

I N S T R U C T I O N M A N U A L

F O R

R E S I S T I V E L E V E L M E A S U R E M E N T

M O D E L : L R 2 0 0

M O D E L : L R 2 1 0



M O D E L : C U 2 0 0 0



Revision 2013-03-28

Read and understand this manual for safely usage.

- This manual describes the product of standard specification. Read the other manual for the product of explosion-proof specification.
- This manual describes the handling, inspection and adjustment of the product which model is mentioned on cover page. Read and understand this manual before handling.
- Follow the additional document and/or direction, submitted by NOHKEN INC. and our distributor or agent, even if the terms are mentioned in this manual.
- Save this manual in proper place being available to refer immediately.
- The specification of product mentioned in this manual may not be satisfied by the condition of environment and usage. Check and consider carefully before using.
- Contact to sales office at NOHKEN INC. for any question or comment about this manual and product.

The followings are the description of the terms in this manual.

 WARNING	Indicates a potentially hazardous situation which, if not pay attention, could result in death, serious injury or serious disaster.
 CAUTION	Indicates a hazardous situation which, if not pay attention, may result in minor or moderate injury or damage to device.

	Indicates prohibited matter. The explanation with this mark shall be followed
	Indicates instructed matter. The explanation with this mark shall be followed.

⚠ **WARNING**

This product is not explosion-proof construction. Do not install this product to the place where the flammable gas or vapor is occurred.

If installed, the flammable gas or vapor may be ignited, and serious disaster may be occurred. Use the product of explosion-proof construction in this case.



Do not modify or disassemble the product. Otherwise, the product and connected device may be malfunctioned, damaged, fired, or miner injury and electric shock may be occurred. (Follow the additional document and/or direction, submitted by NOHKEN INC. and our distributor or agent.)



Turn off the power, before wiring and inspection. Otherwise, electric leakage, fire caused by short circuit, and electric shock may be occurred.



Ensure the wire is properly connected. The product and connected device may be malfunctioned, damaged, fired, or miner injury and electric shock may be occurred by improper wiring.



Turn off the power immediately, if the smoke, strange smell and sound are occurred.

Do not use it until the problem is solved.



⚠ **CAUTION**

Avoid shock and rough handling to this product. The product may be damaged by shock as dropping, falling, throwing, knocking, lugging, and etc.










Follow the specification of operating temperature, operating pressure, switch rating, and etc. Otherwise, the product and connected device may be malfunctioned, damaged, fired, or miner injury and electric shock may be occurred. Check the manual or specification sheet.



Operation test shall be done before practical usage. If the serious accident is expected to occur by malfunction of product, the other operating principle of product shall be installed in parallel.



⚠ CAUTION

Check and deeply consider the chemical compatibility for material of product in advance. The part especially float, which is very thin, may be malfunctioned by miner corrosion.	
Check and deeply consider the chemical compatibility for material of product in advance.	
Hold the stem very close to mounting point, when carrying, installing, and removing. If hold the terminal box, it may be taken off from the flange or plug, and the product may be damaged by dropping.	
<u>The product is 50cm or longer</u> The product shall be kept in horizontally. The product and other goods be damaged, and miner injury may be occurred by falling.	
Earth terminal shall be grounded to JIS Class D ground (earth resistance less than 100Ω). If not grounded, electric shock may occurred by any accident.	
Provide arrester or surge absorber to avoid electrical impact such as lightning and static electricity. If not provide, the product and connected device May be malfunctioned, damaged, and fired, or miner injury and electric shock may be occurred.	
<u>In case of connecting inductive or lamp load to the product.</u> Provide protective circuit to the load to avoid over voltage and over current. If not provide, the contact may be damaged.	

INTRODUCTION

- A) This manual specifies the specification of general product. If you order special product, some details of specification may be different with the manual.
- B) We are glad to suggest and advice for Model selection and chemical resistant of material, but final decision has to be made by the customer.
- C) This manual has prepared with close attention. Ask sales office at NOHKEN INC. for any question or comment about the contents of this manual.
- D) For replacement parts
The quality of product has frequently improved, so same spare part may not be supplied. In this case, replacement part or product may be supplied. Ask sales office at NOHKEN INC. for details.
- E) The contents of this manual are subject to change any time without notice due to the improvement of product.

WARRANTY & DISCLAIMER

- A) NOHKEN INC. warrants this product against defect in design, material and workmanship for a period of 1(one) year from the date of original factory shipment.
- B) The warranty only covers the damage of products. The secondary and third kind disasters are not covered by NOHKEN INC.
- C) NOHKEN INC. shall not be liable for the following.
 - C-a) Do not follow the description and direction in this manual.
 - C-b) Damage due to improper installation, wiring, usage, maintenance, inspection, storing, and etc.
 - C-c) Repair and modification are done by the person who is not employee of NOHKEN INC. and our distributor or agent.
 - C-d) Improper parts are used and replaced.
 - C-e) The damage is occurred by the device or machine except our products.
 - C-f) Improper usage. (See "Proper of usage" in chapter 1 in this manual)
 - C-g) Force Majeure including, but not limited to, fire, earthquake, tsunami, lightning, riots, revolution, war, radioactive pollution, acts of God, acts of government or governmental authorities, compliance with law, regulation, and order.

THE TERMS OF WARRANTY AND DISCLAIMER SHALL IN NO WAY LIMIT YOUR REGAL LIGHT.

TABLE OF CONTENTS

	<u>Page No.</u>		<u>Page No.</u>
1. PURPOSE OF USE	..... 1	5.3 Installation of Sensor	..... 8
2. SPECIFICATIONS	..... 1	5.4 Installation of Converter Unit	..... 9
2.1 Model and Suffix Codes	..... 1	5.5 Installation of CVVS Cable	.....10
2.2 Standard Specifications	..... 2	6. WIRING	.....10
2.3 Dimensions	..... 4	6.1 Sensor Wiring	.....10
3. PRINCIPLE OF OPERATION	..... 5	6.2 Cable inlet	.....11
4. COMPONENT NAMES	..... 6	6.3 Converter Unit Wiring	.....11
4.1 Sensor	..... 6	7. TECHNICAL NOTES	.....12
4.2 Converter Unit	..... 7	8. ADJUSTMENT	.....12
5. INSTALLATION	..... 8	9. INSPECTION AND MAINTENANCE	.....13
5.1 Unpacking	..... 8	10. TROUBLESHOOTING	.....14
5.2 Installation Location	..... 8		

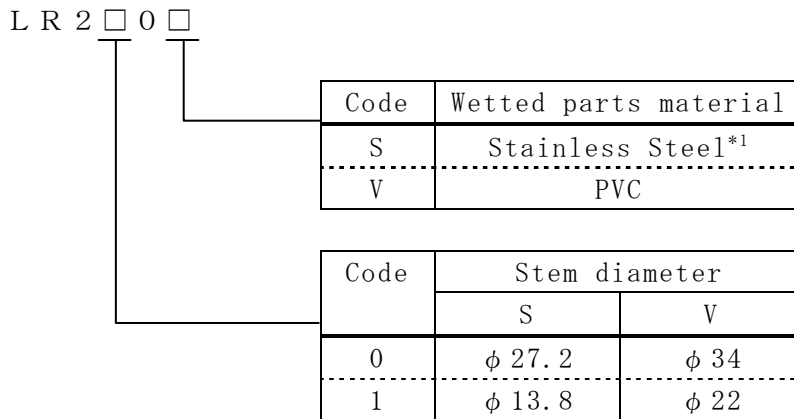
1. PURPOSE OF USE

This Resistive level measurement is designed to measure for clean liquid level, such as oil, water and chemicals in tank. The Resistive level measurement consists of the sensor (Model LR200, LR210 series) and the Converter Unit (Model CU2000) that serves as a converter. The Converter Unit converts the total resistance value of the sensor into an electrical signal and output signal 4 to 20 mA DC.

2. SPECIFICATIONS

2. 1 Model and Suffix Codes

(1) Sensor model



*1 Detail of wetted parts material depends on 「2.2 Standard Specifications」.

(2) Converter Unit model

CU 2 0 0 0

2. 2 Standard Specifications

(1) Sensor

Table 1

Model	LR200S	LR210S	LR200V	LR210V	
Flange size	JIS 5K 100A	JIS 5K 50A	JIS 5K 100A or equivalent	JIS 5K 80A or equivalent	
Stem diameter	φ 27.2	φ 13.8	φ 34	φ 22	
Float dimension	φ 90×H100	φ 49×H50	φ 89×H150	φ 65×H80	
Maximum pressure	500 kPa	500 kPa	200 kPa	200 kPa	
Allowable impact	100 m/s ² Max.				
Working temperature	Wetted part	-10 to +100°C	-10 to +100°C	0 to +50°C	0 to +50°C
	Terminal box part	-10 to +80°C	-10 to +80°C	-10 to +50°C	-10 to +50°C
Construction	IP55	IP65	IP43	IP43	
Minimum S.G.	0.7	0.8	0.85	0.7	
Power supply	0.2 to 3.9 mA DC, 24 V Max. (Power source from CU2000)				
Resolution *2	10 mm				
Accuracy	±0.5 % F.S. (Measuring length < 3000 mm) ±15 mm (Measuring length > 3000 mm)				
Hysteresis	±10 mm				
Total resistance value	(measuring length mm / resolution mm) × 20 Ω				
Max. overall length of stem	3900 mm	3000 mm	3900 mm	3000 mm	
Material	Terminal box	Aluminium die casting		PVC	
	Flange	304 Stainless Steel		PVC	
	Stem	304 Stainless Steel		PVC	
	Float	316 Stainless Steel		PVC	
	Float-travel stop	316L Stainless Steel		PVC	
Insulation resistance test	1×10 ⁸ Ω or more with 500 V DC (Between 1, 2 terminal and E terminal or Non-charge part)				
Withstand voltage test	1500 V AC, 1 Minute (Between 1,2 terminal and E terminal or Non-charge part)				
Cable inlet	G 3/4 or equivalent				

NOTE

*2 Available 5 mm resolution.

The accuracy of 5 mm resolution is ±7.5 mm (Measuring length > 3000 mm).

The hysteresis of 5 mm resolution is ±5 mm.

(2) Converter Unit

Table 2

Model	CU2000
Power source of detector	0.2 to 3.9 mA DC
Allowable resistance of the detector	1.3 k Ω to 12 k Ω
Input signal	2-Wire (Resistive signal use)
Output signal	4 to 20 mA DC
Load resistance	750 Ω Max.
Zero adjustable range	0 to 8 mA DC
Power supply	90 V to 132 V, 180 V to 264 V AC, 50/60 Hz
Power consumption	2 VA Max.
Accuracy	± 0.5 % F.S.
Ambient temperature	0 to 50 $^{\circ}$ C
Preservation temperature	-20 to 70 $^{\circ}$ C
Working humidity	85 % RH Max. (Get rid of dew)
Insulation resistance test	1×10^8 Ω or more with 500 V DC (Between power supply terminal and E terminal)
Withstand voltage test	1500 V AC, 1 Minute (Between power supply terminal and E terminal)
Dimension	W 50 mm \times H 84 mm \times D 109 mm
Installation method	Plug-in Type
Mass	Approx. 350 g

2. 3 Dimensions

(1) Sensor

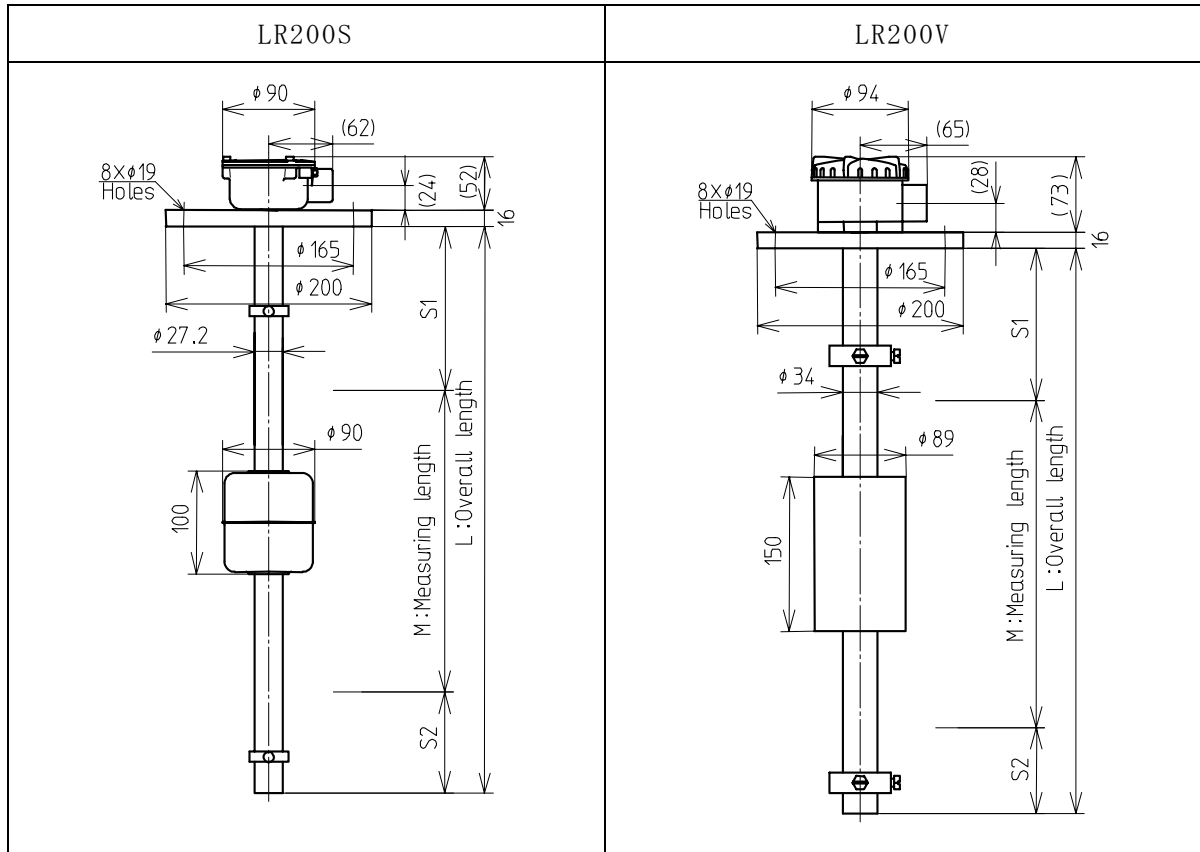


Fig. 1 Drawing of sensor dimensions

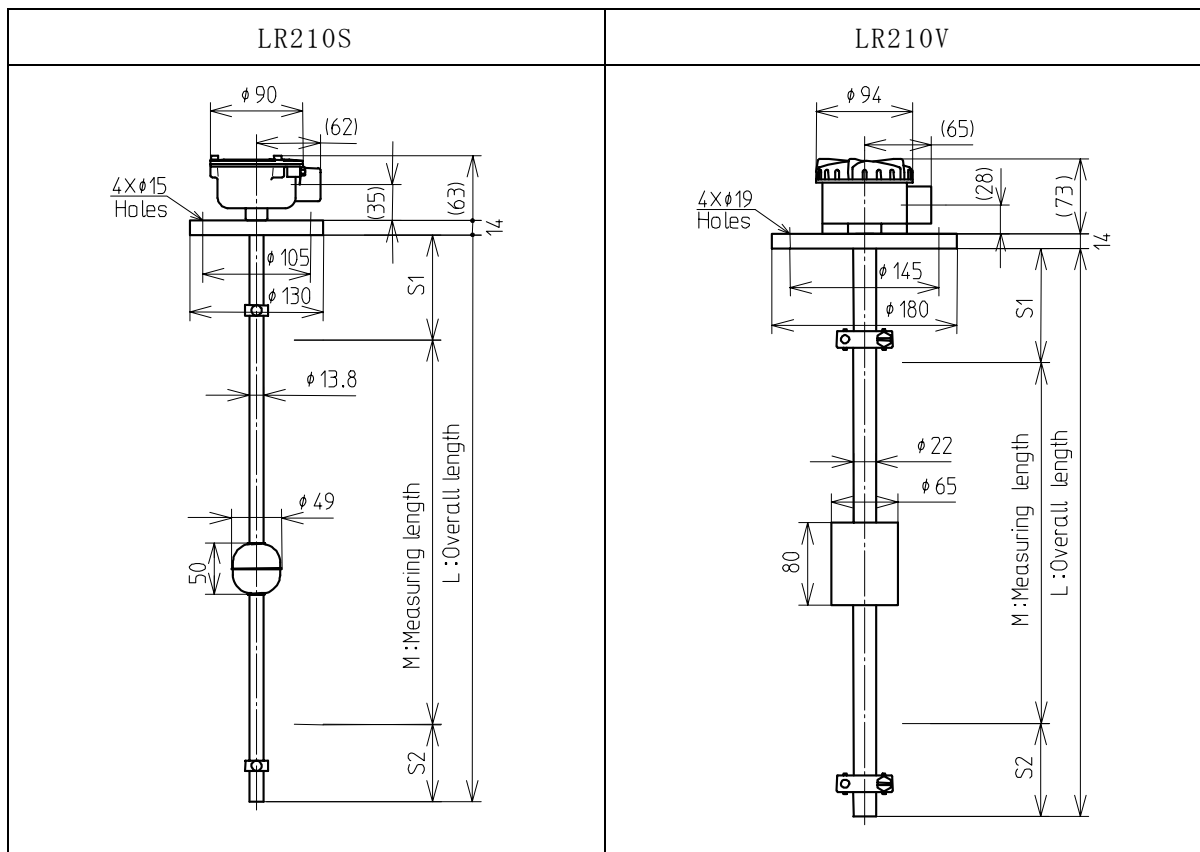


Fig. 2 Drawing of sensor dimensions

(2) Converter Unit

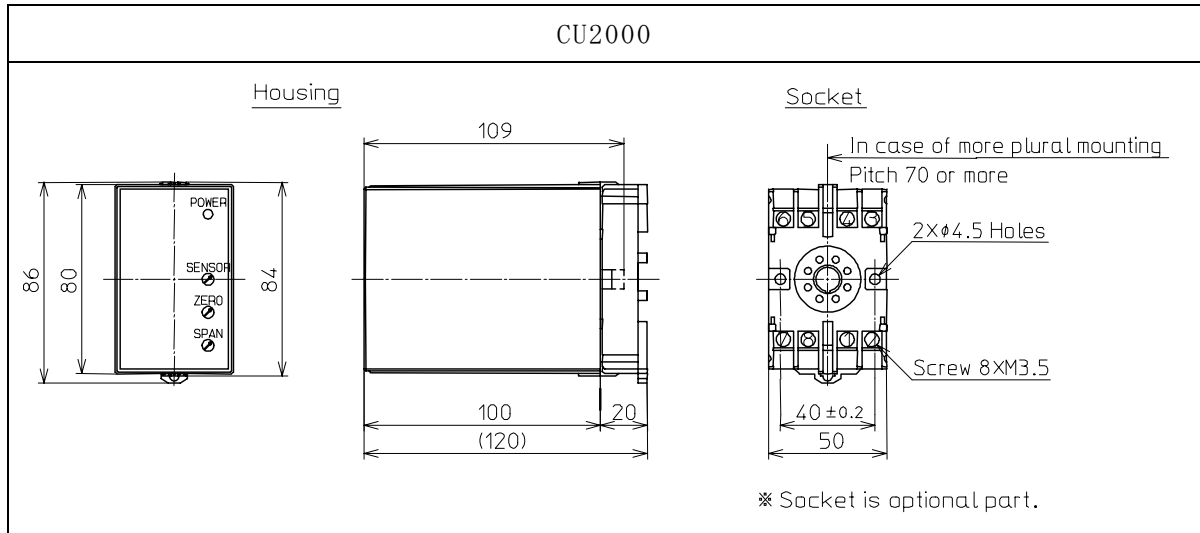


Fig. 3 Drawing of Converter Unit dimensions

3. PRINCIPLE OF OPERATION

The LR series level sensor consists of the float built-in permanent magnet and the stem built-in internal circuit board arranging reed switches, resistances.

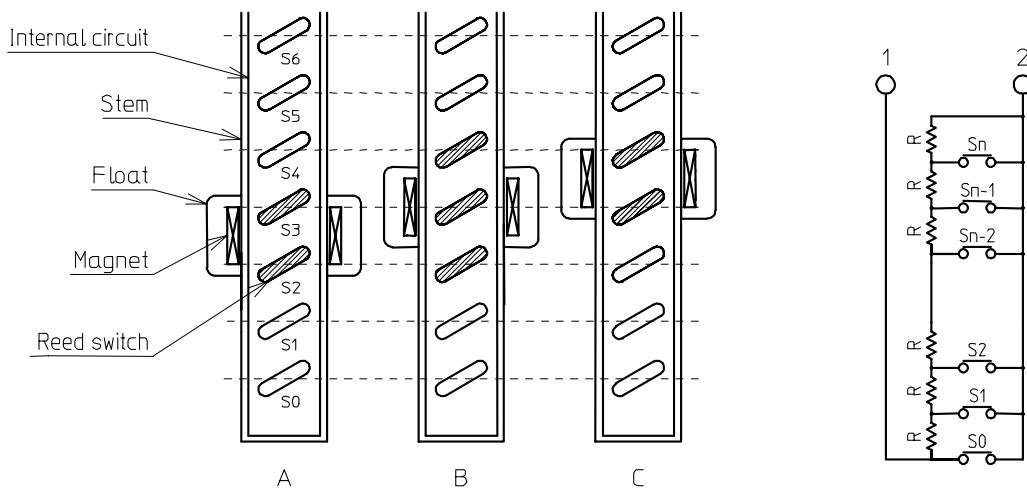


Fig. 4

The float travels freely, between their float-travel stop, rising or falling with liquid level movement.

The reed switches are actuated by the float magnetic field in a “2-3-2 at a time” as the float travels. Accordingly, the total resistance value of internal circuit is changed by float traveling. If supplied constant current between 1 and 2 terminals, the voltage, between 1 and 2 terminals, will change continuously. If the converter unit connected with the sensor, the converter unit converts total resistance value of sensor into output signal 4 to 20 mA DC.

See Fig. 5 Block diagram.

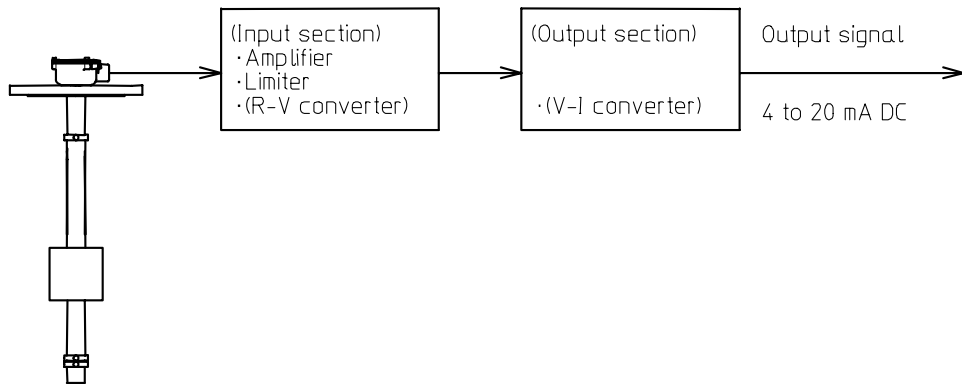


Fig. 5 Block diagram.

4. COMPONENT NAMES

4. 1 Sensor

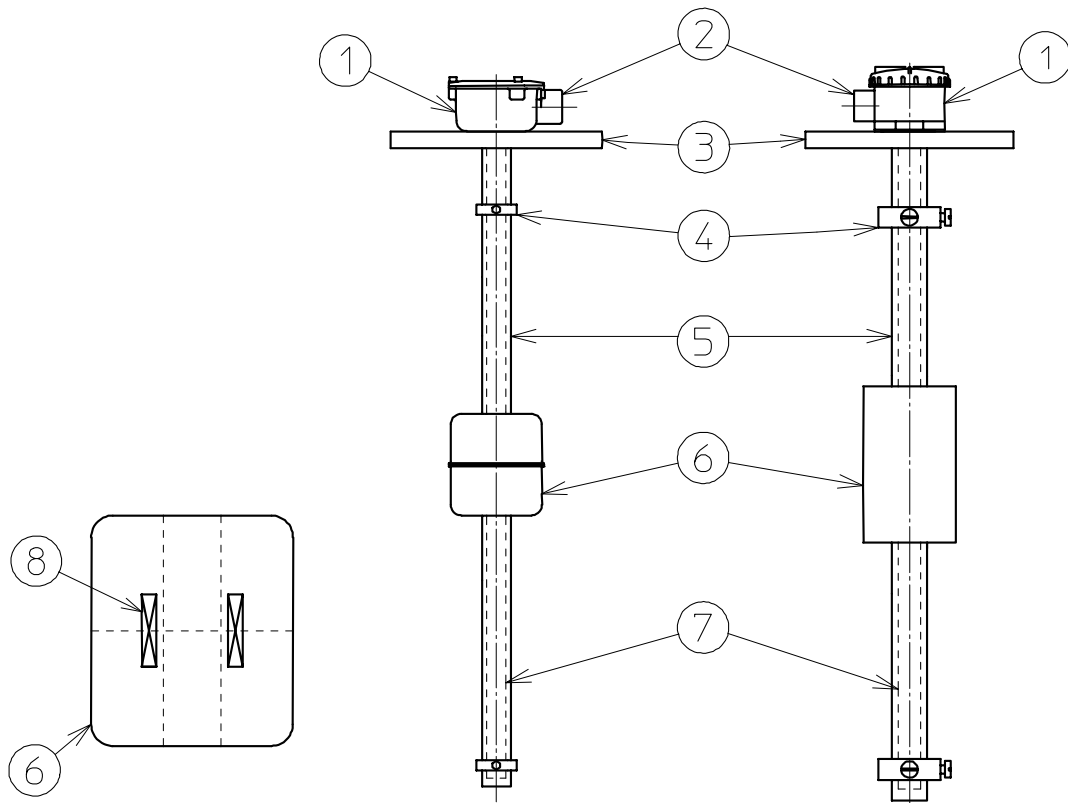


Fig. 6

No.	Name	No.	Name
①	Terminal box	⑤	Stem
②	Cable inlet	⑥	Float
③	Flange	⑦	Internal circuit
④	Float-travel stop	⑧	Permanent magnet

4. 2 C o n v e r t e r U n i t

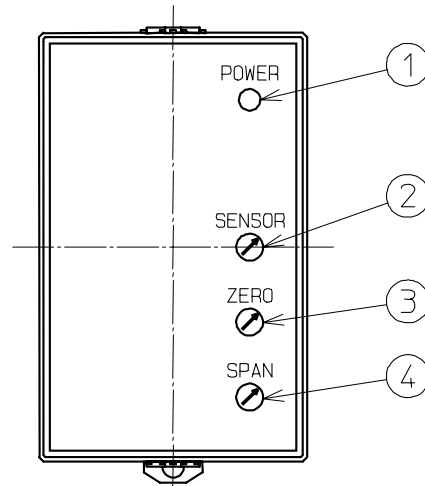


Fig. 7

- ① Power indication lamp
This lamp light up, when the unit is turned on the power.
- ② Detector current adjusting volume
This is the semi-fixed volume for adjusting the current of the power source of the detector with an adjustment range of 0.2 to 3.9 mA DC. Adjust this volume for 3 V DC, the maximum voltage of the detector.
- ③ External output zero adjusting volume
This is semi-fixed volume for fine zero adjustment of the external output signal(4 to 20 mA DC). Adjust this volume to obtain an output of 4 mA DC for input voltage of 0 V DC.
- ④ External output span adjusting volume
This is semi-fixed volume for fine span adjustment of the external output signal(4 to 20 mA DC). Adjust this volume to obtain an output of 20 mA DC for input voltage of 3 V DC.

5. INSTALLATION

5. 1 Unpacking

This unit has been thoroughly inspected and carefully packed at the factory to prevent from damage during shipment. When unpacking, exercise due care not to subject the instrument to mechanical shock. After unpacking, visually check the instrument exterior for damage.

NOTE the following points:

- (1) Do not carry the sensor with one hand, use both hands to protect the long stem from bending. (See Fig. 8)
- (2) Hold the float not hit the stopper or flange. Otherwise, the magnet inside the float will be cracked. (See Fig. 8.)

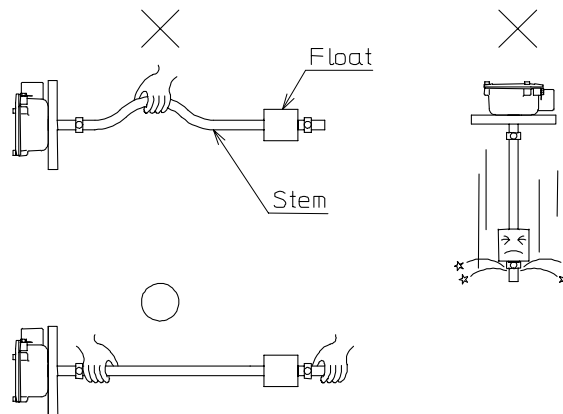


Fig. 8

5. 2 Installation Location

This unit should be installed in an area where the following condition.

- (1) Provide ample space for maintenance/inspection.
- (2) Low relative humidity and no exposure to moisture.
- (3) No corrosive gases. (Such as NH_3 , SO_2 , Cl_2 etc.)
- (4) No excessive vibration.

5. 3 Installation of Sensor

This sensor mounting method depend on flange mounted type. (See Fig. 9)

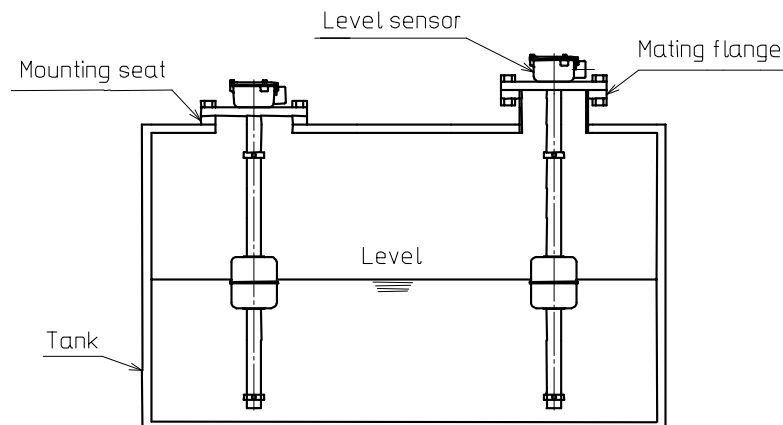


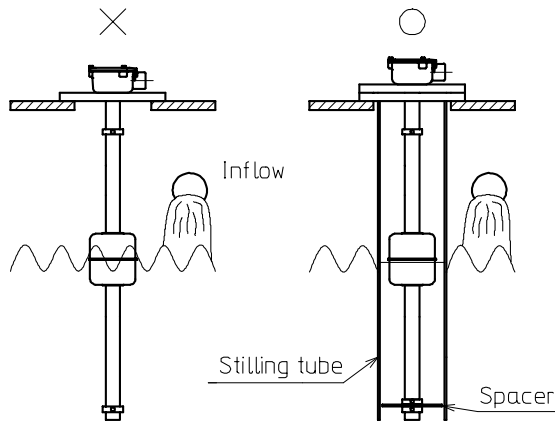
Fig. 9

NOTE the following points:

- (1) This sensor should be installed in an area where the ambient temperature range is -10 to 60 °C.

▲ CAUTION

Provide appropriate means to guard against moisture if the temperature is low. Otherwise, the sensor may be damaged.



- (2) If there is surface wave motion, we recommend the installation of a stilling tube. Drill vent holes in the tube and use spacer to keep the float traveling. (See Fig. 10)
- (3) This sensor should be located away from strong magnetic fields such as those produced by motors or solenoid valves.
- (4) This sensor should be mounted up to vertical.

Fig. 10

▲ CAUTION

Do not provide bending or hitting stem during installation. Otherwise, the sensor may be damage.

5. 4 Installation of Converter Unit

NOTE the following points:

This Converter Unit should be installed in an area where the ambient temperature is 0 to 50 °C.

▲ CAUTION

Provide appropriate means to guard against moisture if the temperature is low, Otherwise the converter unit may be damage.

Proceed as follows:

- (1) Fix the socket(optional part) on mounting board directly with M4 screws ($2 \times \phi 4.5$ holes, Pitch 40), or insert that into DIN rail(35 mm).
- (2) Put in the Converter Unit into the socket.

5. 5 Installation of CVVS Cable

2-core CVVS(1.25 mm²) connecting cable shall be used between the sensor and the converter unit. The cable length shall not exceed 300 m(lead wire loop resistance 12 Ω Max.). The CVVS cable must be run in conduit, or must be used cable inlet.

⚠ CAUTION

- (1) Do not kink the CVVS cable. Damage can occur causing the sensor and the converter unit to malfunction. The CVVS cable must be laid at a distance of 50 cm or more from the power cable. Otherwise, the sensor and the converter unit may be damaged by induced current.
- (2) The CVVS cable should be grounded by JIS Class D Grounded. (Grounded resistance 100 Ω Max.)

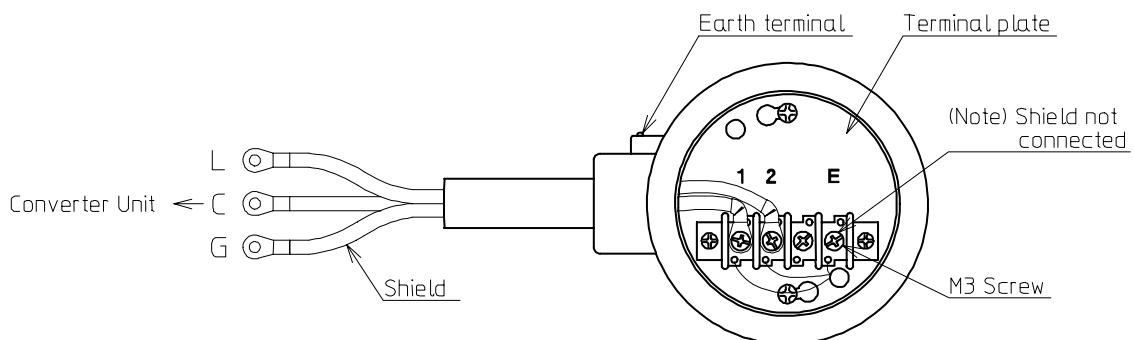
6. WIRING

6. 1 Sensor Wiring

Normally, wiring data is indicated to the back of terminal box cover. Proceed as follows:

Proceed as follows:

- (1) Remove the terminal box cover.
- (2) Bring the cable into the terminal box.
- (3) Connect the cables to the terminals as shown Fig. 11.
CU2000 L terminal ----- sensor 1 terminal
CU2000 C terminal ----- sensor 2 terminal
- (4) Make sure that there is no miswiring.
- (5) Reinstall the terminal box cover in accordance with protection category IP55,65(LR2□0S) or IP43(LR2□0V).



(Note) 'E' terminal is connected with Terminal box.

Fig. 11

NOTE the following points:

- (1) Install solderless lugs fitted to M3 screw to the end of lead wires.
- (2) The cable inlet must be protected the sensor from rain, splashing water and so on.

6. 2 Cable inlet

The size of the cable inlet is G 3/4.


There are two ways for connecting the sensor cable. One is fixing the cable with a cable gland. The other is connecting a conduit to the housing. In either case, an adequate sealing should be provided to prevent water or dust ingress into the housing through the sensor cable.

Secure the cable using sealing material for the conduit connection, or a Proper tool when the gland is used, to protect the housing inside from dust or water. When water or moisture comes into the housing from the conduit, use putty to fill the inside of the conduit.

6. 3 Converter Unit Wiring

Proceed as follows:

- (1) Connect the cables to the terminals as shown in Fig. 12.


 CAUTION

Make sure that the power supply is turned off.

- (2) Double-check wiring for correctness.

NOTE the following points:

- (1) The cable for relay, output signal and power supply must be used between 0.3 mm² to 1.25 mm².
- (2) The terminal screws are used M3 screw.

 WARNING

- (1) To avoid injury, connect the power supply to the converter unit, after making connection.
- (2) "EARTH TERMINAL" should be grounded. If it is not grounded, you will get an electrical shock.

- (3) Make sure that the shield cables are one-point grounded.

- (4) This converter unit is designed to operate with maximum load resistance 750 Ω.

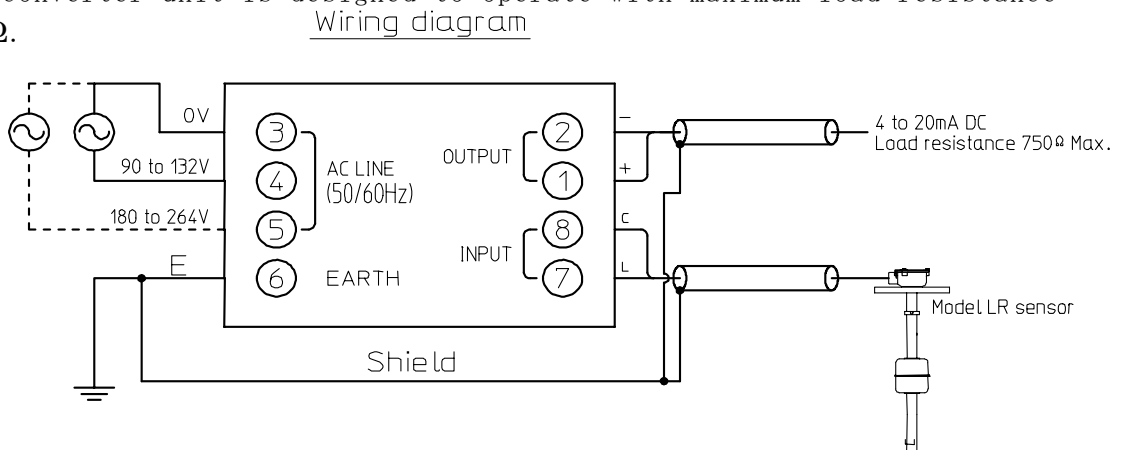


Fig. 12

7. TECHNICAL NOTES

- (1) Actuation levels are assumed with water (SG=1.0). If your liquid has a different specific gravity, please specify this when you order.
- (2) Maximum allowable impact is 10 G. Shocks greater than 10 G may damage the sensor.
- (3) The float-travel stop settings are based on how the magnetic field influences the reed switches. Do not move the float-travel stop.
- (4) This products must be stored in a day, warm place where condensation of humidity will not occur.

8. ADJUSTMENT

NOTE: The adjusting volume of the converter unit have been adjusted specified value before shipment. If it need fine adjustment, adjust output signal in accordance with follows.

Proceed as follows:

- (1) Make sure that there are no miswiring.

 CAUTION

Supply voltage must match the terminals indicated on the front panel.
Incorrect voltage miswiring will damage the converter unit.

- (2) Connect digital ammeter to output terminals(+ and -).
- (3) Turn on the power.
- (4) Connect a voltmeter having an internal resistance of 500 k Ω or more between the input terminals(L=Positive side and C=Negative side).
- (5) Set the float on highest level and adjust the current adjusting volume ② of the detector so that the voltmeter indicates 3 V DC.
- (6) Set the float on lowest level and adjust zero point by adjusting volume ③ that output signal is 4 mA DC.
- (7) Set the float on highest level and adjust span point by adjusting volume ④ that output signal is 20 mA DC.
- (8) Set the float on lowest level again, and check that output signal is 4 mA DC. If that is not 4 mA DC, re-adjust zero and span points accordance with parts of "8.ADJUSTMENT (6) and (7)".

9. INSPECTION AND MAINTENANCE

The following annual servicing tasks should be carried out on the sensor and Converter unit.

- (1) Visual inspection
 - (a) Remove the sensor from tank carefully.
 - (b) Ensure there is no damage.
 - (c) The float-travel stop setting are based on how the magnetic field influence the reed switch. If float overrun, check and reset the float-travel stop.
 - (d) If the float is filled with water or collapsed, it must be replaced immediately. Do not attempt to repair a float.
- (2) Cleaning the sensor.
 - (a) Never remove the terminal box cover. It become damaged or misplaced, order a reinstallation immediately.
 - (b) If sediment or other foreign matters are stained between float and stem, detecting errors may be caused. Keep clean float and stem.
 - (c) Be care of the float orientation when you reassemble the resin float. If you insert the wrong direction, the sensor may cause false operation. The correct direction shows the following table.

Float size	Type of marking	Direction
$\phi 65 \times H80$	Type of marking	The marked side must be installed the tip of the stem side(bottom)
marked float	groove	The marked side must be installed the tip of the stem side(bottom)
another float		Do not prescribe

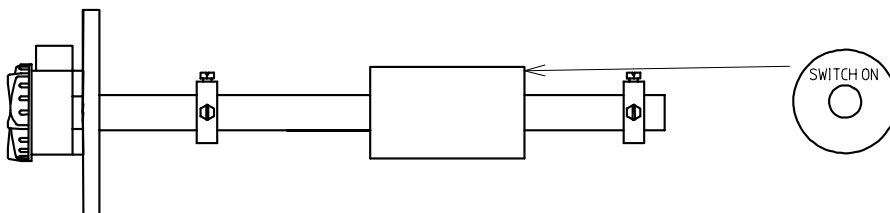


Fig. 13

- (3) Sensor operating(See Fig. 14)

After removing the terminal box cover, check switch actuation as follows.

 - (a) Remove the connection from the converter unit.
 - (b) Connect a ohmmeter between 1 and 2 terminals.
 - (c) Travel the float between their float-travel stop, and check the resistance value changes constantly.
 - (d) If the sensor is normal, the resistance value changes at the rate of 20 Ω for resolution.

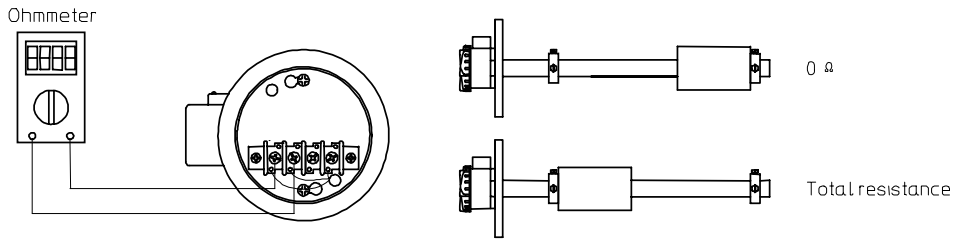


Fig. 14

(4) Converter unit inspection

- (a) Don't turn on the power source while the input terminal of converter unit is open.
- (b) Turn off power source, when the converter unit is attached or detached from the socket.
If don't turn off, internal electric parts is broken.

10. TROUBLESHOOTING

▲ CAUTION

Use the following chart to troubleshoot the malfunctioning sensor.
If your remedies are unsuccessful, ask Nohken for repair and replacement.

Table 3

Problems	Causes	Solutions
The power lamp does not light	The power supply is not connected.	Ensure the wiring, and connect the power.
Output signal does not change from 4 mA DC.	Line between L and C terminals is short circuit.	Ensure the wiring on this line.
	Sediment or other foreign matter adhere to between float and stem.	Clean the sensor.
	Float is filled with liquid on corrosion.	Replace float after checking corrosion resistance.
Output signal does not change from 20 mA DC.	Sediment or other foreign matter adhere to between float and stem.	Clean the sensor.
	Falling the float form the stem.	Put the float on stem, and tighten the float travel-stop.
Output signal dose not change at somewhere.	Sediment or other foreign matter adhere to between float and stem.	Clean the sensor.
Output signal is over range.	Wiring between sensor and converter unit is disconnected.	Ensure the wiring

NOHKEN INC.

HEAD OFFICE : 15-29, Hiroshiba-cho, Suita-city, Osaka 564-0052, Japan.

TEL:06-6386-8141 FAX:06-6386-8140

TOKYO BRANCH OFFICE : 67, Kandasakumagashi, Chiyoda-ku, Tokyo 101-0026, Japan.

TEL:03-5835-3311 FAX:03-5835-3316

NAGOYA OFFICE : 3-10-17, Uchiyama, Chikusa-ku, Nagoya-city, Aichi 464-0075, Japan.

TEL:052-731-5751 FAX:052-731-5780

KYUSHU OFFICE : 14-1, 2-chome, Asano, Kokurakita-ku, Kitakyushu-city, Fukuoka 802-0001, Japan.

TEL:093-521-9830 FAX:093-521-9834