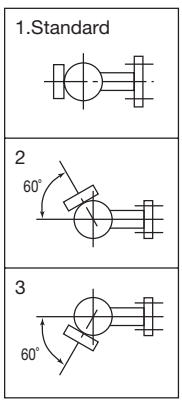
AVAILABLE RANGES OF PRODUCTS

Range : Min. 0~250mm
Max. 0~2000mm *2
Max. Op. Press. : 0.2MPa
Temp. range : 0°C≦t≦60°C (HPVC : 0°C≦t≦80°C)

DIMENSIONS



INDICATOR INSTALLATION ANGLE



MODEL CODE

		—	12			—		Description
Flapper pitch	FM							10mm (Accuracy ±15mm)
Chamber material				4				PVC
				4H				HPVC
				5				St. Stl.+PVC lining
Density range (g/cm³) Float material *1					5			0.75~0.9 (0.7~0.8)
					6			0.8~1.0 (0.75~0.9)
					7			0.9~1.3 (0.85~1.2)
					8			1.05~1.7 (1.0~1.5)
					9			1.35~2.0 (1.35~2.0)
Connection flange rating *3							0	25A JIS 10KFF (t=21)
							2	1" JPI 150#RF (t=19.7)
							3	1" ANSI 150#RF (t=19.7)
							7	25A JIS 5KFF (t=17)
							8	Other 1" (25A) flanges
							9	Special

*1 Float material is PVC or HPVC. ( ) indicates applicable density range for FM-125 □ type (Stainless steel + PVC lining).
*2 In case of material code 5, max.4000mm is available.
*3 Connection flange of lined version is Flat Face (20A or more). The inside of parenthesis shows the thickness of flange.

FLOAT AVAILABILITY AND SIZES

For PVC version FM-124 □ and HPVC version FM-124H □

No.	Density (g/cm³)	Design C	Design E	Float L	Float
5	0.75~0.9	290	120	300	φ48, L, PVC,HPVC
6	0.8~1.0	250	120	250	
7	0.9~1.3	200	120	200	
8	1.05~1.7	150	120	150	
9	1.35~2.0	140	120	150	

For Stainless steel+PVC lining version FM-125 □

No.	Density (g/cm³)	Design C	Design E	Float L	Float
5	0.7~0.8	290	150	300	φ46, L, PVC
6	0.75~0.9	250	150	250	
7	0.85~1.2	200	160	200	
8	1.0~1.5	150	170	150	
9	1.35~2.0	140	180	150	

FM-1260, 1270

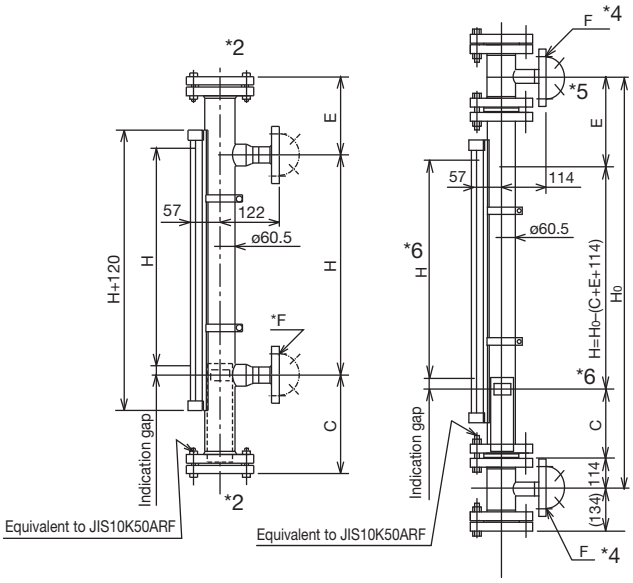
Made of Fluorocarbon resin for low pressure and moderate temperature

This series of gauges is made of fluorocarbon resin and other anti-corrosive materials.

AVAILABLE RANGES OF PRODUCTS

Range : Min. 0~250mm
Max. 0~3500mm
Maximum range of ETFE lining type is 2400mm
Max. Op. Press. : 0.2MPa
Temp. range : 0°C≦t≦100°C
Details of lining
ETFE lining : FM-126 □ Lining thickness 1.6 mm
PFA lining : FM-127 □ Lining thickness 1.75 mm

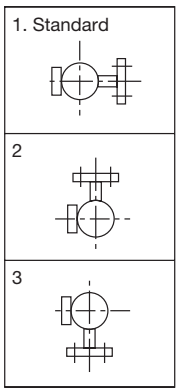
DIMENSIONS



ETFE lining
FM-126 □

PFA lining
FM-127 □

INDICATOR INSTALLATION ANGLE



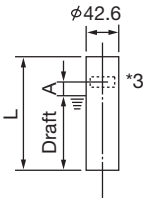
MODEL CODE

		—	12			—		Description	
Flapper pitch	FM							10mm(Accuracy ±15mm)	
Chamber material			6					ETFE lining	
			7					PFA lining	
Density range (g/cm³) Float material				A				0.72~0.75	NBR+ PFA lining(1.5t) *1
				B				0.75~0.8	
				C				0.8~0.9	
				E				0.9~1.0	
				F				1.0~1.3	
				G				1.3~1.5	
				H				1.5~2.0	
				9				—	Special
Connection flange rating *							1	25A JIS 10K	
							2	1" ANSI(JPI)#150	
							9	Special	

* The flange face of lining type is equivalent to the raised face of flange.

FLOAT AVAILABILITY AND SIZES

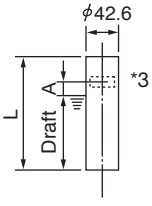
For ETFE lining version FM-126 □

No.	Density (g/cm³)	Design C	Design E	Float L	Float
A	0.72~0.75	400	190	400	
B	0.75~0.8	370	190	345	
C	0.8~0.9	310	190	280	
E	0.9~1.0	240	190	210	
F	1.0~1.3	200	190	170	
G	1.3~1.5	190	190	190	
H	1.5~2.0	190	190	190	

Titanium+PFA lining available on request
(Dimension will be changed. Consult factory for details.)

*1 The float for vacuum services is made of either stainless steel or titanium lined by ETFE.
*2 The blind flanges for vacuum services are made of carbon steel lined by PTFE.
*3 The float for vacuum services has a different shape and sizes.
*4 Connection F
*5 Shape and dimension E
*6 Measuring range H

For PFA lining version FM-127 □

No.	Density (g/cm³)	Design C	Design E	Float L	Float
A	0.72~0.75	400	270	400	
B	0.75~0.8	350	270	345	
C	0.8~0.9	280	280	280	
E	0.9~1.0	210	280	210	
F	1.0~1.3	170	280	170	
G	1.3~1.5	190	260	190	
H	1.5~2.0	170	270	190	

Titanium+PFA lining available on request
(Dimension will be changed. Consult factory for details.)

FM-1280

Made of Fluorocarbon resin for low pressure and moderate temperature

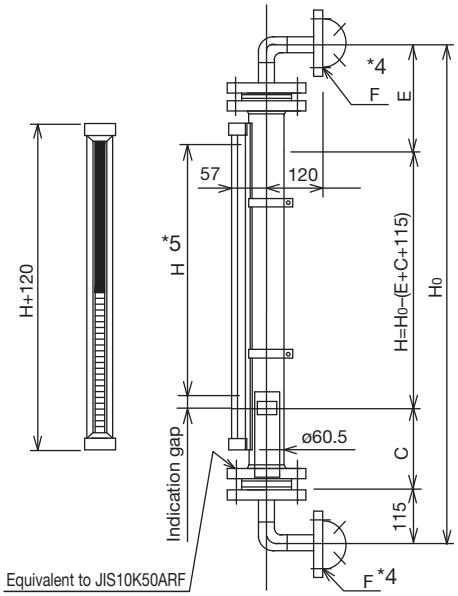
This series of gauges is made of fluorocarbon resin and other anti-corrosive materials.

AVAILABLE RANGES OF PRODUCTS

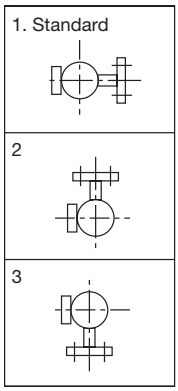
Range : Min. 0~250mm
Max. 0~3500mm *1
Max. Op. Press. : 0.2MPa
Temp. range : 0°C≦t≦100°C
Details of lining
PTFE lining : FM-128□ Lining thickness 2 mm
: 3mm for vacuum application

*1: Max. 2500mm for vacuum application

DIMENSIONS



INDICATOR INSTALLATION ANGLE



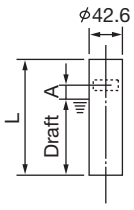
MODEL CODE

		—	12		—		Description	
Flapper pitch	FM						10mm(Accuracy ± 15mm)	
Chamber material			8				PTFE lining	
Density range (g/cm³) Float material				A			0.72~0.75	NBR+ *3 PFA lining(1.5t)
				B			0.75~0.8	
				C			0.8~0.9	
				E			0.9~1.0	
				F			1.0~1.3	
				G			1.3~1.5	
				H			1.5~2.0	
				9			—	Special
Connection flange rating *2						1	25A JIS 10K	
						2	1" ANSI(JPI)#150	
						9	Special	

*2 The flange face of lining type is equivalent to the raised face of flange.
*3 The float for vacuum services is made of either stainless steel or titanium lined by ETFE.
*4 Connection F
*5 Measuring range H

FLOAT AVAILABILITY AND SIZES

No.	Density (g/cm³)	Design		Float
		C	E	L
A	0.72~0.75	400	260	400
B	0.75~0.8	350	260	345
C	0.8~0.9	280	270	280
E	0.9~1.0	210	270	210
F	1.0~1.3	170	270	170
G	1.3~1.5	190	260	190
H	1.5~2.0	190	270	190



* Titanium+PFA lining available on request
(Dimension will be changed. Consult factory for details.)
* Vacuum application of PTFE, dimension will be changed.

FM-1290

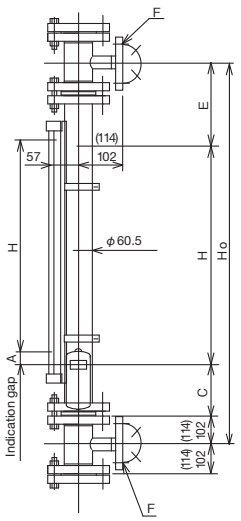
Glass lining type for low pressure and moderate temperature

FM-1290 series is glass lining type for very corrosive services

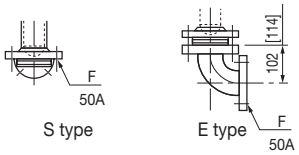
AVAILABLE RANGES OF PRODUCTS

Range : Min. 0~250mm
Max. 0~3000mm
Max. Op. Press. : 0.2MPa
Temp. range : -30°C≦t≦120°C *4

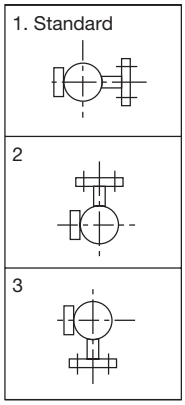
DIMENSIONS



Figures in [ ] show those for JPI and ANSI flanges.



INDICATOR INSTALLATION ANGLE



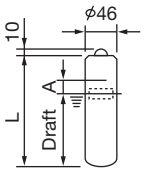
MODEL CODE

FM-129		—		Description
Chamber material				Stainless steel+Glass lining *3
Density range (g/cm³) (Float material : Glass)	3			0.9~1.0
	5			1.0~1.1
	6			1.1~1.25
	7			1.2~1.4
	8			1.3~1.6
Connection flange *2 (The connection flange codes 1,2,3,4 and 9 consist of tees or reducing tees.)			1	25A JIS 10KRF
			2	1" JPI(ANSI)150#RF
			3	50A JIS 10KRF
			4	2" JPI(ANSI)150#RF
			5	S 50A JIS 10KRF
			6	E 50A JIS 10KRF
			7	S 2" JPI(ANSI)150#RF
			8	E 2" JPI(ANSI)150#RF
			9	Special

* 1 "H" length of 4 to 20 mA output type may become shorter. Please contact TOKYO KEISO.
* 2 The flange face of lining type is equivalent to the raised face of flange
* 3 The flange is made of carbon steel lined by glass.
* 4 The indicator has a non-frost acrylic resin plate for the service below -10°C.

FLOAT AVAILABILITY AND SIZES

No.	Density (g/cm³)	Design C	Design E	Float L	Float
3	0.9~1.0	300	280	270	
5	1.0~1.1	240	280	210	
6	1.1~1.25	200	280	175	
7	1.2~1.4	190	280	160	
8	1.3~1.6	180	280	150	



FM-1690

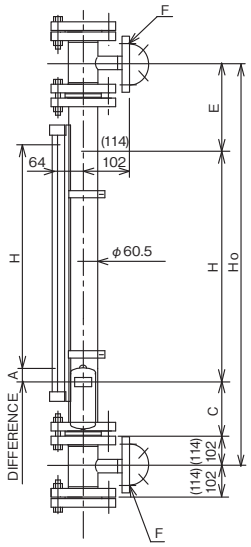
Glass lining type for low pressure and high temperature

FM-1290 series is glass lining type for very corrosive services

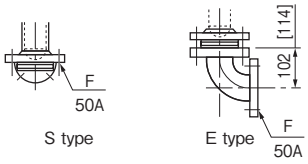
AVAILABLE RANGES OF PRODUCTS

Range : Min. 0~250mm
Max. 0~3000mm
Max. Op. Press. : 0.2MPa
Temp. range : 120°C<t≦150°C

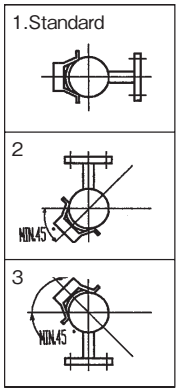
DIMENSIONS



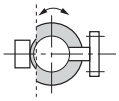
Figures in [ ] show those for JPI and ANSI flanges.



INDICATOR INSTALLATION ANGLE



IF NECCESSORY, INSULATION MUST BE APPLIED ONLY BEHIND OF THE SEPARATOR-PLATE.



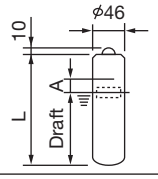
MODEL CODE

FM-169		—		Description
Chamber material				Stainless steel+Glass lining *3
Density range (g/cm³) (Float material : Glass)	3			0.9~1.0
	5			1.0~1.1
	6			1.1~1.25
	7			1.2~1.4
	8			1.3~1.6
Connection flange *2 (The connection flange codes 1,2,3,4 and 9 consist of tees or reducing tees.)			1	25A JIS 10KRF
			2	1" JPI(ANSI)150#RF
			3	50A JIS 10KRF
			4	2" JPI(ANSI)150#RF
			5	S 50A JIS 10KRF
			6	E 50A JIS 10KRF
			7	S 2" JPI(ANSI)150#RF
			8	E 2" JPI(ANSI)150#RF
			9	Special

* 1 "H" length of 4 to 20 mA output type may become shorter. Please contact TOKYO KEISO.
* 2 The flange face of lining type is equivalent to the raised face of flange
* 3 The flange is made of carbon steel lined by glass.

FLOAT AVAILABILITY AND SIZES

No.	Density (g/cm³)	Design C	Design E	Float L
3	0.9~1.0	300	280	270
5	1.0~1.1	240	280	210
6	1.1~1.25	200	280	175
7	1.2~1.4	190	280	160
8	1.3~1.6	180	280	150



FM-1310, 1320, 1330, 13Z0

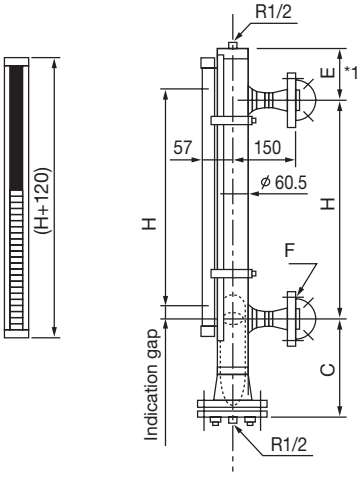
Metallic type for medium pressure and moderate temperature

FM-1300 is a series of medium pressure metal tube level gauge with stainless steel chamber and titanium float.

AVAILABLE RANGES OF PRODUCTS

Range : Min. 0~250mm
Max. 0~4380mm
Max. Op. Press. : 5MPa (Max.4.5MPa for titanium alloy float)
(Subject to connection flange rating)
Temp. range : -10°C≦t≦120°C

DIMENSIONS

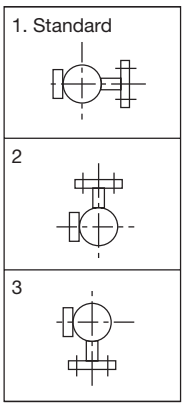


MODEL CODE

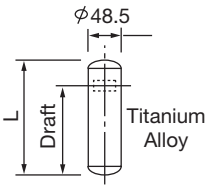
FM-13				Description	
Chamber material	1			SUS304	
	2			SUS316	
	3			SUS316L	
	Z			Special	
Density range (g/cm³) Float material	E			0.55~0.62	Titanium alloy (Max. 4.5MPa)
	—			—	
	1			0.6~0.64	TP340 Titanium
	2			0.64~0.7	
	3			0.7~0.81	
	5			0.74~0.86	
	6			0.8~1.02	
	7			0.96~1.3	
	9			Special material other than above	
Connection flange rating		1		25A JIS 20KRF	
		2		1" JPI 300#RF	
		3		1" ANSI 300#RF	
		4		25A JIS 30KRF	
		5		25A JIS 40KRF	
		6		1" JPI 600#RF	
		7		1" ANSI 600#RF	
		9		Special	

* 1 Shape and dimension E

INDICATOR INSTALLATION ANGLE



FLOAT AVAILABILITY AND SIZES

No.	Density (g/cm³)	Design C	Design E	Design L	Float
E	0.55 ~ 0.62	*	200	*	
—	—	—	—	—	
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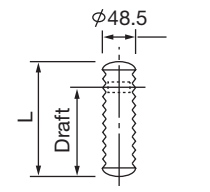
—	—	—	—	—	
—	—	—	—	—	
—	—	—	—	—	
1	0.6 ~ 0.64	810	160	820	
2	0.64 ~ 0.7	620	160	630	
3	0.7 ~ 0.81	470	160	485	
5	0.74 ~ 0.86	400	160	405	
6	0.8 ~ 1.02	320	160	325	
7	0.96 ~ 1.3	250	160	260	
9	Special	—	—	—	

* Consult factory for details.

FM-1410, 1420, 1430, 14Z0

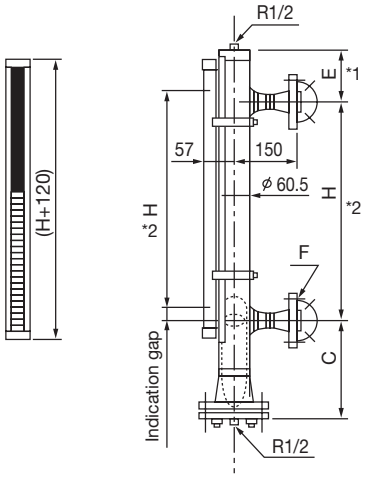
Metallic type for high pressure and moderate temperature

FM-1400 is a series of high pressure metal tube level gauge with stainless steel chamber and titanium or glass epoxy float.

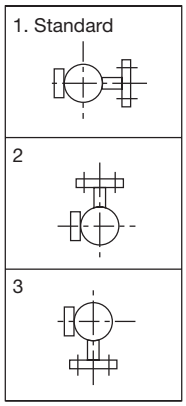
AVAILABLE RANGES OF PRODUCTS

Range : Min. 0~250mm
Max. 0~4380mm
Max. Op. Press. : 7.3MPa
(Subject to connection flange rating)
Temp. range : 0°C≦t≦120°C (Glass epoxy : 0°C≦t≦100°C)

DIMENSIONS



INDICATOR INSTALLATION ANGLE



MODEL CODE

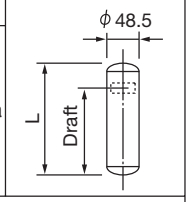
FM-14 –				Description	
Chamber material	1			SUS304	
	2			SUS316	
	3			SUS316L	
	Z			Special	
Density range (g/cm³) Float materia		E		0.7 ~ 0.74	Titanium alloy
		F		0.73 ~ 0.83	
		G		0.8 ~ 0.96	
		H		0.9 ~ 1.2	
		6		0.8 ~ 1.0	Glass Epoxy
		7		0.9 ~ 1.2	
		8		1.0 ~ 1.4	
		9		Special	
Connection flange rating			1	25A JIS 40KRF	
			2	1" JPI 600#RF	
			3	1" ANSI 600#RF	
			4	25A JIS 63KRF	
			5	1" JPI 900#RF	
			6	1" ANSI 900#RF	
			9	Special	

*1 Shape and dimension E
*2 Measuring range H

FLOAT AVAILABILITY AND SIZES

Titanium Alloy floats

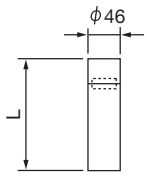
No.	Density (g/cm³)	Design C	Design E	Float L	Float Spec.
E	0.7~0.74	*	200	*	7.3 MPa
F	0.73~0.83	*	200	*	
G	0.8~0.96	*	200	*	
H	0.9~1.2	*	200	*	
9		—	—	—	



*Consult factory for details.

Glass Epoxy floats

No.	Density (g/cm³)	Design C	Design E	Float L
6	0.8~1.0	290	120	280
7	0.9~1.2	210	110	200
8	1.0~1.4	170	100	155



FM-3110, 3120, 3130

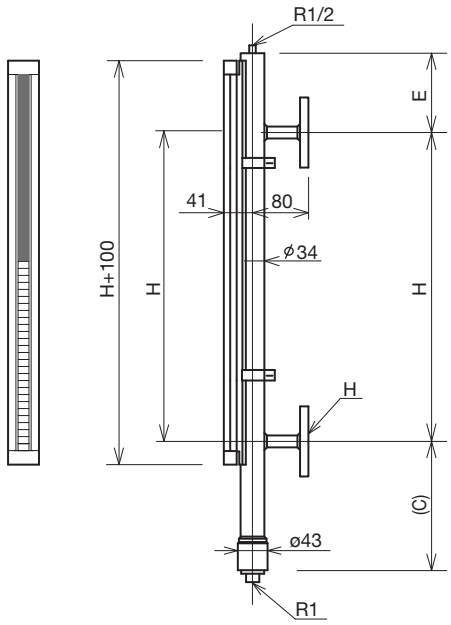
Compact size and metallic type for low pressure and moderate temperature

FM-3100 series is a small and lightweight Mag gauge with a chamber (ø34) made of SUS304, SUS316 or SUS316L stainless steel and SUS316L float.

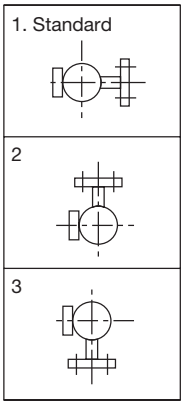
AVAILABLE RANGES OF PRODUCTS

Range : Min. 0~250mm
: Max. 0~2000mm
Max. Op. Press. : 1MPa
(Subject to connection flange rating)
Temp. range : -5°C≦t≦120°C *7
: Alarm contact transmitter (Water-tight, intrinsic safety, flameproof) is available.*1

DIMENSIONS



INDICATOR INSTALLATION ANGLE



MODEL CODE

		—	31			—		Description
Flapper pitch	**FM**							10mm (Accuracy –15mm)
Chamber material *2				**1**				SUS304
				2				SUS316
				3				SUS316L
Density range (g/cm³) *3 Float material *4					**1**			0.85~0.97 / SUS316L
					2			0.95~1.12
					3			1.10~1.42
					4			1.40~2.0
Connection flange rating							**0**	10A JIS 10KFF
							1	10A JIS 10KRF
							2	10A JIS 5KFF
							3	10A JIS 5KRF
							4	15A (1/2") flanges *5
							5	20A (3/4") flanges *5
							6	25A (1") flanges *5
							9	Special *6

*1 : Analog level transmitter is not applicable. FM-1000 series is recommended.
*2,*4 : FM-1000 series is recommended if special materials are required.
*3 : FM-1000 series is recommended if special range of density is required.
*5 : JIS10KFF, JIS10KRF, JPI #150 and ANSI #150 are available.
*6 : Consult factory for details.
*7 : The indicator cannot have a non-frost acrylic resin plate.

FLOAT AVAILABILITY AND SIZES

No.	Density (g/cm³)	Design		Floot		
		C	E	Material	L	
1	0.85~0.97	320	100	SUS316L	320	ø26 / L
2	0.95~1.12	230			229	
3	1.10~1.42	180			177	
4	1.40~2.00	180			177	

FM-1610, 1620, 1630, 16Z0

Metallic type for low pressure and high temperature

FM-1600 is a series of metal tube level gauge for high temperature with stainless steel chamber and float (titanium float for low density applications). A thermal insulation is provided between indicator and chamber to cover high temperature.

AVAILABLE RANGES OF PRODUCTS

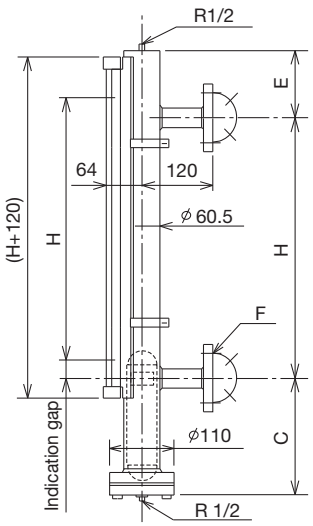
Range : Min. 0~250mm
Max. 0~4380mm *

Max. Op. Press.: 2MPa (Titanium float : 1.6MPa)
(Subject to connection flange rating)

Temp. range : 120°C<t≦300°C (Titanium float : 120°C<t≦250°C)
(Select standard types of FM-12 $\frac{1}{2}_{3}$ 0 series for the temperature range of -10°C≦t≦120°C.)

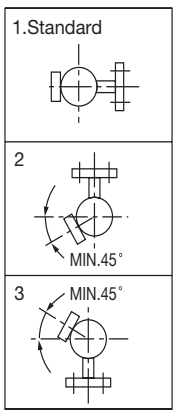
* Observe heat expansion factor of stainless steel chamber and vessel material to finalize measuring range.

DIMENSIONS

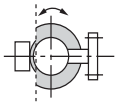


* Dimension will be changed.
Consult factory for details.

INDICATOR INSTALLATION ANGLE



Heating / thermal insulation are to be conducted onto chamber portion only.

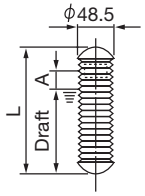


MODEL CODE

FM-16			—		Description	
Chamber material	1				SUS304	
	2				SUS316	
	3				SUS316L	
	Z				Other	
Density range (g/cm³) Float material		A			0.39~0.45	TP340 Titanium
		0			0.44~0.52	
		1			0.5~0.6	
		2			0.55~0.7	
		3			0.62~0.8	
		P			0.65~0.8	SUS316 or SUS316L
		5			0.7~0.9	
		6			0.8~1.0	
		7			0.9~1.4	
		8			1.0~1.5	
Connection flange rating			—	0	25A JIS 10KFF	
			—	1	25A JIS 10KRF	
			—	2	1" JPI 150# RF	
			—	3	1" ANSI 150# RF	
			—	4	25A JIS 20KRF	
			—	5	1" JPI 300# RF	
			—	6	1" ANSI 300# RF	
			—	7	25A JIS 5KFF	
			—	8	Other 1"(25mm) flanges	
			—	9	Special	

FLOAT AVAILABILITY AND SIZES

No.	Density (g/cm³)	Design C	Design E	Float Material	Float L
A	0.39～0.45	620	200	TP340 Titanium *(1.31MPa)	650
0	0.44～0.52	490	200		520
1	0.5～0.6	390	200		410
2	0.55～0.7	340	200		360
3	0.62～0.8	290	200		300
P	0.65～0.8	460	170	SUS316 or SUS316L *(1.35MPa)	460
5	0.7～0.9	400	170		400
6	0.8～1.0	300	150		300
7	0.9～1.4	260	150		260
8	1.0～1.5	230	130		230



* Consult factory for details when max. press. exceeds these value.

FM-1710, 1720, 1730, 17Z0

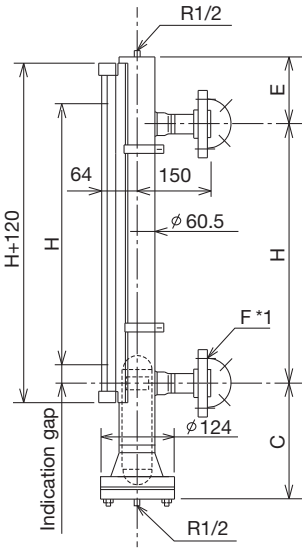
Metallic type for medium pressure and high temperature

FM-1700 is a series of metal tube level gauge with stainless steel chamber and titanium alloy float for high temperature and medium pressure.

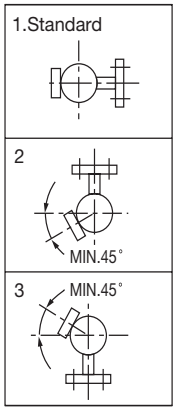
AVAILABLE RANGES OF PRODUCTS

Range : Min. 0~250mm
Max. 0~4380mm *
Max. Op. Press.: 3.9MPa
(Max. 4.4MPa for TP340 float)
(Subject to connection flange rating)
Temp. range : 120°C<t≦285°C
(Select standard types of FM-1300 series for the temperature range of -10°C≦t≦120°C.)
* Observe heat expansion factor of stainless steel chamber and vessel material to finalize measuring range.

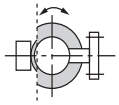
DIMENSIONS



INDICATOR INSTALLATION ANGLE



Heating / thermal insulation are to be conducted onto chamber portion only.

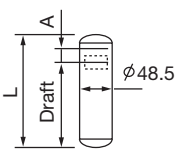
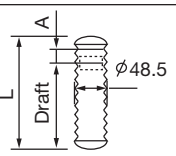


MODEL CODE

FM-17			—		Description	
Chamber material	1				SUS304	
	2				SUS316	
	3				SUS316L	
	Z				Special	
Density range (g/cm³) Float material		F			0.66~0.68	Titanium alloy Max.3.9MPa
		—			—	
		—			—	
		—			—	
		1			0.64~0.69	TP340 Titanium Max.4.4MPa
		2			0.69~0.77	
		3			0.77~0.88	
		5			0.82~0.96	
		6			0.95~1.2	
		7			1.1~1.5	
		9			Special	
Connection flange rating				1	1" JPI 300# RF	
				2	1" ANSI 300# RF	
				3	1" JPI 600# RF	
				4	1" ANSI 600# RF	
				5	1" JPI 600# RTJ	
				6	1" ANSI 600# RTJ	
				9	Special	

*1 Connection F

FLOAT AVAILABILITY AND SIZES

No.	Density (g/cm³)	Design C	Design E	Design L	Float
F	0.66~0.68	*	200	*	
—	—	—	—	—	
—	—	—	—	—	
—	—	—	—	—	
—	—	—	—	—	
—	—	—	—	—	
—	—	—	—	—	
1	0.64~0.69	820	200	820	
2	0.69~0.77	630	200	630	
3	0.77~0.88	480	200	485	
5	0.82~0.96	390	200	405	
6	0.95~1.2	320	200	325	
7	1.1~1.5	250	200	260	
9	Special	—	—	—	———

*Consult factory for details.

FM-1810, 1820, 1830, 18Z0

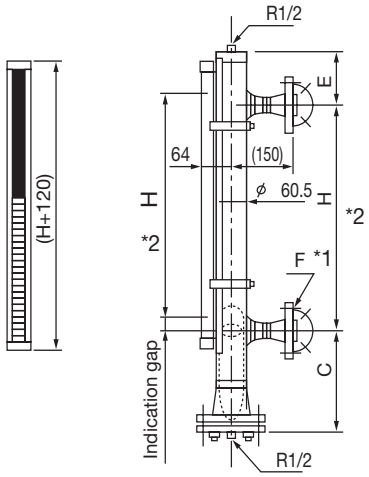
Metallic type for high pressure and high temperature

FM-1800 is a series of metal tube level gauge with stainless steel chamber and titanium alloy float for high temperature and high pressure.

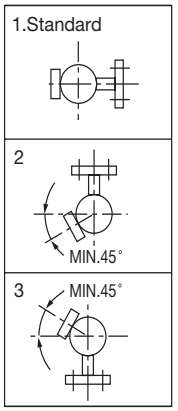
AVAILABLE RANGES OF PRODUCTS

Range : Min. 0~250mm
Max. 0~4380mm *
Max. Op. Press. : 7MPa
(Subject to connection flange rating)
Temp. range : 120°C<t≦285°C
(Select FM-1400 series for the temperature range of -10°C≦t≦120°C.)
* Observe heat expansion factor of stainless steel chamber and vessel material to finalize measuring range.

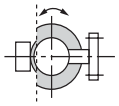
DIMENSIONS



INDICATOR INSTALLATION ANGLE



Heating / thermal insulation are to be conducted onto chamber portion only.

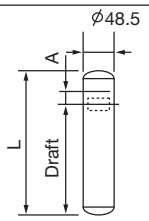


MODEL CODE

FM-18				Description	
Chamber material	1			SUS304	
	2			SUS316	
	3			SUS316L	
	Z			Special	
Density range (g/cm³) Float material		F		0.76~0.77	Titanium alloy (Gas filled)
		G		0.79~0.89	
		H		0.86~0.98	
		I		0.95~1.2	
		J		1.08~1.3	
		9		Special	
Connection flange rating			1	1" JPI 900#RF	
			2	1" ANSI 900#RF	
			3	1" JPI 900#RTJ	
			4	1" ANSI 900#RTJ	
			5	1" JPI 1500#RF	
			6	1" ANSI 1500#RF	
			7	1" JPI 1500#RTJ	
			8	1" ANSI 1500#RTJ	
			9	Special	

FLOAT AVAILABILITY AND SIZES

No.	Density (g/cm³)	Design C	Design E	Design L	Float
F	0.76~0.77	*	200	*	
G	0.79~0.89	*	200	*	
H	0.86~0.98	*	200	*	
I	0.95~1.2	*	200	*	
J	1.08~1.3	*	200	*	
—	—	—	—	—	
—	—	—	—	—	
9	Special				



*Consult factory for details.

*1 Connection F
*2 Measuring range H

ADD-ON ALARM CONTACTS

Alarm contact (s) can be provided to all FM Mag Gauges.
A reed switch is located at side portion of chamber which is actuated by the magnet in float. Watertight, Intrinsically safe as well as Flameproof versions are available.

MODEL CODE OF ALARM CONTACTS

FM-□□□-□5 6 7/□□□□

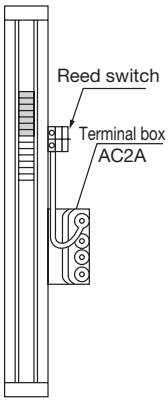
FM-1	5	6	7		
Enclosure	W				Watertight (Non-explosion proof)
	E				EX-d, Flameproof
	S				EX-i, Intrinsically safe
Contact					No. of contact
Terminal box					No. of terminal box

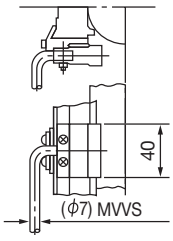
SPECIFICATION

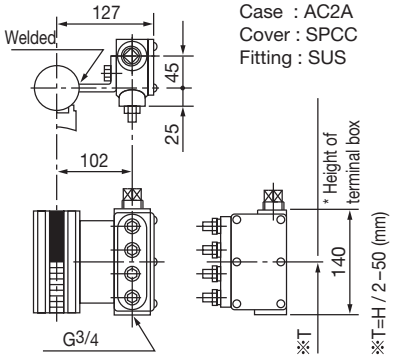
● Watertight version (FM-□□□-□W□□)

Type of contact : 1 X SPST(Self-holding contact)
Contact capacity : 10W, AC/DC
Max. voltage ; AC,DC 100V
Fluid temp. : –10~200°C
Ambient temp. : –10~60°C
Enclosure : Watertight

No. of contact : Depending on the length of chamber (No limitation)
Repeatability : ±15mm (Equivalent to indicator accuracy)
Reset span : Max. 30mm (Fixed)
Alarm action : High or Low (To be specified. Also at field adjustable)
Setting range : 50mm
Min. gap between points : 50mm (Shorter gap on request)
Accessory : Surge suppressor intergrated (It is not attached to IS version)
Terminal box : The cable from a reed switch is drawn and it is used for terminal connection.
Installed terminal : 8P, M3.5 screws
Cable entries : For alarm switches
4 entries with packing type cable gland,
Max. cable dia. 7 mm
For alarm outlet
1 X G3/4 (Female)





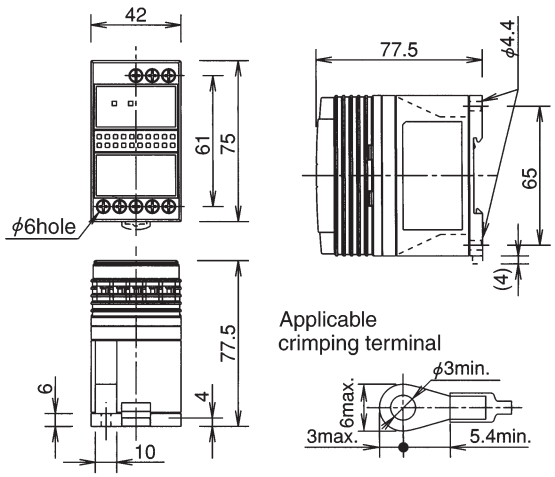


Note 1: When installing the insulating material, do not install it around the alarm sensor.

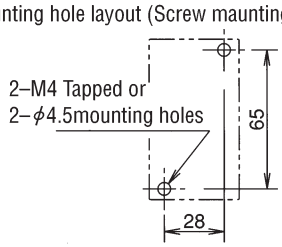
● Intrinsically safe version (FM - □□□ -□S □□)
A safety relay is inserted into the contact loop of watertight version to achieve Insrinsically safe loop.

IS classification : Ex ia IIC T6
(Subject to using of specified safety relay)

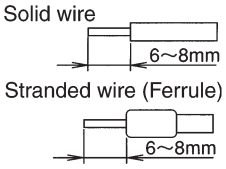
Dimension of Safety Relay EB3C-R01A (1 point use)



Mounting hole layout (Screw maunting)



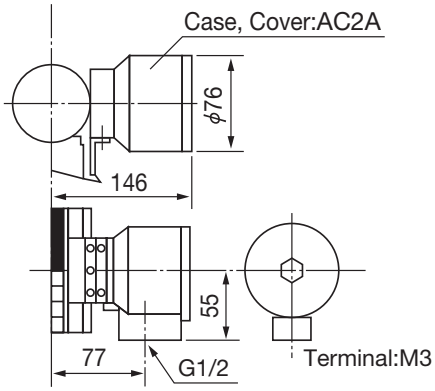
Stripping the wire end



● Flameproof enclosure version (FM-1□□□- □E□□)

Individual reed switch and terminals are capcellated in one pressure tight housing for each alarm contact.

Construction : Flameproof enclosure (d2G5) (No. T49972)
Type of contact : SPST (Self-holding contact)
Contact capacity : 10W, AC/DC
Max. voltage ; AC,DC 100V
No. of contact : Depending on the length of chamber
(No limitation)
Repeatability : ±15mm
(Equivalent to indicator accuracy)
Reset span : Max. 30mm (Fixed)
Alarm action : High or Low (To be specified.)
Setting range : From 100 mm above lower end to 100 mm below upper end
Min. gap between points :
200mm (Shorter gap on request)
Fluid temp. : -10~200˚C
Amb. temp. : -10~60˚C
Accessory : Surge suppressor integrated
Built-in terminal : 2P (M3)
Installation : Clamping onto chamber
Cable entry : 1XG1/2 (Female)
Alarm contact signals are sent to the non-hazardous area for further processing. The packing type cable gland to be supplied by the customers.



ADD-ON CURRENT LEVEL TRANSMITTER

The 4 to 20mA 2-wire current transmitter can be additionally provided for all types of FM-1000 Mag Gauge even together with alarm contact (s).

Watertight, Intrinsically safe and Flameproof versions are available to meet area classification.

MODEL CODE OF ANALOG TRANSMITTER

FM-1	8	9	10	
Enclosure	W			Watertight
	E			Flameproof
	S			Intrinsically safe
Direction of sensor		R		Right hand side
		L		Left hand side
Direction of Converter			R	Right hand side
			L	Left hand side

SPECIFICATION

Output span : Min. 0~250mm
Max. 0~4380mm
(Shorter output span than measuring range on request)

Enclosure : 1) Watertight
FM-1□□□- □□□□/ □W□□
2) Flameproof
FM-1□□□- □□□□/ □E□□
Ex d IIB T6, RIIS certification No. TC14720
3) Intrinsically safe
FM-1□□□- □□□□/ □S□□
Ex ia IIC T4, RIIS certification No. TC16354

Fluid temp. : –10~200˚C

Amb. temp. : –10~55˚C

Power supply: Nominal DC24V

Max. load resistance

Watertight (W)	600Ω
Flameproof (E)	600Ω

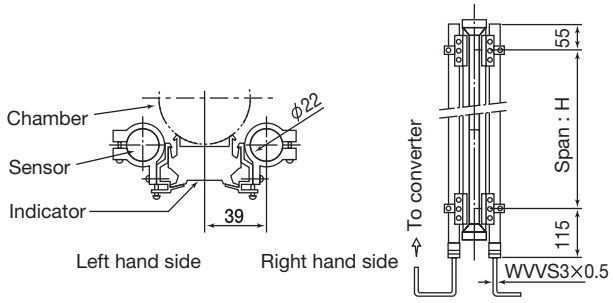
Intrinsically safe construction (600 – Resistance inside barrier)Ω
When using MTL728+, 600 – 340 = 260Ω

Output accuracy : $\pm(0.2+\frac{10}{H}\times100)\%$ F.S.
H : Measuring range(mm)

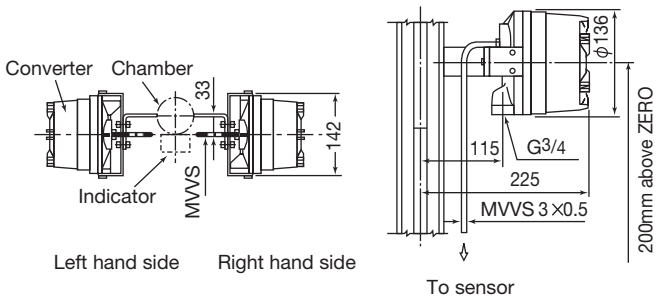
DIMENSION

Watertight (W) and Intrinsically safe (S)

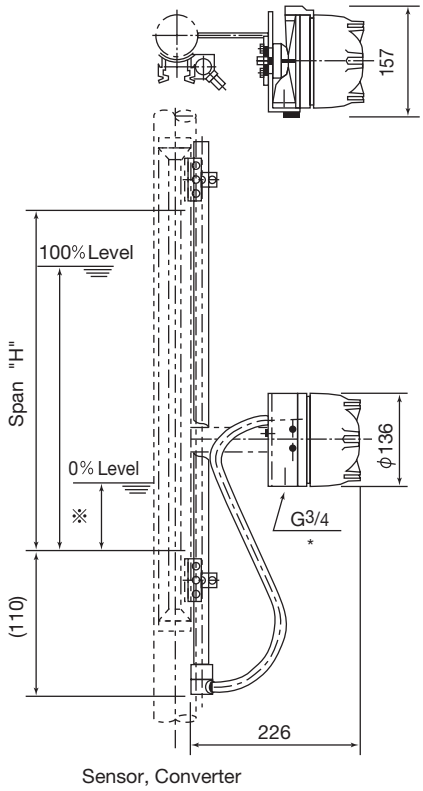
a. Sensor (Installed onto indicator housing)



b. Convertor (Installed onto chamber)



Flameproof version (E)



*: WITH CABLE GLAND
MODEL : SXC-22B
Outer diameter of cable: Up to Ø9.9 mm

Note 1: The transmitter (14 to 20mA) shall be replaced or readjusted after returning to Tokyo Keiso.

Note 2: When installing the insulating material, do not install it around the detector.

Typical specification sheet

Use following sheet for your inquiry or ordering

Model code	FM-1□□□-□□□□ / □□□			Quantity	
Fluid		Density		Viscosity	
Pressure	MPa		Temperature	°C	
Measuring span (measuring range)	mm		Connection flange size and rating		
Other requirements					

* Specification is subject to change without notice.

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