TECHNICAL GUIDANCE

FS Series

SPRING BALANCED DISPLACEMENT TYPE
LEVEL INDICATOR / TRANSMITTER

OUTLINE

FS series detects and indicates liquid level by spring balanced displacer. Along with local level indication by pointer dial, alarm contacts, pneumatic output or electiric outout can be provided for versatile application. FS series is very suitable for high temperature and high pressure applications thanks to perfect isolation from pressurized part by magnetic coupling.

STANDARD SPECIFICATIONS

Mechanical portion

Detection method : By spring balanced displacer

Measuring range : Min.300mm
Max.3000mm

Suitable liquid density : Standard range 0.7~1.3g/cm^3
Other density range available on request. However, size of connection flanges may differ from standard sizes.

Viscosity : Max. 600 mPa•s. Liquid without sticking, crystallization, or freezing

Installation and connection flange size:

a. Without chamber (Fig.1) or Welding type internal chamber (Fig.2)
   Measuring range upto 1000mm : 4” flange
   Measuring range more than 1000mm : 3” flange
   (The above may differ depending on density.)

b. Bolt-on internal chamber (Fig.3) or Insertion type internal chamber (Fig.4)
   Measuring range upto 1000mm : 5” flange
   Measuring range more than 1000mm : 4” flange
   (The above may differ depending on density.)

c. Tank side external chamber (Fig.5 and 6)
   Through 1$^1/_2$” flanges irrespective of measuring range

Indication : By single pointer, 0~100%, standard scale length 80mm (actual scale available on request)

Accuracy : ±1.5% F.S. (Based on mass conversion correction at factory calibration)

Pressure rating :
- Low pressure version : Max. 1MPa
- Medium pressure version : Max. 2MPa
- High pressure version : Contact us for details.

Liquid temperature :
- Standard : –10~+150°C
- With radiation fin : –40~–11°C (Low temp. version)
  +151~+350°C (High temp. version)
  Contact factory for material limitation for Low and High temp. version.

Material construction :
- Spring : SUS316, MA276, others
- Displacer : SUS304, SUS316, SUS316L, MA276, PVC, others
- Upper flange : Carbon steel, SUS304, SUS316, SUS316L, MA276 covered, others
- Chamber : Carbon steel, SUS304, SUS316, SUS316L, others
- Indicator : ADC12 (Aluminum die-casting)
- Radiation fin : AC2A (Aluminum casting)
- Painting : Indicator ; Polyurethan resin baking paint (Munsell 7.5BG 4/1.5)
  Chamber ; Only carbon steel is painted in silver.

BASIC CODE (1)	INSTALLATION CODE (2)	MATERIAL CODE (3)	FUNCTION • PRESSURE • CONNECTION (4)

FS- □□□□ □ — □ — □□□□□ — □□□□

(1) BASIC CODE

— □□□□ —

FUNCTION	1	1	0		Local indication
	1	1	5		+Alarm contact (s)
	3	1	3		+Pneumatic output
	5	1	2		+Electric output
	5	1	7		+Electric+contact (s)*
CONSTRUCTION				W	Weather proof
				E	Explosion proof

* : Only in weather proof type.

(2) INSTALLATION CODE

— □ —

CHAMBER CONSTRUCTION	1	Without chamber	Fig.1
	2	Welding type internal chamber	Fig.2
	3	Bolt-on internal chamber	Fig.3
	4	Insertion type internal chamber	Fig.4
	5	Side~side external chamber	Fig.5
	6	Side~bottom external chamber	Fig.6
	9	Special design	

(3) MATERIAL CODE

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SPRING	6				SUS316 *1
	C				MA276 *1
	E				Inconel *2
	9				OTHERS
DISPLACER		4			SUS304
		6			SUS316
		L			SUS316L
		C			MA276
		9			OTHERS
UPPER FLANGE			S		CARBON STEEL
			4		SUS304
			6		SUS316
			L		SUS316L
			C		MA276 COVERED
			9		OTHERS
CHAMBER				S	CARBON STEEL
				4	SUS304
				6	SUS316
				L	SUS316L
				9	OTHERS
				1	Without chamber

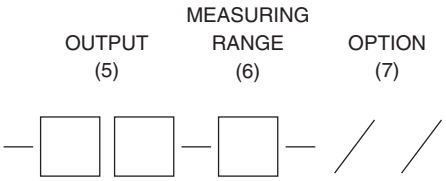
*1: Liquid temperature upto 230°C
*2: For liquid temperature 231°C~350°C (Confirm anti-corrosive capability.)

(4) FUNCTION • PRESSURE • CONNECTION

— □□□□ —

FUNCTION	1				Liquid level	
	2				Interface *1	
PRESS. RATING		L			Low press.	
		M			Medium press.	
		H			High press.	
PROCESS FLANGE SIZE			3		3" flange	Fig.1,2,3 and 4
			4		4" flange	
			5		5" flange	
			6		1-½" flange	
			9		OTHERS	Fig.5,6
PROCESS FLANGE RATING				1	JIS 10K	RF
				2	JIS 20K	RF
				3	ANSI#150	RF
				4	ANSI#300	RF
				5	JPI#150	RF
				6	JPI#300	RF
				9	OTHERS	

*1: Displcaer is to be totally dipped into liquid to be measured



(5) OUTPUT

Output Signal	**0**		**NIL**	For FS-110
	1		**1 point**	For FS-115☐
	2		**2 points**	
	3		**3 points**	
	4		**4 points**	
	5		**5 points**	
	6		**6 points**	
	7		**20~100KPa =0 ~ 100%**	For FS-313
	8		0.2~1.0 bar G =0 ~ 100%	
	A		**DC4~20mA =0 ~ 100%**	For FS-512☐
	Z		OTHERS*	
Entry		**1**	**Rc (=PT) female**	For FS-313
		2	NPT female	
		3	**G (=PF) female**	For FS-115☐ and FS-512☐
		4	NPT female	
		9	OTHERS*	

(7) OPTION

Indicate necessary options by the following abbreviations:

CG : Pressure tight cable gland *1
CF : Radiation fin
AS : Air set (Filter regulator, for FS-313)
VP : Vent plug
VS : Volume graduation *2
SS : Special graduation *2
HS : Liquid height graduation
BS : No indication (Blind plate)
SC : Special color, paint
DV : Drain valve (Material as per chamber material)

*1 : Specify external diameter of cable
*2 : Specify graduation (Heght~volume etc.)

(6) Measuring range

Measuring range	**1**	**300mm**
	2	**500mm**
	3	**800mm**
	4	**1000mm**
	5	**1200mm**
	6	**1500mm**
	7	**1800mm**
	8	**2000mm**
	9	**2500mm**
	A	**3000mm**
	Z	**Order made** *

* : Specify measuring range in case of Order made (Z).

Versions shown in **bold type** are manufactured as standard. The rest are special versions for which longer delivery time is required.

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

CAUTION ON SELECTION

- The FS level gauge 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. Therefore, this switch is not suitable for use in conditions where the operating density or temperature tends to fluctuate.
- Do not use this switch in tanks with a mixer or other similar apparatus.

DIMENSIONS

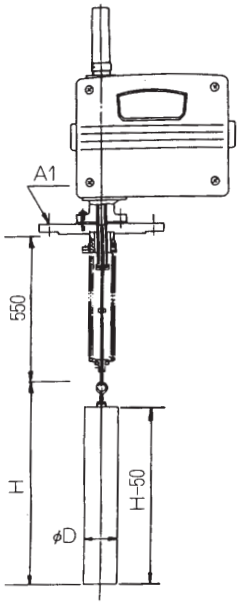


Fig. 1

Without chamber

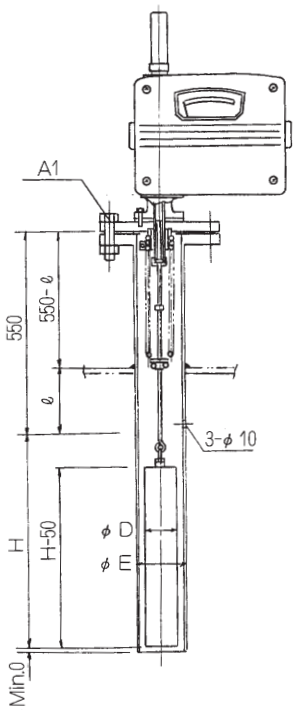


Fig. 2

Welding type internal chamber

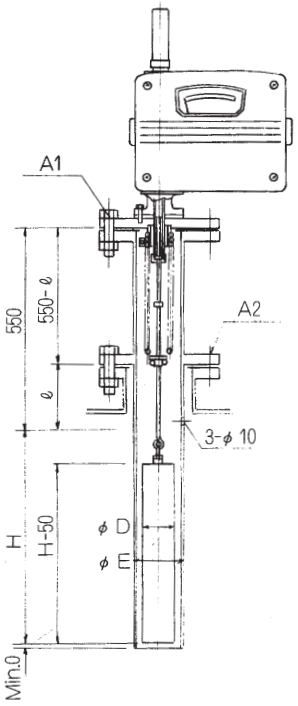


Fig. 3

Bolt-on internal chamber

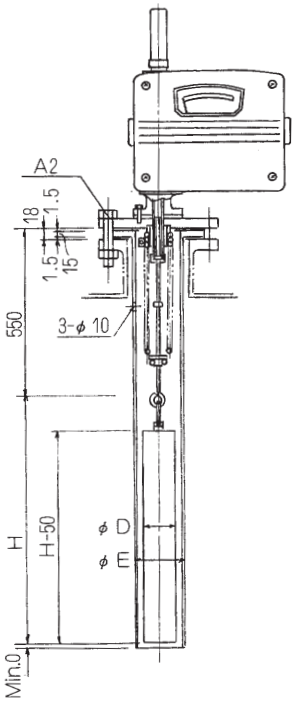


Fig. 4

Insertion type internal chamber

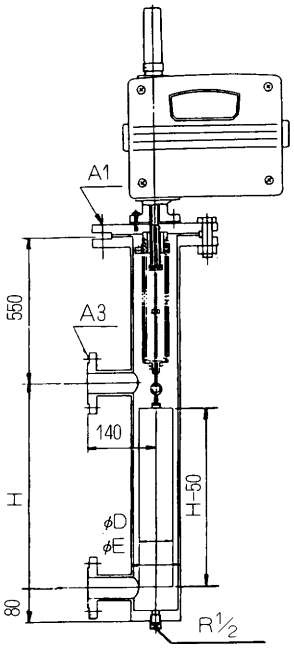


Fig. 5

Side~side external chamber

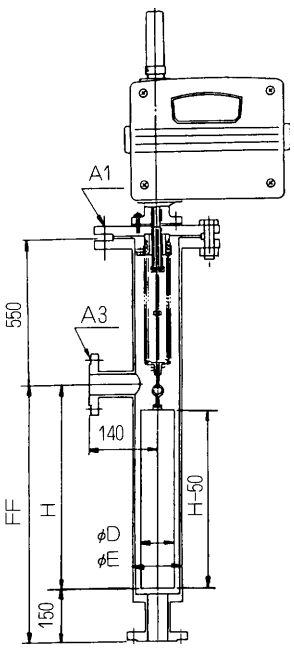


Fig. 6

Side~Bottom external chamber

STANDARD DIMENSION TABLE

	H	FF	øD	øE	A1	A2	A3
Measuring range (mm)	300	450	89.1	5"	5"	6"	1 1/2"
	500	650	76.3	4"	4"	5"	
	800	950					
	1000	1150	60.5	3"	3"	4"	
	1200	1350					
	1500	1650	48.6				
	1800	1950	42.7				
	2000	2150					
	2500	2650	34.0				
	3000	3150					

Refer to Fig.1 to 6 for signs.
Values in the table are for measuring the level of liquids with a standard density. They may differ when measuring the level of liquids with a non-standard density or measuring the interface of two liquids.

TRANSMITTERS SPECIFICATION

(1) ALARM CONTACT (FS-115 □)

Construction

Weather proof	:	IP54 equ. (FS-115W)
Explosion proof	:	d2G4 (FS-115E)
Intrinsically safe	:	Ex ia IIC T6 (FS-115S)
		With intrinsically safe relay

Number of contact : Max. 6 points

Lowest position	:	Higher than 10% of full span
Highest position	:	Lower than 90% of full span
Min. point inteval	:	Higher than 10% of full span

Contact setting accuracy : 1.0% F.S.

Reset span	:	10% F.S.
Switch	:	Microswitch SPDT
Contact capacity	:	AC250V, 5A (Resistance load)
		DC125V, 0.4A (Resistance load)

Ambient Temp. :

Weather proof (FS-115W)	:	–25~+80°C
Explosion proof (FS-115E)	:	–10~+60°C
Intrinsically safe (FS-115S)	:	–10~+40°C

Provide heat insulation if required.

Cable entry:

No. of alarm point	1	2	3	4	5	6
Connection size	1/2B		3/4B			
No. of connection	1		1 *			

Connection: (Standard) ISO G female screw
(Option) NPT female screw
*: 2 points are also available as special order.

Option :

1) Cable gland with pressure tight gasket

External dimension for indicator and terminal box

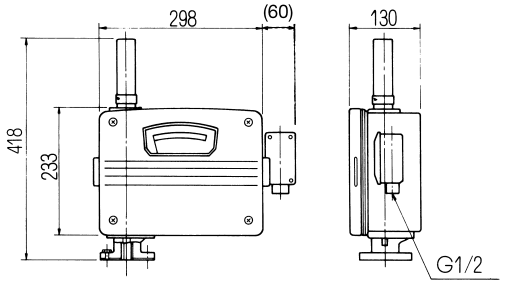


Fig. 7 : FS-115W/S, 1 and 2 points

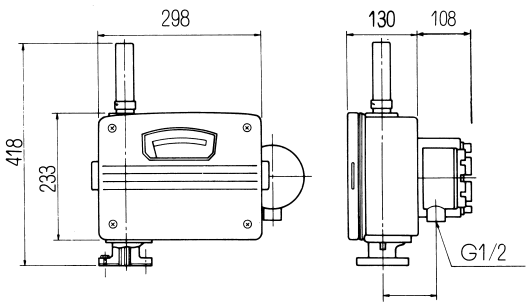


Fig. 8 : FS-115E, 1 and 2 points

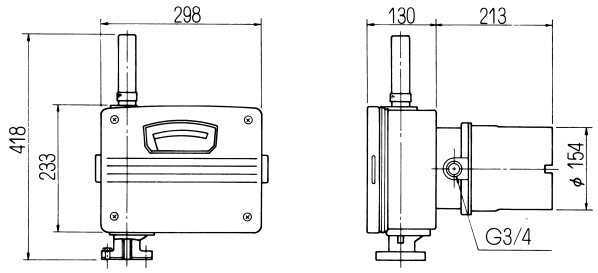


Fig. 9 : FS-115W/S, 3~6 points

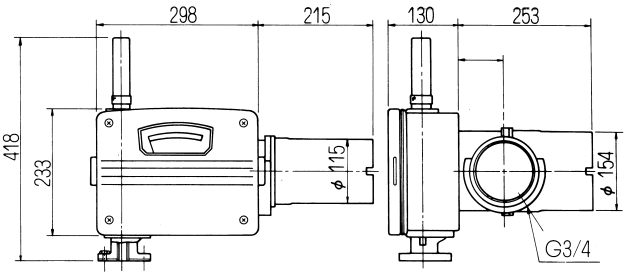


Fig. 10 : FS-115E, 3 and 6 points

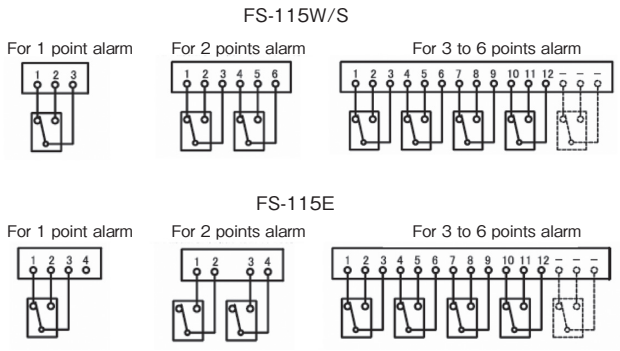


Fig. 11 : Terminal arrangement
(Standard NO contact. Specify clearly if NC contact is required.)

(2) PNEUMATIC TRANSMITTER (FS-313W)

Construction : Weather proof (IP54 equ.)
Input : 0.14±0.01MPa
Output : Standard 0.2 to 100kPa
Option 0.2 to 1.0bar
Output accuracy : ±1.0% F.S. (Against the indication)
Air connection : Standard 2 × Rc 1/4 (=PT1/4)
Option 2 × NPT1/4 female
(Input and output pressure gauges provided.)
Ambient temp. : –20~+80°C
Option :
1) Air set (Filter regulator)
Input : Max. 990kPa

External dimension of indicator and pneumatic transmitter

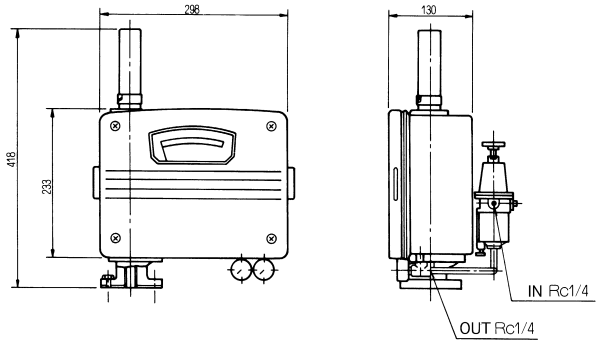


Fig. 12 : FS-313W (Air set : option)

(3) ELECTRIC TRANSMITTER (FS-512 □)

Construction
Wether proof (FS-512W) IP54 equivalent
Pressure tight Ex-proof (FS-512E) Exd IIB T4
Power supply voltage
Weather proof (FS-512W) and Pressure tight Ex-proof (FS-512E)
DC12~30V
Output DC4~20mA
Max. Load
Weather proof (FS-512W) and Pressure tight Ex-proof (FS-512E)
600Ω (At 24VDC)
Intrinsically safe (FS-512S)
750Ω
Cable entry G1/2
In case of Ex-d (FS-512E), use Pressure tight cable gland type SCX-16B manufactured by Shimada Electric
Output accuracy ±1.0% F.S. (Against local indication)
Amb. Temp.
Weather proof (FS-512W)
–30~+70°C
Pressure tight Ex-proof (FS-512E)
–20~+55°C

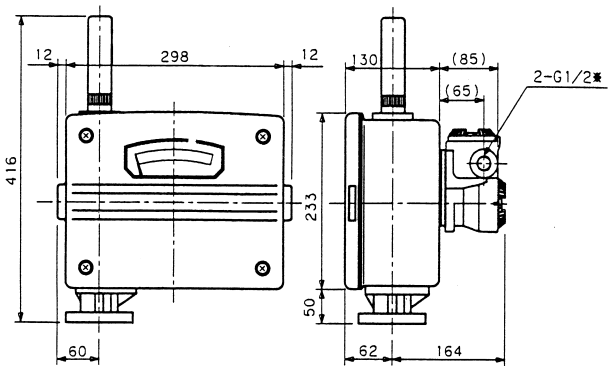
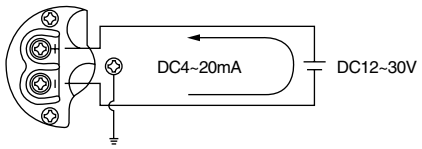


Fig. 13 : Indicator and transmitter assembly (FS-512W and FS-512E)



Load Max. : 600Ω (at 24VDC)

Fig. 14 : Terminal Arrangement (FS-512W and FS-512E)

(4) ELECTRIC TRANSMITTER AND ALARM CONTACT (FS-517 □)

Construction
Wether proof (FS-517W)
Ex-d version is not available. Maximum alarm contact is 2 points.
Specification for Alarm contact is as of FS-115.
Specification for Analog output is as of FS-512. Refer to them for details.

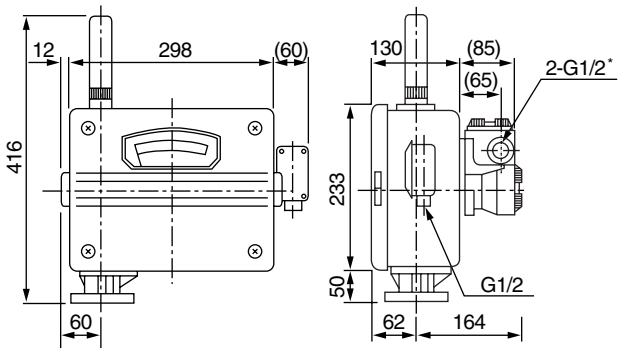


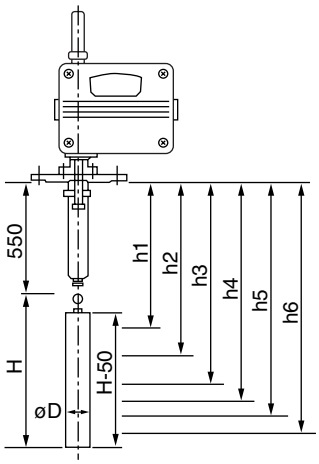
Fig. 15 : Indicator and transmitter assembly (FS-517W)

SUPPLY SCOPE

1. Blots, nuts and gaskets for process connection are customer's scope of supply.
2. Standard accessories
   Special tool for explosion proof housing
   Instruction manual.

ORDERING FORM

Specify the following for order or inquiry :

1	TAG.NO.					
2	Model code	FS – □□□□ – □ – □□□□ – □□□□ – □□ –				
3	Liquid name	Upper			Lower	
4	Density					
5	Viscosity					
6	Pressure				☐ MPa	☐
7	Temperature	NOR.		MAX.	☐ °C	☐ °F
8	Vapour density				☐ AIR RATIO	☐ kg/m³
9	Measuring range				☐ mm	☐ inch
10	ALARM SETTING POINT AND ACTION *	h_1		*		
		h_2				
		h_3				
		h_4				
		h_5				
		h_6				
	* Switch action (HC, HO, LC, LO)					
11	SPECIAL NOTE					

* Specification is subject to change without notice.

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