

FS Series

SPRING BALANCED DISPLACEMENT TYPE
LEVEL INDICATOR / TRANSMITTER

GENERAL

FS series detects and indicates liquid level by spring balanced displacer. Along with local level indication by pointer dial, alarm contacts, pneumatic output or electric output 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. Besides liquid level measurement, measurement of interface of two different liquids and liquid density are also possible.

STANDARD SPECIFICATION

Mechanical portion

Detection method : By spring balanced displacer

Measuring range : Min.0~300mm
Max.0~3000mm

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

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

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

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 : $\pm 1.5\%$ F.S. (Calibrated by weight)

Pressure rating :

Low pressure version : Max. 10kg/cm² G

Medium pressure version : Max. 20kg/cm² G

High pressure version : Max. 100kg/cm² G

Special design according to High Pressure Gas Regulation available on request.



Liquid temperature :

Standard : -10~+150°C

With radiation fin: -40~-10°C (Low temp. version)

+150~+350°C (High temp. version)

Contact factory for material limitation for Low and High temp. version.

Material construction :

Spring : SUS316, Hastelloy C, Elimber, others

Displacer : SUS304, SUS316, SUS316L, Hastelloy C, PVC, others

Upper flange : Carbon steel, SUS304, SUS316, SUS316L, Hastelloy C covered, others

Chamber : Carbon steel, SUS304, SUS316, SUS316L, Hastelloy C, others

Indicator : ADC12 (Aluminum die-casting)

Radiation fin : AC2A (Aluminum casting)

Painting : Indicator ; Polyurethan resin baking paint (Munsell N1.2)
Chamber ; Nitrocellulose resin paint (silver)

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

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		
	S	Intrinsically safe		

* : Weather proof (W) or intrinsically safe (S) only Max. alarm contact is 2 points.

(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

SPRING	6			SUS316
	C			HASTELLOY C
	E			ELIMBER
	9			OTHERS
DISPLACER	4			SUS304
	6			SUS316
	L			SUS316L
	C			HASTELLOY C
	P			PVC
	9			OTHERS
UPPER FLANGE	S			CARBON STEEL
	4			SUS304
	6			SUS316
	L			SUS316L
	C			HASTELLOY C COVERED
	9			OTHERS
CHAMBER	S			CARBON STEEL
	4			SUS304
	6			SUS316
	L			SUS316L
	C			HASTELLOY C
	9			OTHERS

*1: Liquid temperature upto 230°C

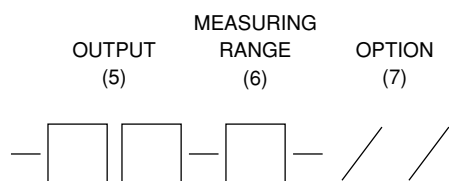
*2: For liquid temperature 230°C~350°C (Confirm anti-corrosive capability.)

(4) FUNCTION • PRESSURE • CONNECTION

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

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

*2: Displcaer is to be totally dipped into liquid to be measured and its level is to be stable.



(5) OUTPUT

	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	For FS-313
	7	0.2~1.0 kg/cm ² G	
	8	0.2~1.0 bar G	
	9	3~15 psi G	For FS-512□
	A	DC4~20mA	
	Z	OTHERS	

	1	Rc (=PT) female	For FS-313
	2	NPT female	For FS-115□ and FS-512□
	3	G (=PF) female	
	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)

MC : Controller (PI, PID and other modes, for FS-313) *2

VP : Vent plug

VS : Volume graduation *3

SS : Special graduation *3

HS : Liquid height graduation

BS : No indication (Blind plate)

SC : Special color, paint

DV : Drain valve (Material as per chamber material)

JC : External chamber with steam jacket

JF : Steam jacket for lead pipe part

*1 : Specify external diameter of cable

*2 : Specify controller model code

*3 : Specify graduation (Height~volume etc.)

(6) Measuring range

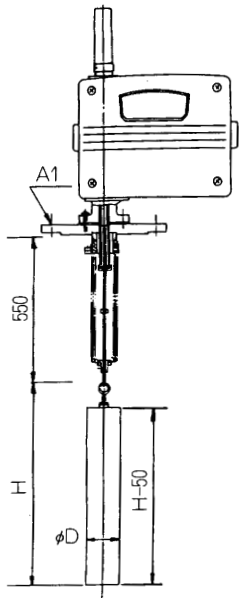
Measuring range	1	300mm
	2	500mm
	3	800mm
	4	1000mm
	5	1200mm
	6	1500mm
	7	1800mm
	8	2000mm
	9	2500mm
	A	3000mm
	Z	Order made *

* : 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.

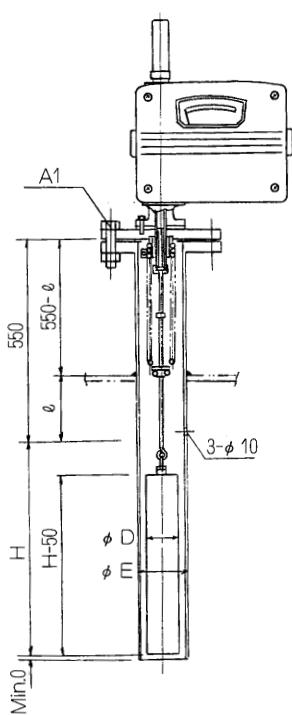
DIMENSIONS

Fig. 1



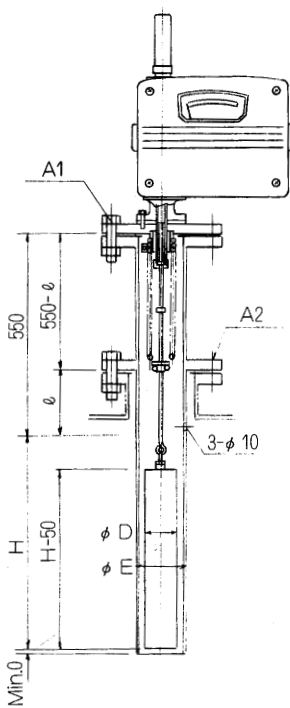
Without chamber

Fig. 2



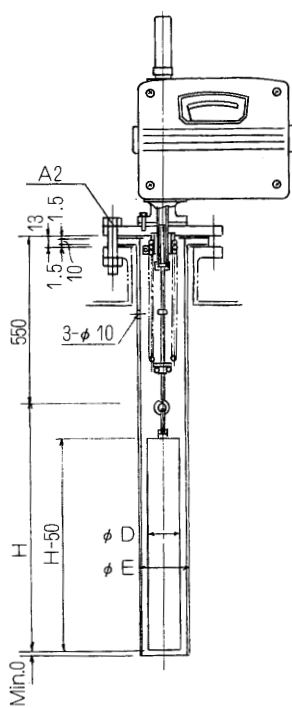
Welding type internal chamber

Fig. 3



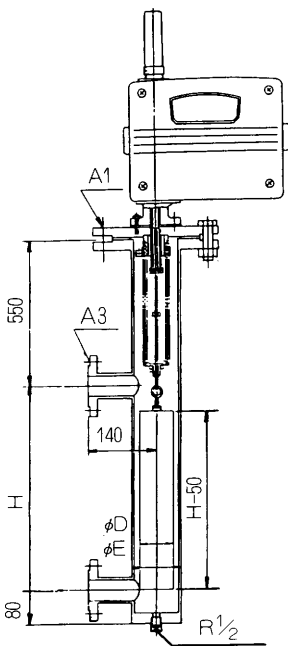
Bolt-on internal chamber

Fig. 4



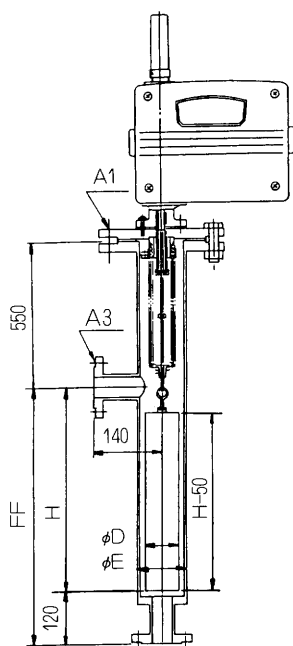
Insertion type internal chamber

Fig. 5



Side~side external chamber

Fig. 6



Side~Bottom external chamber

STANDARD DIMENSION TABLE

H	FF	øD	øE	A1	A2	A3				
300	420	76.3	4"	4"	5"	1 1/2"				
500	620									
800	920									
1000	1120	60.5	3"	3"	4"					
1200	1320									
1500	1620									
1800	1920	42.7								
2000	2120									
2500	2620	34.0								
3000	3120									

TRANSMITTERS SPECIFICATION

(1) ALARM CONTACT (FS-115 □)

Construction

Weather proof	: IP54 equ. (FS-115W)
Explosion proof	: d2G4 (FS-115E)
Intrinsically safe	: i3nG5 (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 interval	: 0mm

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)	: -20~+80°C
Explosion proof (FS-115E)	: -10~+40°C
Intrinsically safe (FS-115S)	: -10~+40°C
Provide heat insulation if required.	

Cable entry : Standard ISO G (=PF) thread
Option NPT female thread

Size of cable entry : 1 and 2 points alarm : NB 15mm(1/2")
3~6 points alarm : NB 20mm(3/4")

Option :

- 1) Cable gland with pressure tight gasket

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

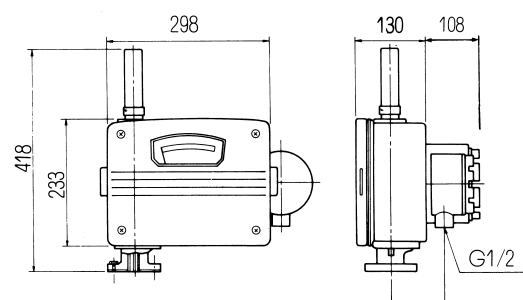


Fig. 9 : FS-115W and FS-115S, 3~6 point

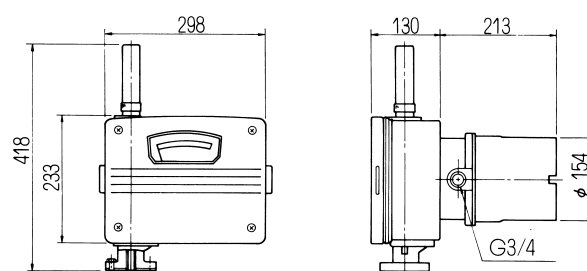
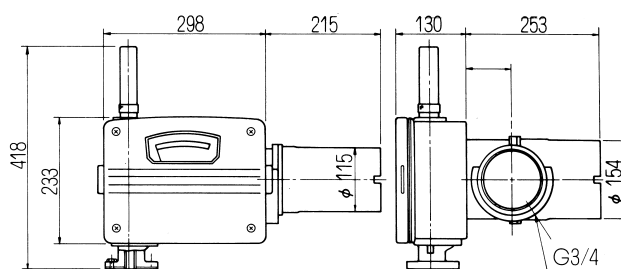


Fig. 10 : FS-115E, 3 and 6 point



External dimension for indicator and terminal box

Fig. 7 : FS-115W and FS115S, 1 and 2 point

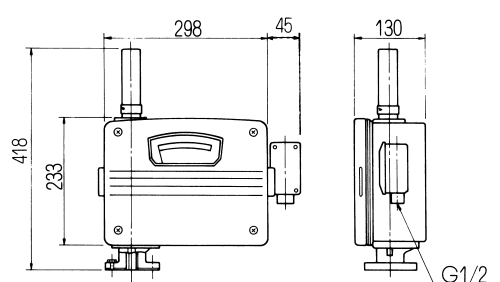


Fig. 11 : Intrinsically safe relay (For FS-115S)

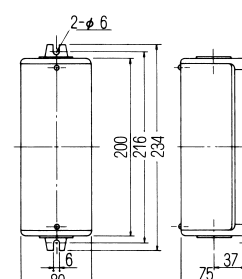
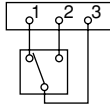
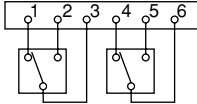


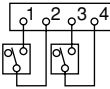
Fig. 12 : Terminal arrangement
(Standard NO contact. Specify clearly if NC contact is required.)



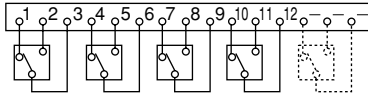
For 1 point alarm



For 2 point alarm (FS-115W and FS-115S)



For 2 point alarm (FS115-E)



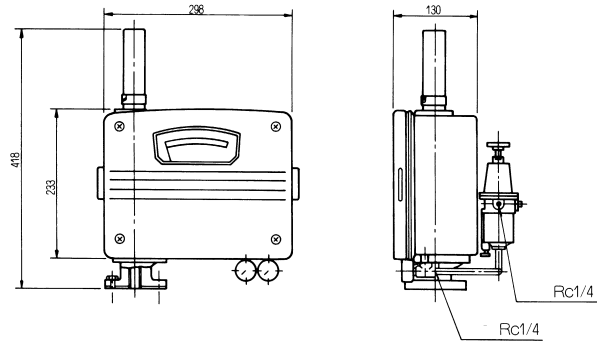
For 3~6 point alarm

(2) PNEUMATIC TRANSMITTER (FS-313W)

- Construction : Weather proof (IP54 equ.)
 Input : $1.4\text{kg/cm}^2\text{G} \pm 0.1\text{kg/cm}^2\text{G}$
 Output : Standard $0.2\sim 1.0\text{kg/cm}^2\text{G}$
 Option $3\sim 15\text{psiG}$
 Output accuracy : $\pm 1.0\%$ F.S.
 Air connection : Standard $2 \times \text{Rc } 1/4$ (=PT1/4)
 Option $2 \times \text{NPT } 1/4$ female
 (Input and output pressure gauges provided.)
 Ambient temp. : $-10\sim +50^\circ\text{C}$
 Option :
 1) Controller for PI or PID and other mode
 2) Air set (Filter regulator)
 Input : $1.4\sim 9.9\text{kg/cm}^2\text{G}$
 Output : $1.4\text{kg/cm}^2\text{G}$

External dimension of indicator and pneumatic transmitter

Fig. 13 : FS-313W (Air set : option)



(3) ELECTRIC TRANSMITTER (FS-512 □)

Construction

- Weather proof (FS-512W) IP54 equivalent
 Pressure tight Ex-proof (FS-512E) Exd IIC T4
 Intrinsically safe (FS-512S) Exd IIC T5 or T6

Power supply voltage

- Weather proof (FS-512W) and Pressure tight Ex-proof (FS-512E)
 DC12~30V
 Intrinsically safe (FS-512S)
 DC24V or AC110 $\pm 15\%$, 50/60Hz
 (To be supplied to Power Pack)

Output DC4~20mA

Max. Load

- Weather proof (FS-512W) and Pressure tight Ex-proof (FS-512E)
 600 Ω (At DC24V)
 Intrinsically safe (FS-512S)
 750 Ω

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 $\pm 1.0\%$ F.S. (Against local indication)

Amb. Temp.

- Weather proof (FS-512W)
 $-10\sim +80^\circ\text{C}$
 Pressure tight Ex-proof (FS-512E)
 $-10\sim +55^\circ\text{C}$
 Intrinsically safe (FS-512S)
 Exib IIC T5 $-25\sim +60^\circ\text{C}$
 Exib IIC T6 $-25\sim +45^\circ\text{C}$

Fig. 14 : Indicator and transmitter assembly
(FS-512W and FS-512E)

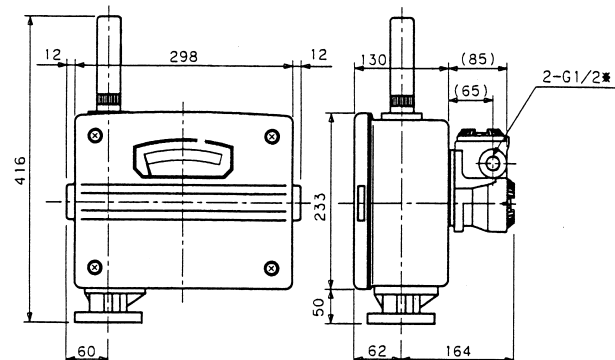


Fig. 15 : Indicator and transmitter assembly (FS-512S)

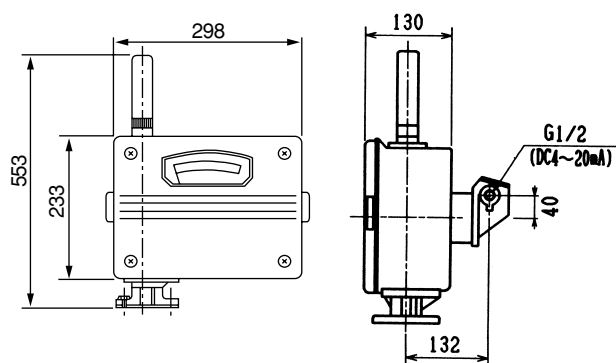
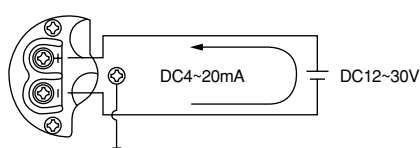
Fig. 16 : Terminal Arrangement
(FS-512W and FS-512E)

Fig. 17 : Terminal Arrangement and wiring for FS-512S

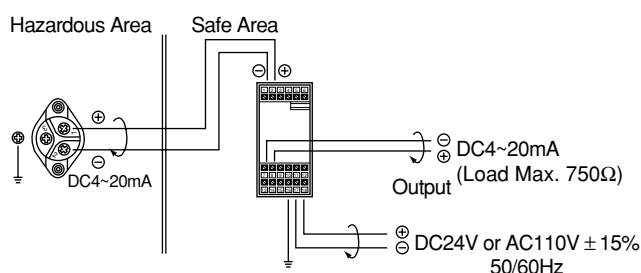
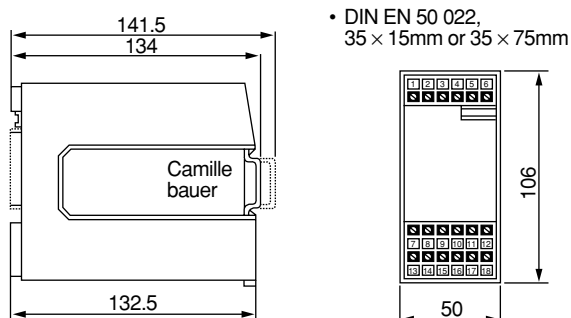


Fig. 18 : Safety Isolator (Power Pack for FS-512S)



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

Construction

Wether proof (FS-517W) or Intrinsically safe* (FS-517S)

* : Electric output loop is Ex ib IIC T5 or T6. Alarm contact loop is i3nG.

Ex-d version is not available. Maximum alarm contact is 2 points.

Specification for Alarm contact is as of FS-515.

Specification for Analog output is as of FS-512. Refer to them for details.

Fig. 19 : Indicator and transmitter assembly (FS-517W)

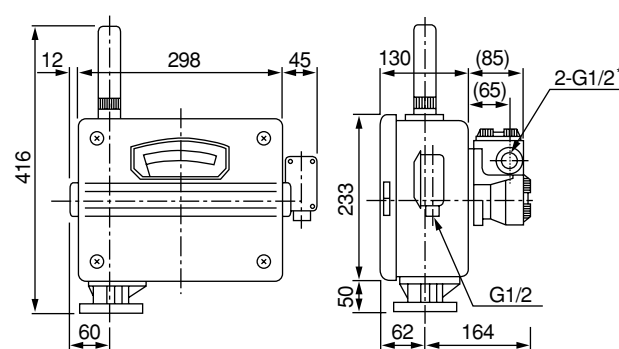
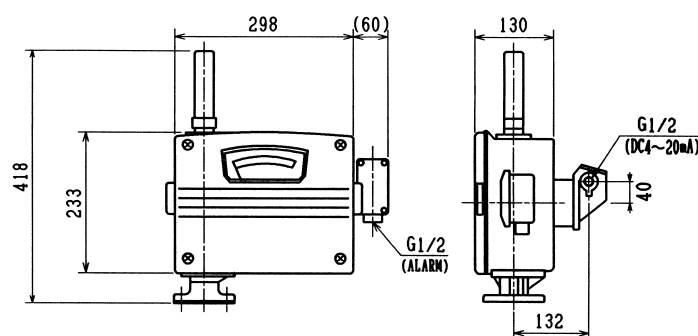


Fig. 20 : Indicator and transmitter assembly (FS-517S)



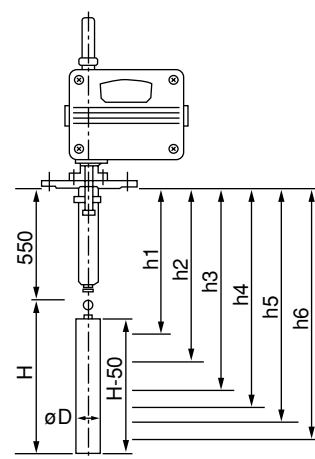
SUPPLY SCOPE

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	Sp. Gr.			
5	Viscosity			
6	Pressure	☐ kg/cm ² G ☐		
7	Temperature	NOR.	MAX.	☐ °C ☐ °F
8	Vapour density	☐ AIR RATIO ☐ kg/Nm ³		
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 subject to change without notice

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