



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.

Hermetic Seal Switch version is additionally available.



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 dIIC 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
- Nuclear power plant process control
- Water treatment plants
- Oil rig's platform
- Sealing liquid level control for generators and turbines
- Other liquid level control

STANDARD SPECIFICATION

- Detection method : By float
- Measurement object : Liquids (Level)
- Density range : For level detection 0.530~2.0g/cm³
For interface detection Difference to be more than 0.2g/cm³
- Pressure rating : 10K (150#), 20K (300#) and 30K (600#)
- Accuracy : ±10mm (Density 1.0g/cm³)
- Repeatability : For level detection ±5mm
- Reset span : Within 15mm (Fixed), 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 ExdIICT6 FR-609□EX
Intrinsically Safe ExialIC 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
JIS30K, ANSI#600, JPI#600
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
25AJIS30KRF, 1"ANSI#600, 1"JPI#600
other 1"flange or others

- Material :
Float / SUS316, SUS316L, or Titanium (JIS TP35)
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.)
- Colour : Silver (std.)
- Alarm point : 1 point for low or high
- Contact : 1 x SPDT or 2SPDT (Equ. to DPDT)
- Contact capacity : Refer to Model code
- Cable entry :

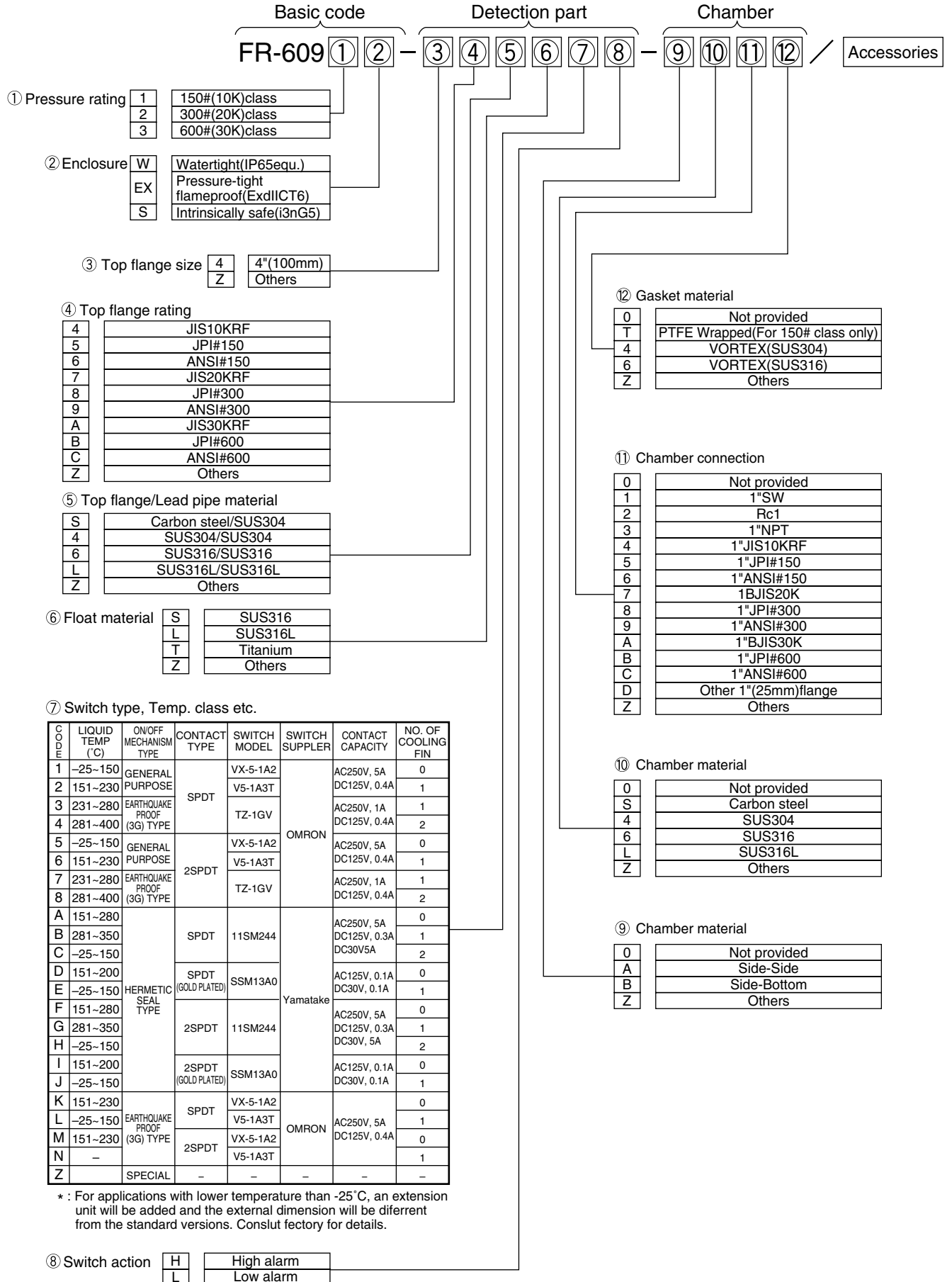
Model	Classification	Cable entry	Remarks
FR-609□W	(Watertight)	G3/4	-
FR-609□EX	Ex dIIC T6	G1/2	Cable dia. ø9 to 11
		G3/4	Cable dia. ø12 to 14
FR-609□S	Ex ialIC T6	G3/4	

NPT and other threads are available by adapters.

- Cable termination : By M3.5 screw terminal (M3 screw terminal for high temp. versions)
Products approved by Japanese High Pressure Gas Application Regulation are available on request.

Material	Design temp	Design Press	Flange
Carbon steel	0 to 350°C	≦ 3MPa	≦ 150A
Stainless Steel	-253 to 450°C	≦ 3MPa	≦ 150A

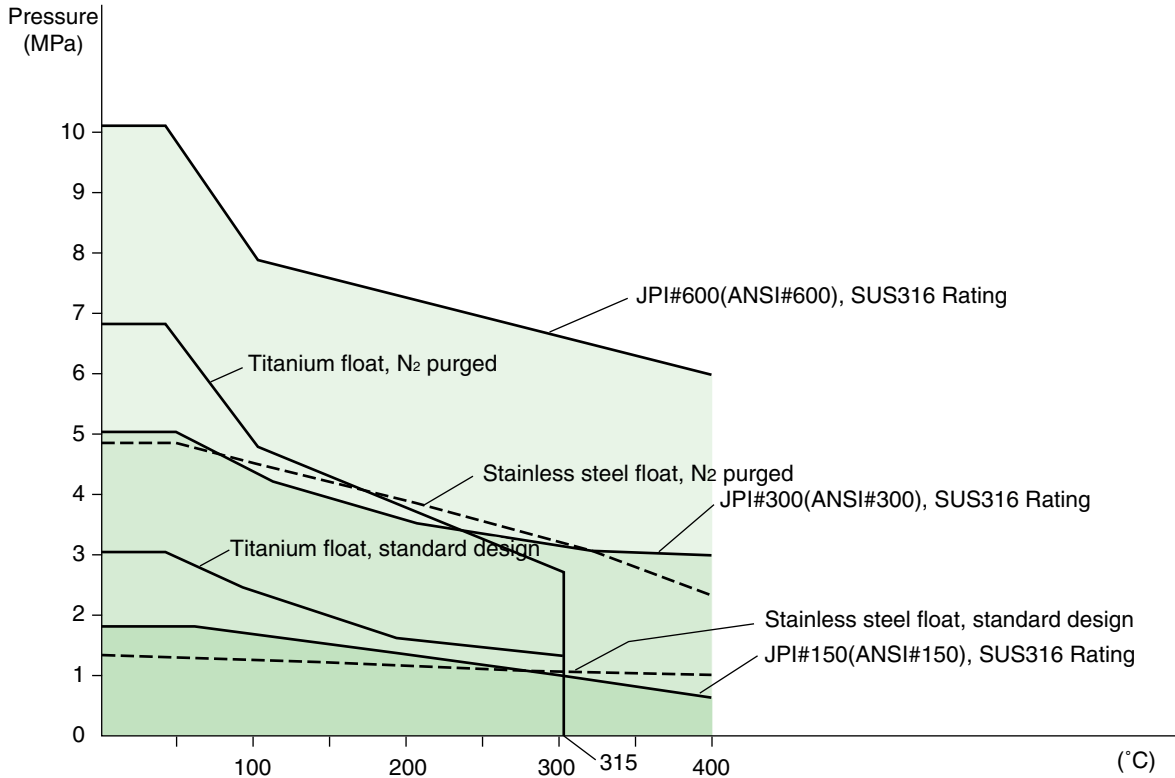
MODEL CODE



MODEL SELECTION

1) Select suitable pressure rating referring to Fig-1 below:

Fig.1: Max. acceptable pressure for float and flange rating chart



2) Confirmation of float availability

Confirm suitable float is available for the application (Pressure, temperature and liquid density) by referring to table 1.

In case suitable float is not available because of pressure and/or temperature, consult factory for other versions. FS-100 type spring balanced displacer type level switches are available for higher pressure and temperature applications.

3) Decision of float material

For some limited applications, only Titanium (JIS TP35) is available. But for almost all applications, SUS316 and SUS316L are available to meet the necessary anti-corrosive capability.

4) External chamber

In case external chamber is required, specify its specification (type, material, connection, etc.)

5) Accessories

Necessary accessories are to be described at the end of model code.

OG :Pressure tight cable glands *1

VP :Vent plug

SC :Special colour and/or painting material

DV :Drain valve (Material will be equivalent to chamber material)

*1 :Specify cable diameter

Describe the details of special requirement, if any.

FLOAT TYPE AND DIMENSIONS

Table 1: Float Table

Float No	Minimum possible density (g/cm ³)			Maximum possible pressure (MPa)					
	-25~150°C	151~280°C	281~400°C	-15~40°C	200°C	315°C	400°C		
1	A	T	0.530	0.540	0.550	3	1.65	1.29	
	N	T	0.591			6.67	3.72	2.64	
2	A	6	0.595	0.612	0.628	1.34	12.2	1.09	1.05
		L				1.07	0.85	0.67	0.62
	N	6	0.663			4.7	3.73	3.23	3.13
		L				3.73	2.84	2.35	2.25
3	A	T	0.604	0.618	0.632	3.24	1.77	1.40	
	N	T	0.674			6.96	3.72	2.74	
4	A	6	0.670	0.693	0.715	1.55	1.38	1.26	1.06
		L				1.24	0.96	0.77	0.63
	N	6	0.753			4.9	3.92	3.33	3.13
		L				3.82	2.94	2.35	2.25
5	A	6	0.741	0.771	0.800	1.63	1.47	1.32	1.25
		L				1.29	1.03	0.81	0.74
	N	6	0.848			5.0	4.02	3.43	3.33
		L				3.92	3.04	2.45	2.35
6	A	6	0.831	0.866	0.898	1.3	1.18	1.06	1.01
		L				1.04	0.94	0.84	0.80
	N	6	0.955			4.7	3.73	3.13	3.04
		L				3.73	2.94	2.64	2.35
7	A	6	0.870	0.912	0.943	1.68	1.5	1.37	1.29
		L				1.34	1.19	1.09	1.03
	N	6	1.0			5.01	4.02	3.53	3.33
		L				4.02	3.13	2.74	2.64

T : Titanium (JIS TP35)
 6 : SUS316
 L : SUS316L
 A : Standard design
 N : N₂ purged

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

Fig 2 : Float design

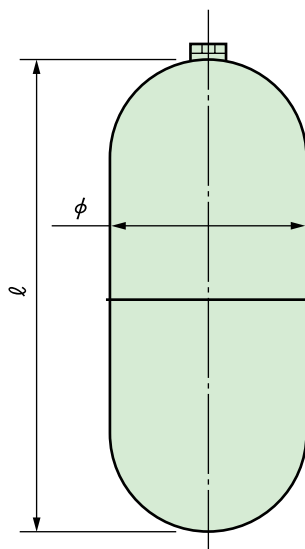


Table 2 : Float dimension

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
6-□ ⁶ _L	160	70
7-□ ⁶ _L	160	70

EXTERNAL DIMENSIONS

1. Detection part

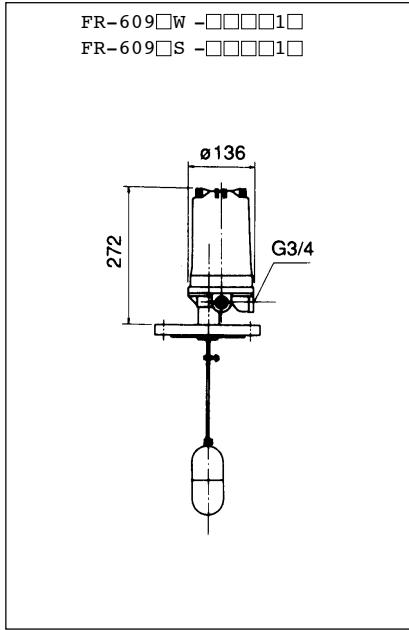


Fig. 3

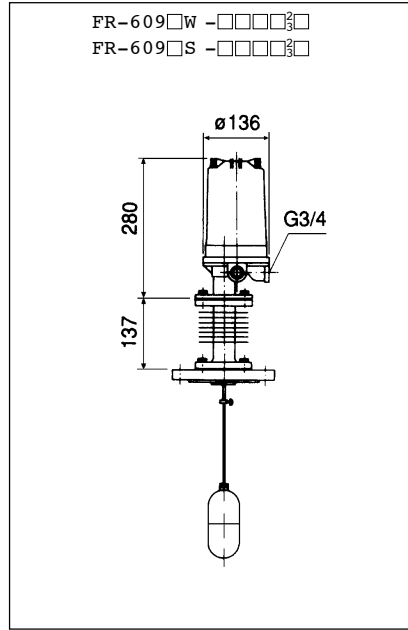


Fig. 4

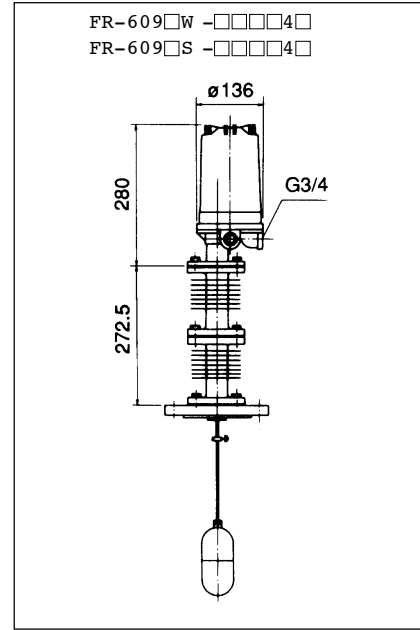


Fig. 5

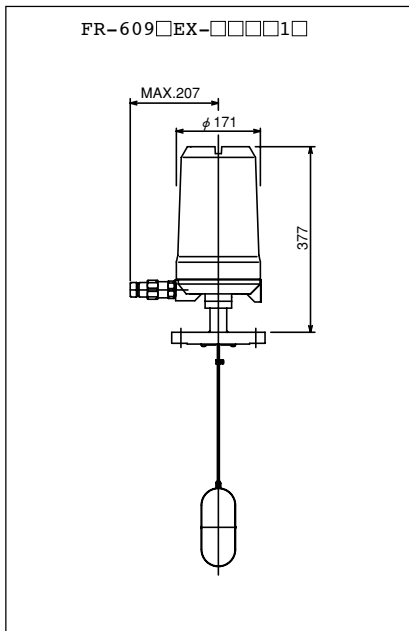


Fig. 6

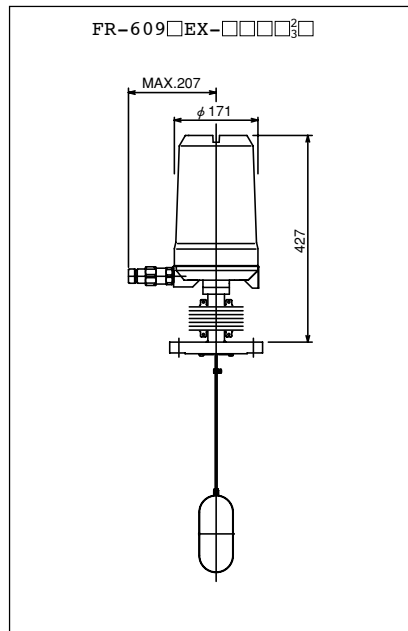


Fig. 7

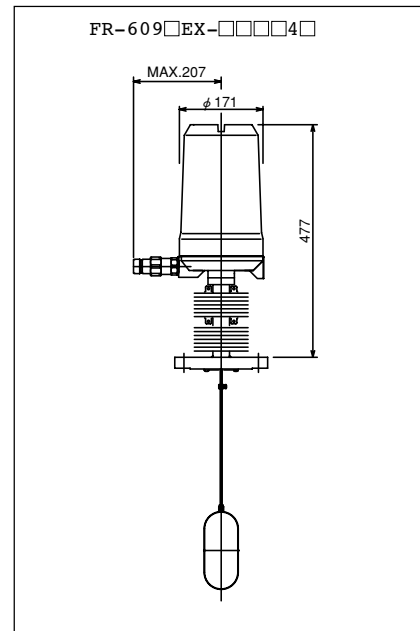


Fig. 8

2. External Chamber

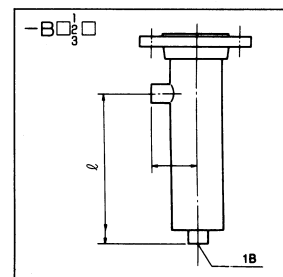


Fig. 9

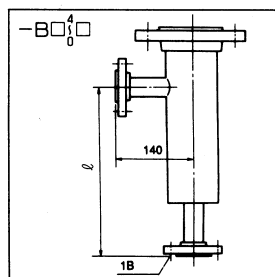


Fig. 10

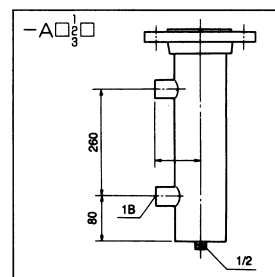


Fig. 11

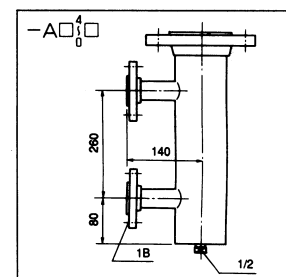
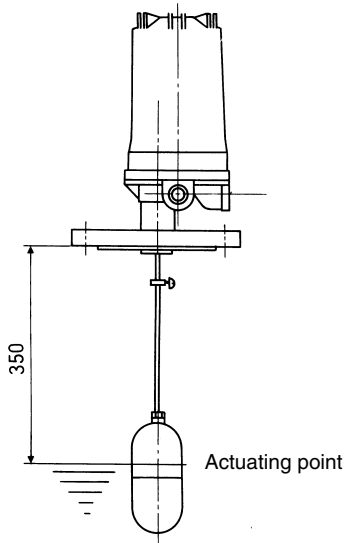


Fig. 12

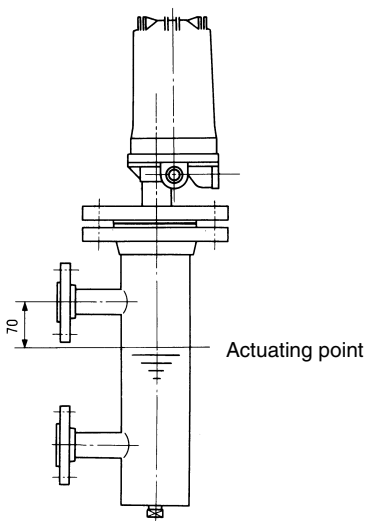
ALARM ACTUATING POINT

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

1) For Top flange installation type



2) For External chamber installation type

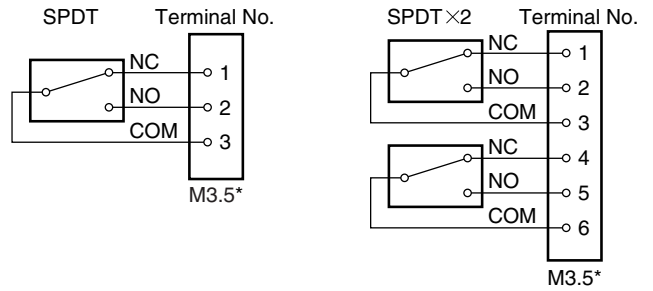


70mm below the center line of upper nozzle both for side~side and side~bottom type chambers.

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 IIC T6 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)

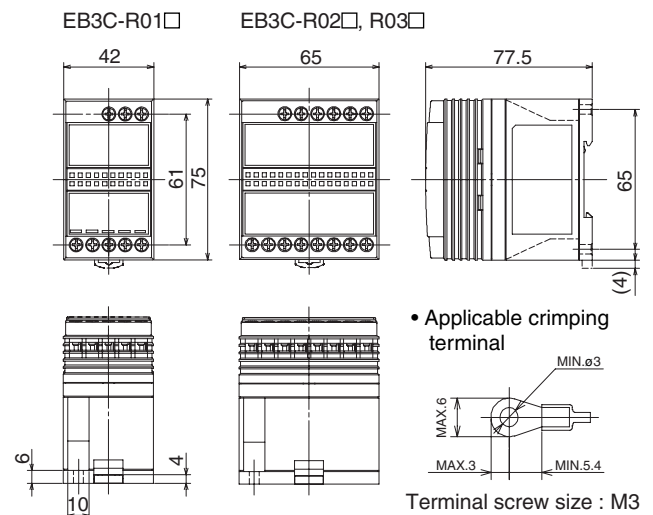
Intrinsically safe relay is to be inserted into the contact loop of FS-10□S type level switch. 1 to 3 points use relays are available. Select suitable IS relay considering the total number of contacts.

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



● Applicable crimping terminal

Terminal screw size : M3

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.	□°C		□()			
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)	<input type="checkbox"/> IS relay to be included <input type="checkbox"/> IS relay not included Q'ty 1 point use × (), 3 points use × () Power supply <input type="checkbox"/> 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.

<p>FB-5000 Ball float type</p>
<p>FB-7000 Ball float type</p>
<p>FP-4000 Lead pipe type</p>
<p>FS-100 Displacer type</p>
<p>FM-1000 Metal tube magnetic float type</p>

* Specification is subject to change without notice.

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