TECHNICAL GUIDANCE

PRESSURE- TIGHT FLAMEPROOF FOR HYDROGEN ATMOSPHERE READY

FR-6000 Series

FLOAT TYPE LEVEL SWITCH

OUTLINE

FR-6000 is a float-rod type level switch which applies for wide range of pressure and temperature. FR-6000 is suitable for the monitoring of liquid levels in various process tanks, boiler feeding water, etc.

FEATURES

- ❏ Wide selection range for temperature and pressure.
- ❏ Variety of material selection for float and chambers for suitable anti-corrosive capability.
- ❏ Perfect isolation between pressurized part and electric component by magnetic coupling for high reliability and safety.
- ❏ In addition to watertight construction, pressure tight and intrinsically safe versions are ready to meet hazardous application.
  Especially, pressure-tight flameproof suitable for Hydrogen atmosphere (Ex d IIC T6) is available which eliminates the necessity of safety barriers.

MAIN APPLICATIONS

- ● Boiler Feeding drum water control
- ● Fuel oil tank level control
- ● Process control for petrochemical plants
- ● Water treatment plants
- ● Oil rig's platform
- ● Sealing liquid level control for generators and turbines
- ● Other liquid level control

TOKYO KEISO CO.,LTD.

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STANDARD SPECIFICATION

●Detection method : By float
●Measurement object : Liquids (Level)
●Viscosity : Max. 600 mPa•s. Liquid without sticking, crystallization, or freezing
●Density range : For level detection
0.56 to 2.0g/cm^3
●Pressure rating : 10K (150#), 20K (300#)
●Accuracy : ±10mm (Density 1.0g/cm^3)
●Repeatability : For level detection ±5mm
●Reset span : Within 15mm, but more than 15mm, depending on the switch specification and the density.
●Liquid temp. : -25 to +400˚C
One cooling fin will be provided for the version for higher temp. than 151˚C.
Two cooling fins will be provided for the version for higher temp. than 281˚C.
Contact capacity of such high temp. versions will differ from standard version. Refer to "CONTACT CAPACITY" for further details.
●Enclosure : Watertight IP65 equ. FR-609❑W
Pressure-tight flameproof
Ex d IIC T6 FR-609❑EX
Intrinsically Safe Ex ia IIC T6 FR-609❑S
(Safety relay to be separately installed)
Ambient temperature: -20°C to +80°C, but Flameproof type: -20°C to +55°C
Intrinsically safe ex-proof type: -20°C to +80°C
●Installation : Tank top flange connection or
Tank side connection through chamber
●Connection : For tank top installation
Through 4B flange
JIS10K, ANSI#150, JPI#150
JIS20K, ANSI#300, JPI#300
or Others
For tank side connection
through chamber
1"SW,Rc1,1"NPT
25AJIS10KRF, 1"ANSI#150, 1"JPI#150
25AJIS20KRF, 1"ANSI#300, 1"JPI#300
other 1"flange or others

●Material :
Float / SUS316, SUS316L, or TP340)
Lead pipe / SUS304, SUS316, or SUS316L
Top flange / Carbon steel, SUS304, SUS316, or SUS316L
Housing / Aluminium alloy casting
Chamber / Carbon steel
SUS304 / SUS304
SUS316 / SUS316 or
SUS316L / SUS316L
●Painting : For liquid temp.upto 150˚C
Polyurethan resin painting
For liquid temp.more than 151˚C
Silicone resin painting
(Only the exterior side of iron and aluminium is painted.)
●Color : Silver (std.)
●Alarm point : 1 point (High or Low)
●Contact : 1 x SPDT or
2SPDT (Equ. to DPDT)
●Contact capacity : Refer to Model code
●Cable entry :

Model	Classification	Cable entry	Remarks
FR-609□W	(Watertight)	G3/4	–
FR-609□EX	Ex d IIC T6	G1/2	Cable dia. ø9 to 11
		G3/4	Cable dia. ø12 to 14
FR-609□S	Ex ia IIC T6	G3/4	

NPT and other threads are available by adapters.

●Cable termination : By M3.5 screw terminal
(M3 screw terminal for high temp. versions)

MODEL CODE

Basic code — Detection part — Chamber

FR-609 ① ② – ③ ④ ⑤ ⑥ ⑦ ⑧ – ⑨ ⑩ ⑪ ⑫

① Pressure rating

1	150#(10K)class
2	300#(20K)class

② Enclosure

W	Watertight(IP65equ.)
EX	Pressure-tight flameproof(Ex d IIC T6)
S	Intrinsically safe(i3nG5)

③ Top flange size

4	4"(100mm)
Z	Others

④ Top flange rating

4	JIS10KRF
5	JPI#150
6	ANSI#150
7	JIS20KRF
8	JPI#300
9	ANSI#300
Z	Others

⑤ Top flange/Lead pipe material

S	Carbon steel/SUS304
4	SUS304/SUS304
6	SUS316/SUS316
L	SUS316L/SUS316L
Z	Others

⑥ Float material

S	SUS316
L	SUS316L
T	Titanium
Z	Others

⑦ Switch type, Temp. class etc.

CODE	LIQUID TEMP (°C)	ON/OFF MECHANISM TYPE	CONTACT TYPE	SWITCH MODEL	SWITCH SUPPLER	CONTACT CAPACITY	MINIMUM APPLICABLE LOAD	NO. OF COOLING FIN
1	–25~150	GENERAL PURPOSE	SPDT	VX-5-1A2	OMRON	AC250V, 5A DC125V, 0.4A	DC5V 160mA	0
2	151~230			V5-1A3T				1
3	231~280			TZ-1GV		AC250V, 1A DC125V, 0.4A	DC5V 20mA	1
4	281~400							2
5	–25~150		2SPDT	VX-5-1A2		AC250V, 5A DC125V, 0.4A	DC5V 160mA	0
6	151~230			V5-1A3T				1
7	231~280	EARTHQUAKE PROOF (3G) TYPE		TZ-1GV		AC250V, 1A DC125V, 0.4A	DC5V 20mA	1
8	281~400							2
A	–25~150	HERMETIC SEAL TYPE	SPDT	11SM244	Azbil	AC250V, 5A DC125V, 0.3A DC30V, 5A	DC5V 100mA	0
B	151~280							1
C	281~350							2
D	–25~150		SPDT (GOLD PLATED)	SSM13A0		AC125V, 0.1A DC30V, 0.1A	DC5V 1mA	0
E	151~200							1
F	–25~150		2SPDT	11SM244		AC250V, 5A DC125V, 0.3A DC30V, 5A	DC5V 100mA	0
G	151~280							1
H	281~350							2
I	–25~150		2SPDT (GOLD PLATED)	SSM13A0		AC125V, 0.1A DC30V, 0.1A	DC5V 1mA	0
J	151~200							1
K	–25~150	EARTHQUAKE PROOF (3G) TYPE	SPDT	VX-5-1A2	OMRON	AC250V, 5A DC125V, 0.4A	DC5V 160mA	0
L	151~230			V5-1A3T				1
M	–25~150		2SPDT	VX-5-1A2				0
N	151~230			V5-1A3T				1
Z	–	SPECIAL	–	–	–	–	–	–

∗ : For applications with lower temperature than -26°C, an extension unit will be added and the external dimension will be diferrent from the standard versions. Conslut fectory for details.

⑧ Switch action

H	High alarm
L	Low alarm

⑫ Gasket material

0	Not provided
4	VORTEX(SUS304)
6	VORTEX(SUS316)
Z	Others

Bolts, nuts and gaskets for process connection are to be supplied by the customer.

⑪ Chamber connection

0	Not provided
1	1"SW
2	Rc1
3	1"NPT
4	1"JIS10KRF
5	1"JPI#150
6	1"ANSI#150
7	1BJIS20K
8	1"JPI#300
9	1"ANSI#300
D	Other 1"(25mm)flange
Z	Others

⑩ Chamber material

0	Not provided
S	Carbon steel
4	SUS304
6	SUS316
L	SUS316L
Z	Others

⑨ Chamber material

0	Not provided
A	Side-Side
B	Side-Bottom
Z	Others

FLOAT TYPE AND DIMENSIONS

Table 1: Float Table

Float No			Minimum possible density (g/cm³)			Maximum possible pressure (MPa)			
			−25 to 150℃	151 to 280℃	281 to 400℃	−15 to 40℃	200℃	315℃	400℃
1	A	T	0.56	0.61	0.61	2.0	1.1	0.9	—
	N	T	0.59	0.63	0.64	3.3	3.2	2.6	—
2	A	6	0.6	0.64	0.64	1.0	0.9	0.8	0.8
		L				1.0	0.6	0.5	0.5
	N	6	0.63	0.66	0.67	2.3	2.3	2.1	1.8
		L				2.2	2.2	1.8	1.6
3	A	T	0.66	0.7	0.71	2.4	1.3	1.0	—
	N	T	0.7	0.73	0.74	3.7	3.6	3.0	—
4	A	6	0.73	0.75	0.76	1.1	1.0	0.9	0.8
		L				1.0	0.7	0.6	0.5
	N	6	0.74	0.76	0.77	2.5	2.5	2.2	1.9
		L				2.3	2.3	1.9	1.7
5	A	6	0.83	0.84	0.85	1.2	1.1	1.0	0.9
		L				1.1	0.7	0.6	0.5
	N	6	0.86	0.87	0.88	2.5	2.5	2.3	2.0
		L				2.3	2.3	1.9	1.7

T : TP340
6 : SUS316
L : SUS316L
A : Standard design
N : Purged

The content of this table may differ for alam point and switch type.

Float design

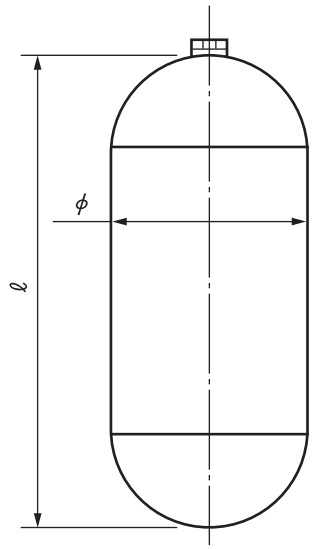


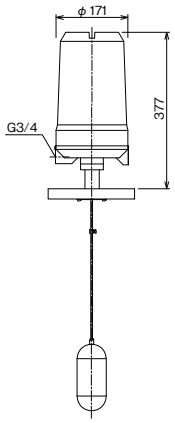
Table 2 : Float dimension

Float No.	Dimension (mm)	
	ℓ	ϕ
1-□T	200	85
2-□$^{6}_{L}$	200	85
3-□T	160	85
4-□$^{6}_{L}$	160	85
5-□$^{6}_{L}$	135	85

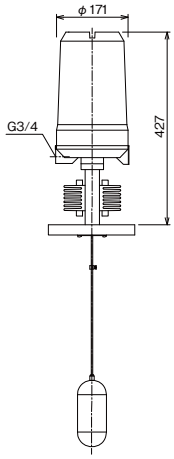
EXTERNAL DIMENSIONS

1. Detection part

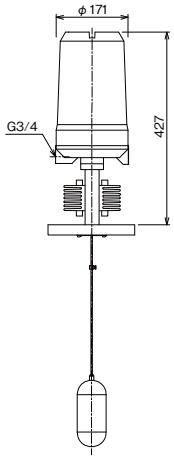
FR-609□W-□□□□1□



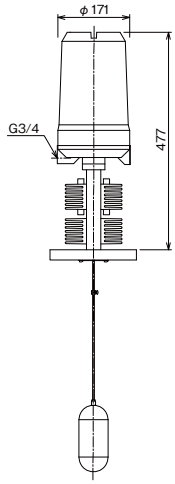
FR-609□W-□□□□2□



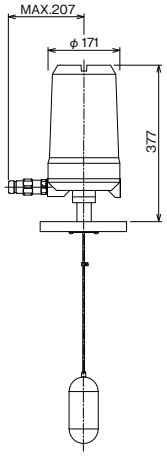
FR-609□W-□□□□3□



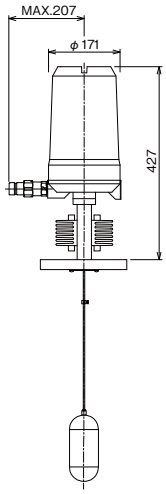
FR-609□W-□□□□4□



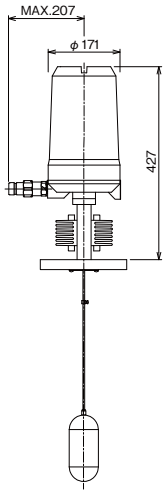
FR-609□EX-□□□□1□



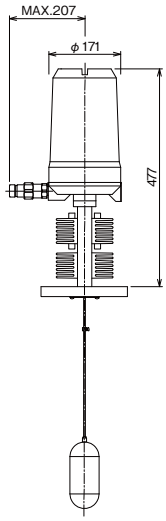
FR-609□EX-□□□□2□



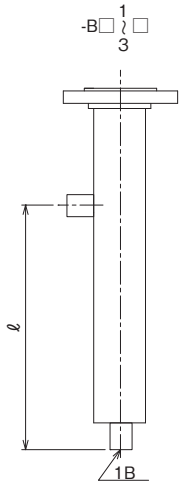
FR-609□EX-□□□□3□

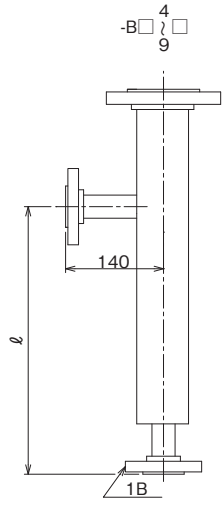


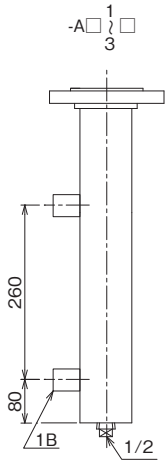
FR-609□EX-□□□□4□

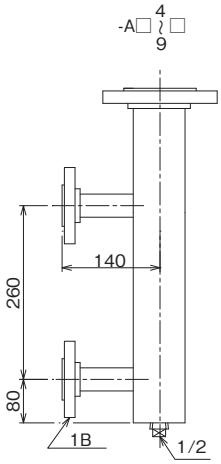


2. External Chamber





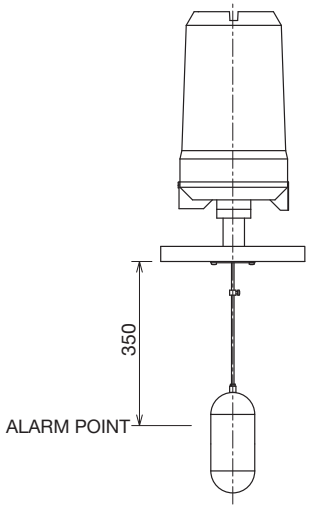




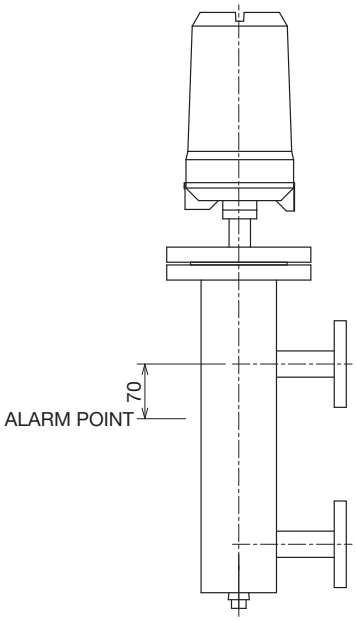
ALARM ACTUATING POINT

The standard alarm actuating point of FR-6000 level switches is as follows. Other actuating point is available as special order. Please ordering.

1) For Top flange installation type



2) For External chamber installation type



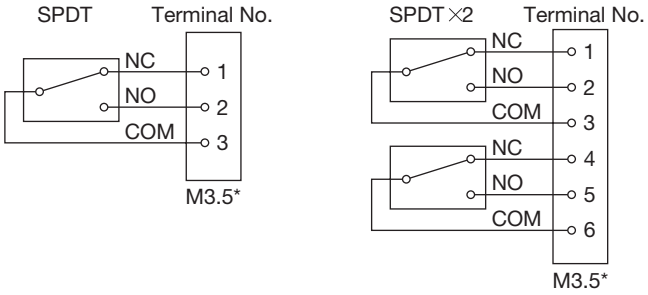
70mm below the center line of upper nozzle both for side~side and side~bottom type chambers.

CAUTIONS FOR WIRING

- In case of the flameproof type (FR-609❑EX) and intrinsically safe (FR-609❑S) to be used in Japan, the cable wiring is to be conducted in accordance with the enforcement regulations of "Cable Wiring" system in FLAMEPROOF TYPE CABLE WIRING as specified in "Industrial Safety and Health Law". For details, refer to "USER'S GUIDELINES for Electrical Installation for Explosive Gas Atmospheres in General Industry" edited by MINISTRY OF HEALTH, LABOR AND WELFARE RESEARCH INSTITUTE OF INDUSTRIAL SAFETY JAPAN.

- FR-609❑EX type pressure tight flameproof version is certified for Exd IICT6 classification under the condition of using our designated pressure-tight cable glands which are delivered together with level switches. They are to be properly installed.

TERMINAL ARRANGEMENT



* M3 terminal for high temp. version

Figures show the switch action at Normal level (Switch is not actuated).

INTRINSICALLY SAFE RELAY (EB3C)

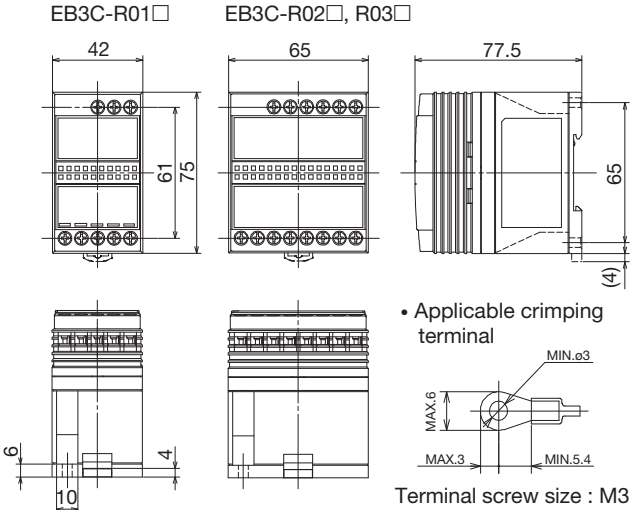
Intrinsically safe relay is to be inserted into the contact loop of FS-10❑S type level switch. 1 to 3 points use relays are available. Select suitable IS relay considering the total number of contacts.

Standard Specification

Explosion protection	Intrinsically safe Ex ia IIC
Rated operating voltage	DC12V±10%
Rated operating current	DC10mA±20%
Installation location	Non-hazardous area
Contact configuration	1a contact
Relay output	AC250V, 3A
(Resistance load)	DC24V, 3A
Contact allowable power	AC750VA
(Resistance load)	DC72W
Insulation resistance	DC500V at 10MΩ
Withstand voltage	AC1500V (1 min.)

Model code				Description
EB3C-	R	□□	□	Model
Output type	R			Relay output
No. of contact		01		1 point use
		02		2 points use
		03		3 points use
Power supply			A	AC100V to 240V, 50/60Hz
			D	DC24V

EB3C Dimensions



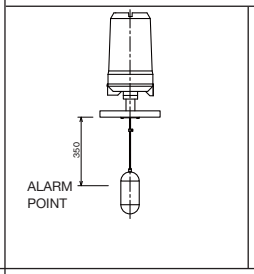
ORDERING SPECIFICATION

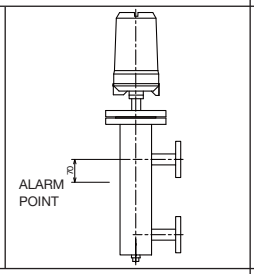
Specify the following for order/inquiry:

TAG No.				
Model	FR-609 □□ – □□□□□□ – □□□□/			
Q' TY				
Liquid name				
Density				
Pressure	NOR.	Max.	□MPa	□( )
TEMP.	NOR.	Max.	□℃	□( )

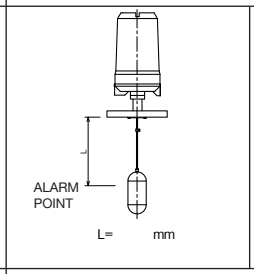
ALARM ACTUATING POINT

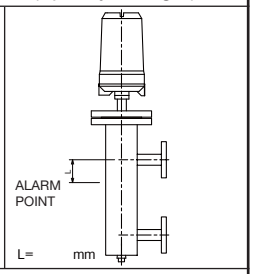
□STANDARD





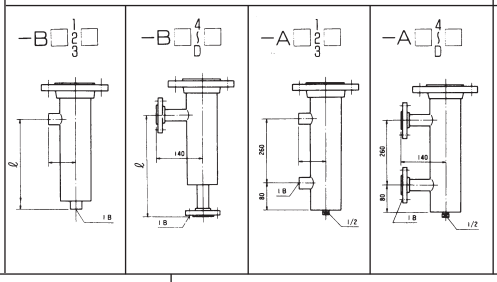
□CUSTOM ORDER (Specify L length)



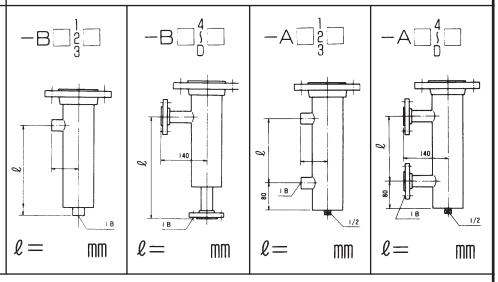


CHAMBER SIZE

□STANDARD



□CUSTOM ORDER (Specify ℓ length)



IN CASE PRESSURE TIGHT CABLE GLANDS ARE INCLUDED:	Outer diameter of cable mm
For IS version (FR-609□S)	□IS relay to be included □IS relay not included Q'ty 1 point use × ( ), 3 points use × ( ) Power supply □AC100/110V, AC200/220V
OTHER SPECIAL INSTRUCTION, IF ANY	

OTHER LEVEL SWITCHES

Different types of level switches are available to meet the requirements. Consult factory for further details.

FB-5000 Ball float type

FB-7000 Ball float type

FP-4000 Lead plpe type

FS-100 Displacer type

FM-1000 Metal tube magnetic float type

* 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