

## FS-100 Series

LEVEL SWITCH

### OUTLINE

**FS-100** is a spring balanced displacer type level switch.

The pressurized part and electric part are perfectly isolated by magnet coupling system to offer much more safety and durability compared to other mechanical sealing types.

**FS-100** can meet tough application with high temperature and high pressure.



### FEATURES

- ❑ Wide selection range for temperature and pressure.
- ❑ Variety of material selection for displacer, spring and chambers for suitable anticorrosive capability.
- ❑ Perfect isolation between pressurized part and electric compartment 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

- ❑ Fuel oil tank level control
- ❑ Process control for petrochemical plants
- ❑ Water treatment plants
- ❑ Oil rig's platform
- ❑ Other liquid level control

**STANDARD SPECIFICATION**

- Detection theory : By spring balanced displacer
- Measuring object : All types of liquids  
(Liquid level or liquid interface)
- Density : For level detection 0.45 g/cm<sup>3</sup> or more  
For liquid interface detection\*  
Difference of 0.2 g/cm<sup>3</sup> or more  
\*Number of points for alarm: 1 point
- Viscosity : Max. 600 mPa·s. Liquid without sticking, crystallization, or freezing
- Accuracy : ±10 mm (Density 1.0 g/cm<sup>3</sup>)  
(For level detection with water (AMB, ATM))
- Repeatability : ±5 mm (Density 1.0 g/cm<sup>3</sup>)  
(For level detection with water (AMB, ATM))
- Reset span : Max.40 mm (Density 1.0g/cm<sup>3</sup>)  
Exceeds 40 mm depending on switch types, density and number of alarm points.
- Pressure range : Full vacuum to 4.9 MPa
- Temp. Range : -60 to +400°C  
(Upto -196°C on request. Consult factory for details.)
- Enclosure :
 

Watertight	IP65 Equ.	FS-10 □ W
Pressure tight flameproof	Ex d IIC T6	FS-10 □ EX
Intrinsically safe	EX ia IIC T6	FS-10 □ S
- Amb. Temp. : -20 to +80°C  
-20 to +55°C for pressure tight flameproof  
-20 to +60°C for Intrinsically safe versions
- Type of process connection and flange sizes :
  - ◎ : Standard
  - : Optionally available
  - : Not available

- Standard Material:  
(Refer to MODEL CODE for special material availability)
- Liquid wetting part
 

Displacer	SUS304, SUS316, SUS316L
Spring	SUS316
Rod	SUS316
Wire	SUS316
Chamber	Carbon steel, SUS304, SUS316, SUS316L
- Vapor contacting part
 

Lead pipe	SUS304, SUS316
Top flange	Carbon steel, SUS304, SUS316 SUS316L
- Non-contacting part
 

Electric housing	Aluminum die-casting
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- Alarm contact : 1,2,3 or 4 points  
Limitation based on switch type and temperature range are applicable, Refer to MODEL CODE ① for further details.
- Type of contact : Standard SPDT Microswitch  
Options 2SPDT  
(Equ. to DPDT action)  
Hermetical sealed  
Microswitch
- Contact capacity : Refer to Model CODE ①
- Cable entry:

Model	Classification	Cable entry	Remarks
FS-10 □W	Watertight	G3/4	—
FS-10 □EX	Ex d IIC T6	G1/2	Cable dia. ø9 to 11
		G3/4	Cable dia. ø12 to 14
FS-10 □S	Ex ia IIC T6	G3/4	—

NPT thread etc. are applicable with adapter.

- Terminal : FS-10 □ W, EX, S  
: Up to 150°C - M3.5 screw  
Over 150°C - M3 screw
- Painting : For liquid temp. upto 150°C  
Polyurethan resin painting  
For liquid temp. more than 151°C  
Silicone resin painting
- Colour : Silver (standard)

① Tank top, welding Internal chamber type

Size	Density < 0.68 g/cm <sup>3</sup>	Density ≥ 0.68 g/cm <sup>3</sup>
80 mm (3")	—	◎
100 mm (4")	◎	○
125 mm (5")	○	○
150 mm (6")	○	○

② Tank top, insertion internal chamber type

Size	Density < 0.68 g/cm <sup>3</sup>	Density ≥ 0.68 g/cm <sup>3</sup>
80 mm (3")	—	—
100 mm (4")	—	◎
125 mm (5")	◎	○
150 mm (6")	○	○

③ Tank side, external chamber type

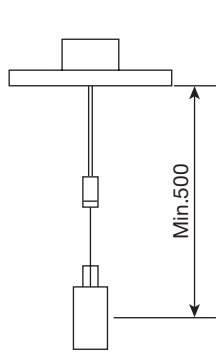
Size	Density < 0.68 g/cm <sup>3</sup>	Density ≥ 0.68 g/cm <sup>3</sup>
80 mm (3")	—	◎
100 mm (4")	◎	○
125 mm (5")	○	○
150 mm (6")	○	○

**INSTRUCTION FOR USE**

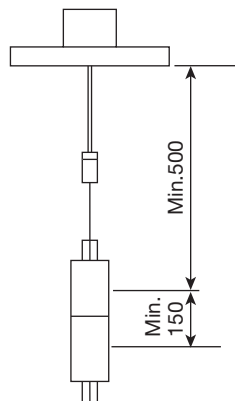
- The FS level switch with a spring operates in response to changes in the buoyancy of the displacer. Because alarms are set at a given operating density and temperature, if the density or temperature changes, the alarm level may shift or the alarm may not be issued.
- Do not use this switch in tanks with a mixer or other similar apparatus.

### ALARM POINT

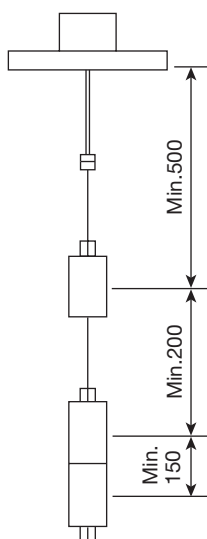
The following figure shows alarm points that can be set under conditions of room temperature, atmospheric pressure, and a liquid equivalent to water. The alarm points depend on the design.



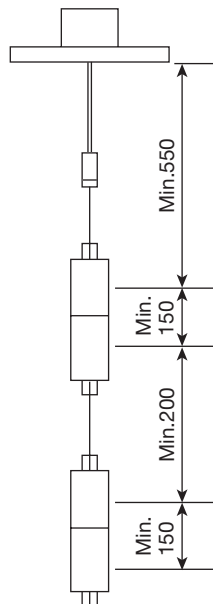
● For 1 point alarm  
(H or L)



● For 2 points alarm  
(H-H, H-L or L-L)



● For 3 points alarm  
(H-H-L or H-L-L)



● For 4 points alarm  
(H-H-L-L)

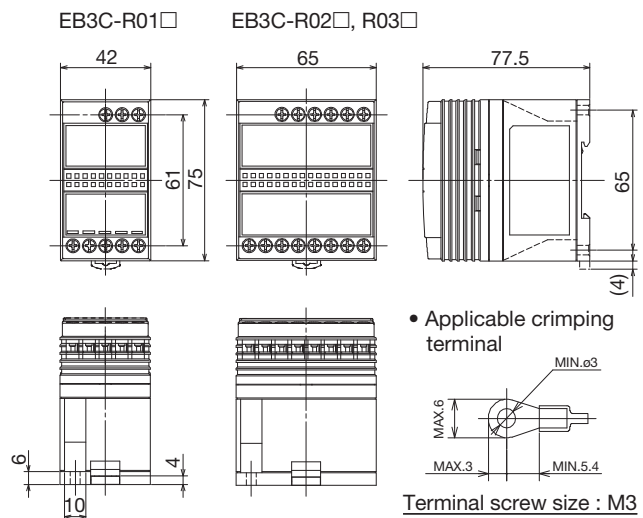
### INTRINSICALLY SAFE RELAY (EB3C)

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	12 V DC ±10%
Rated operating current	10 mA DC ±20%
Installation location	Non-hazardous area
Contact configuration	1a contact
Relay output	250 V AC, 3A
(Resistance load)	24 V DC, 3A
Contact allowable power	750 VA AC
(Resistance load)	72 W DC
Insulation resistance	500 DC V at 10MΩ
Withstand voltage	1500 V AC (1 min.)

Model code			Description
EB3C-	R	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	Model
Output type	R		Relay output
No. of contact		01	1 point use
		02	2 points use
		03	3 points use
Power supply	A	100 V to 240 V AC, 50/60 Hz	
	D	24 V DC	

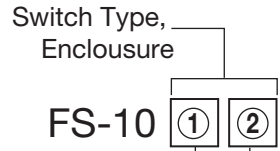


**EB3C Dimensions**

### CAUTIONS FOR PIPING

- In case of the frameproof type (FS-10□EX) and intrinsically safe type (FS-10□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, LABOUR AND WELFARE RESEARCH INSTITUTE OF INDUSTRIAL SAFETY JAPAN.
- FS-10□EX type pressure tight flameproof version is certified for Ex d II C T 6 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.

MODEL CODE



① SWITCH TYPE, TEMP. CLASS

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

\*: For applications with lower temperature than -26°C, an extension unit will be added and the external dimension will be different from the standard versions. Consult factory for details.  
 \*: Applicable alarm of interface detection is 1 point.  
 \*1: 230°C or less are 2 points.

② ENCLOSURE

CODE	ENCLOSURE
W	WATERTIGHT (IP65EQU.)
EX	PRESSURE TIGHT EX-PROOF (Ex d IIC T6)
S	INTRINSICALLY SAFE EX-PROOF (Ex ia IIC T6)

③ NUMBERS OF ALARM

CODE	NUMBER OF ALARM
1	1 POINT
2	2 POINTS
3	3 POINTS
4	4 POINTS

Refer to MODEL CODE ①.

④ PRESSURE RATING

CODE	PRESSURE RATING
1	10K(150#) Class
2	20K(300#) Class
3	30K(600#) Class
4	HIGH PRESS. APPLICATION
Z	OTHERS

⑤ TOP FLANGE MATERIAL

CODE	TOP FLANGE MATERIAL
S	CARBON STEEL
4	SUS304
6	SUS316
L	SUS316L
Z	OTHERS

⑥ LEAD PIPE MATERIAL

CODE	LEAD PIPE MATERIAL
4	SUS304
6	SUS316
Z	OTHERS

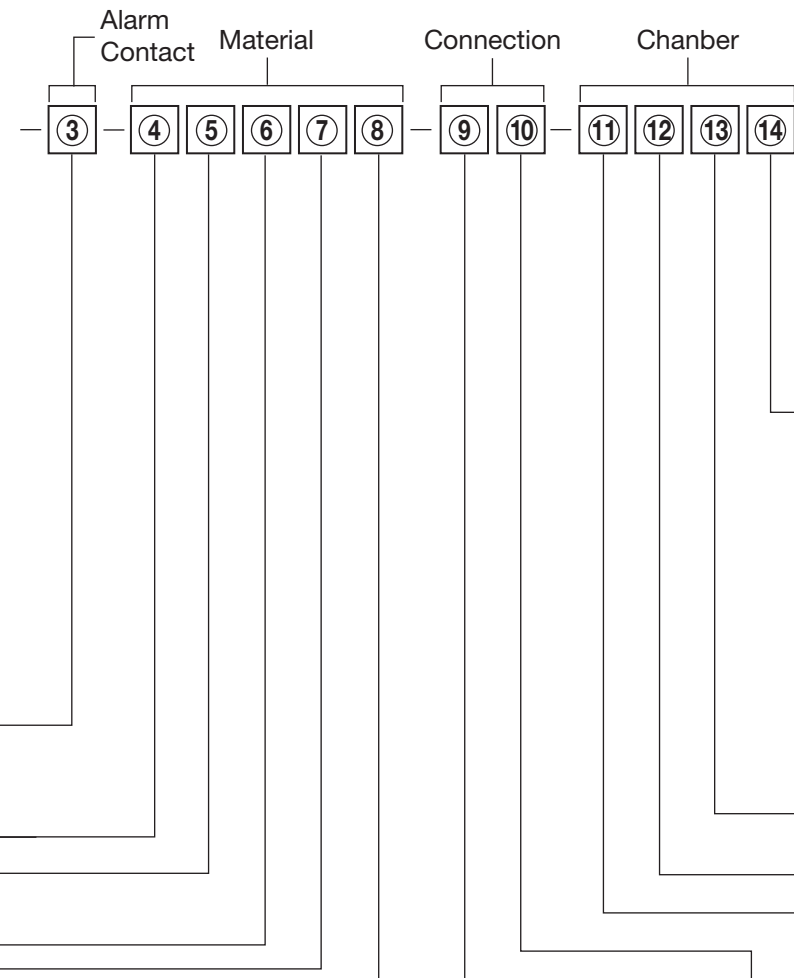
⑦ DISPLACER MATERIAL

CODE	DISPLACER MATERIAL
6	SUS316 (Standard)
4	SUS304
L	SUS316L
Z	OTHERS

⑧ SPRING MATERIAL

CODE	SPRING MATERIAL
6	SUS316 (Up to 230°C)
Z	OTHERS*

\* Available special material  
 UNS N10276 (Equ. to HASTELLOY C), INCONEL  
 (INCONEL is selected for applications more than 231°C temperature.)



**⑨ TOP FLANGE SIZE**

CODE	TOP FLANGE SIZE
3	80mm(3")
4	100mm(4")
5	125mm(5")
6	150mm(6")
Z	OTHERS

**⑩ TOP FLANGE SIZE RATING**

CODE	TOP FLANGE SIZE RATING
0	JIS10KFF
1	JIS10KRF
2	JPI#150
3	ANSI#150
4	JIS20KRF
5	JPI#300
6	ANSI#300
Z	OTHERS

**⑭ UPPER GASKET MATERIAL**

CODE	UPPER GASKET MATERIAL
0	CUSTOMER'S SCOPE (CHAMBER NOT PROVIDED)
4	VORTEX GASKET (SUS304)
6	VORTEX GASKET (SUS316)
Z	OTHERS

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

**⑬ EXTERNAL CHAMBER CONNECTION**

CODE	EXTERNAL CHAMBER CONNECTION
0	CHAMBER NOT PROVIDED
1	1"SW
2	Rc1
3	1"FLANGE
Z	OTHERS

**⑫ CHAMBER MATERIAL**

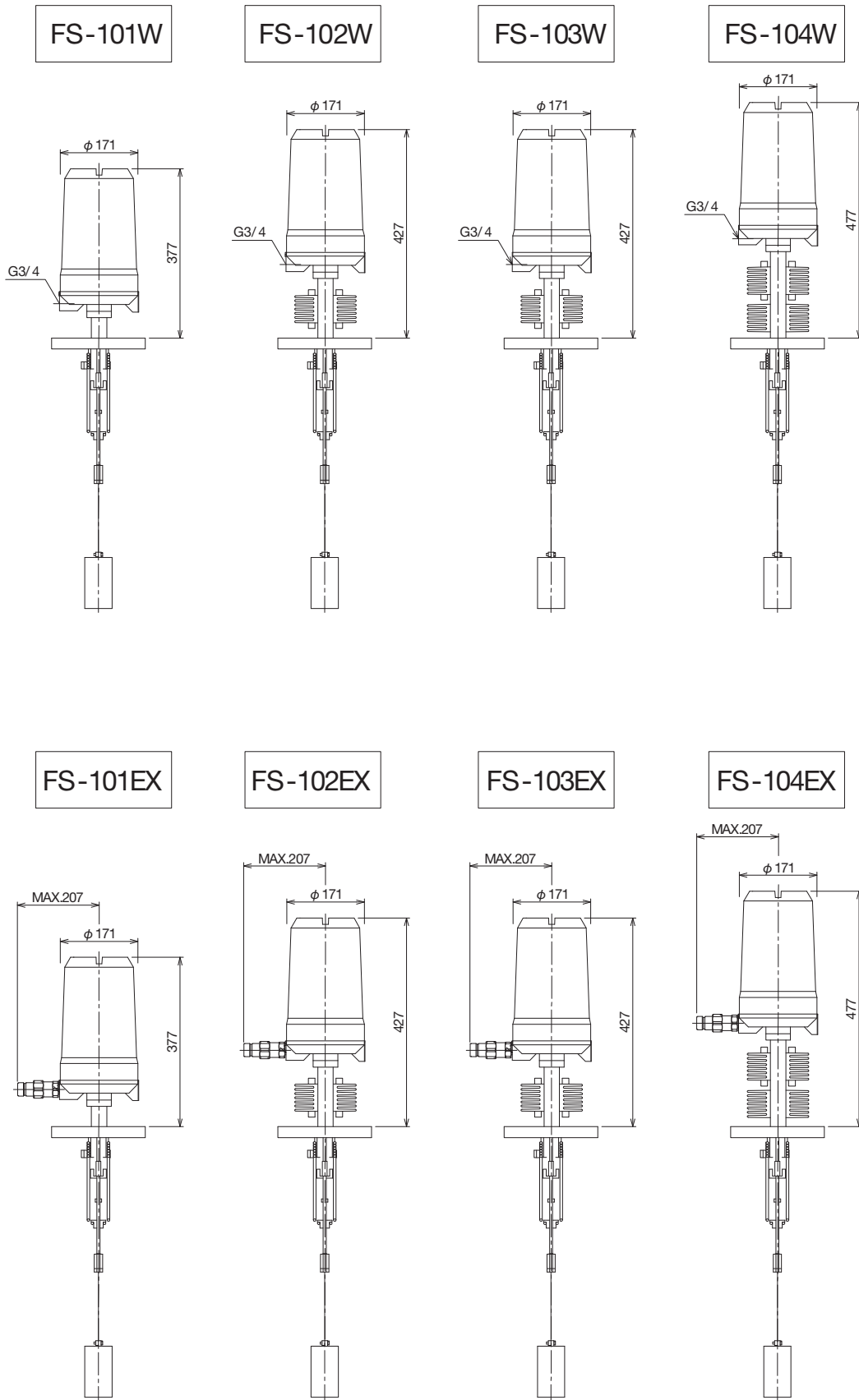
CODE	CHAMBER MATERIAL
0	CHAMBER NOT PROVIDED
S	Carbon steel
4	SUS304
6	SUS316
L	SUS316L
Z	OTHERS

**⑪ CHAMBER CONTRUTION**

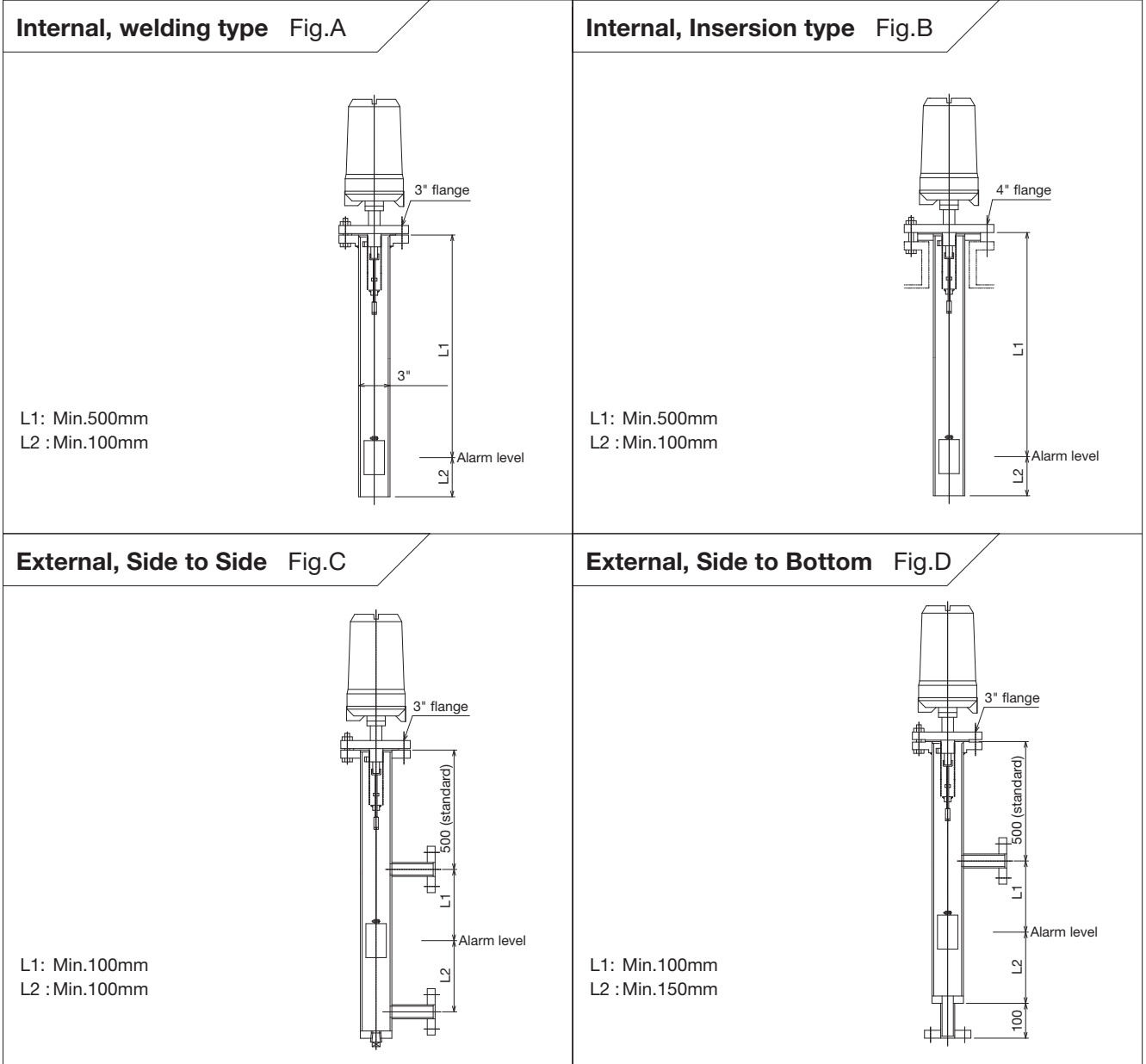
CODE	CHAMBER CONTRUTION
0	NOT PROVIDED
1	INTERNAL, WELDING TYPE(FIG.A)
2	INTERNAL, INSERSION TYPE(FIG.B)
3	EXTERNAL, SIDE-SIDE (FIG.C)
4	EXTERNAL, SIDE-BOTTOM (FIG.D)
Z	OTHERS

DIMENSIONS

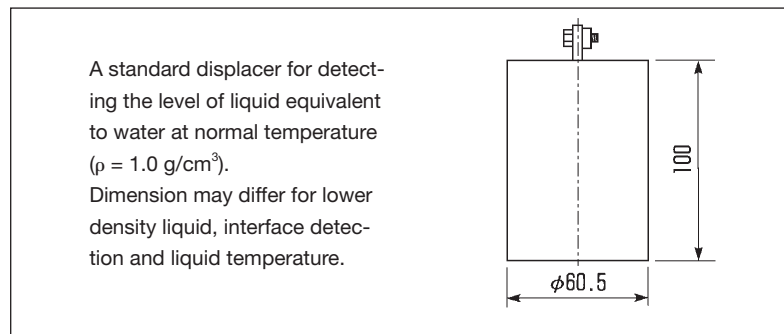
1. DETECTING PART



2. CHAMBERS



3. DISPLACER



**ORDERING INFORMATION**

Please notify the follow for order / inquiry :

TAG NO.			
MODEL	FS-10□□-□-□□□□□-□□-□□□□		
Q'TY			
LIQUID NAME	For liquid level detection	Gas:	Liquid:
	For two liquids interface detection	Upper:	Lower:
DENSITY	For liquid level detection	Gas:	Liquid:
	For two liquids interface detection (Difference of at least 0.2 g/cm <sup>3</sup> required. Only 1 point for alarm.)	Upper:	Lower:
PRESS.	Nor. Max.	<input type="checkbox"/> MPa	<input type="checkbox"/> ( )
TEMP	Nor. Max.	<input type="checkbox"/> °C	<input type="checkbox"/> ( )
ALARM POINT, SETTING, INSTRUCTION	<input type="checkbox"/> 1 point alarm	<input type="checkbox"/> 2 points alarm	<input type="checkbox"/> 3 points alarm
	<p>h1 ___ mm <input type="checkbox"/> High <input type="checkbox"/> Low</p>	<p>h1 ___ mm <input type="checkbox"/> High <input type="checkbox"/> Low h2 ___ mm <input type="checkbox"/> High <input type="checkbox"/> Low</p>	<p>h1 ___ mm High h2 ___ mm <input type="checkbox"/> High <input type="checkbox"/> Low h3 ___ mm Low</p>
Limitation of alarm setting point is applicable due to technical reason. Refer to Page 3 for details.			
CHAMBER	<input type="checkbox"/> Not required	<input type="checkbox"/> Internal welding type	<input type="checkbox"/> Internal insertion type
	<input type="checkbox"/> External, Side to Side	<input type="checkbox"/> External, Side to Bottom	
	l : <input type="checkbox"/> ___ mm	l : <input type="checkbox"/> ___ mm	l : <input type="checkbox"/> ___ mm
OTHER SPECIAL FEATURES AND INSTRUCTION	<hr/> <hr/> <hr/>		

\* Specification is subject to change without notice.



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