

I N S T R U C T I O N M A N U A L
F O R
E L E C T R O D E L E V E L S E N S O R

M O D E L : F E

M O D E L : R E

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NOHKEN INC.

MUST BE READ BEFORE USING

- This manual is for standard specifications. Read the other manuals for explosion-proof specifications.
- This manual describes the handling, inspection and adjustment of the sensor. Read and understand this manual before installation.
- Any documents and/or directions from Nohken and the agents aside from this manual shall be preceded.
- Save this manual to refer when you need.
- If you have any questions or comments about this manual and/or the sensor, ask Nohken's sales office.

Signal words in this manual means as follows:

 CAUTION	Indicates an potentially hazardous situation which, if not avoided, may result in minor or moderate injury.
 NOTE	Indicates exceptional cases and attention for handling of sensors.

	Indicates prohibition. The explanation with this manual should always be followed.
	Indicates directions. The explanation with this manual should always be followed.

MUST BE READ BEFORE USING
WARRANTY & DISCLAIMER

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1. INTRODUCTION

This Electrode Level Sensor is designed to measure for conductive liquid level. This system consists of the sensor (model FE series) and the plug-in relay unit(model RE7□00 series)and so on. This system will controls the liquid level in tank.

2. SPECIFICATION

2.1 Model and Suffix Code

(1) Flange installation type sensor

FE □ □ □ - □

Number of electrode	2 to 7
---------------------	--------

Select the number of electrode required.

Code	Material of electrode
2	316 Stainless Steel
3B	Hastelloy B
3C	Hastelloy C
4	Titanium

Code	Flange size and Material
Blank	Equivalent JIS 10K100A (Proviso 4 holes) Polyvinyl Chloride
2	Other versions available

(2) Thread installation type sensor

FE □ □ □ - □

Number of electrode	2 to 4 (FE7 series)
	2 to 6 (FE8 series)

Select the number of electrode required.

Code	Material of electrode
2	316 Stainless Steel
3B	Hastelloy B
3C	Hastelloy C
4	Titanium

Model	Tread size and material
FE7	G2 / Phenol
FE8	G2 / Polyvinyl Chloride

2. 2 Specifications

(1) Flange installation type sensor

Model		FE2	FE3B	FE3C	FE4
Allowable temperature		-20 to 50 °C			
Flange size		Equivalent JIS10K100A (Proviso 4 holes)			
Material	Electrode rod	316 SS	Hastelloy B ^{*1}	Hastelloy C ^{*2}	Titanium
	Connector	316 SS	Hastelloy B	Hastelloy C	Titanium
	Lock nut	316 SS	Hastelloy B	Hastelloy C	Titanium
	Terminal box	ABS(Acrylonitrile butadiene styrene)			
	Flange	PVC(Polyvinyl chloride)			
Insulation tube ^{*3}		Polyolefine			
Mass ^{*4}		Approx. 1.6 kg			
Cable inlet		Equivalent JIS F 20a (G3/4)			
Construction		IP 45			

Model		FE22	FE23B	FE23C	FE24
Allowable temperature		*5			
Flange size		*5			
Material	Electrode rod	316 SS	Hastelloy B	Hastelloy C	Titanium
	Connector	316 SS	Hastelloy B	Hastelloy C	Titanium
	Lock nut	316 SS	Hastelloy B	Hastelloy C	Titanium
	Terminal box	*5			
	Flange ^{*6}	*5			
Insulation tube		*5			
Mass ^{*4}		*5			
Cable inlet		*5			
Construction		*5			

(2) Thread installation type sensor

Model		FE72	FE73B	FE73C	FE74
Allowable temperature		-20 to 60 °C			
Thread size		G 2			
Material	Electrode rod	316 SS	Hastelloy B	Hastelloy C	Titanium
	Connector	316 SS	Hastelloy B	Hastelloy C	Titanium
	Lock nut	316 SS	Hastelloy B	Hastelloy C	Titanium
	Terminal box	Phenol			
	Insulation tube	Polyolefine			
Mass ^{*4}		Approx. 0.3 kg			
Cable inlet		Equivalent JIS F 20a (G3/4)			
Construction		IP 43			

Model	FE82	FE83B	FE83C	FE84	
Allowable temperature	-20 to 50 °C				
Thread size	G 2				
Material	Electrode rod	316 SS	Hastelloy B	Hastelloy C	Titanium
	Connector	316 SS	Hastelloy B	Hastelloy C	Titanium
	Lock nut	316 SS	Hastelloy B	Hastelloy C	Titanium
	Terminal box	PVC(Polyvinyl chloride)			
	Insulation tube	Polyolefine			
Mass ^{*4}	Approx. 0.4 kg				
Cable inlet	Equivalent JIS F 20a (G3/4)				
Construction	IP 43				

*1 *2 Registered trademark of Mistubishi Metal Corporation.

*3 Allowable temperature of Polyethylene is 100 °C Max. Other material of insulation tube available. When ordering a sensor, specify working temperature.

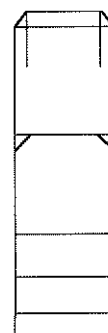
*4 Not include electrode rod.

*5 *6 Other versions available. Please consult factory for more information.

(3) Identifications

Electrode rod

Material	Identification mark
316 Stainless steel	None
Hastelloy B	3
Hastelloy C	2
Titanium	1



Identification mark

Connector

Material	Identification shape
316 Stainless steel	Hexagon with screw
Hastelloy B	Column
Hastelloy C	Column
Titanium	Hexagon without screw

Lock nut

Material	Identification shape
316 Stainless steel	Hexagon with '6' mark
Hastelloy B	Oblong
Hastelloy C	Oblong
Titanium	Hexagon without mark

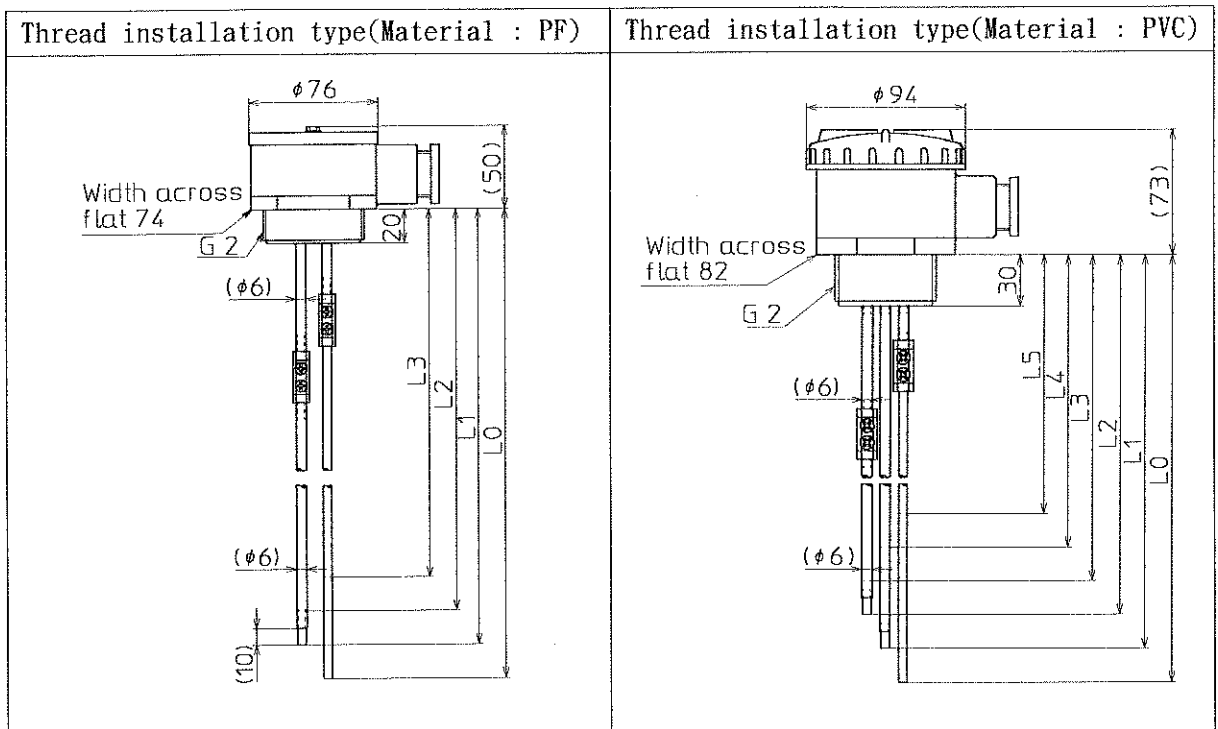


Fig 2

(2) Dimension of electrode holder and electrode arrangement

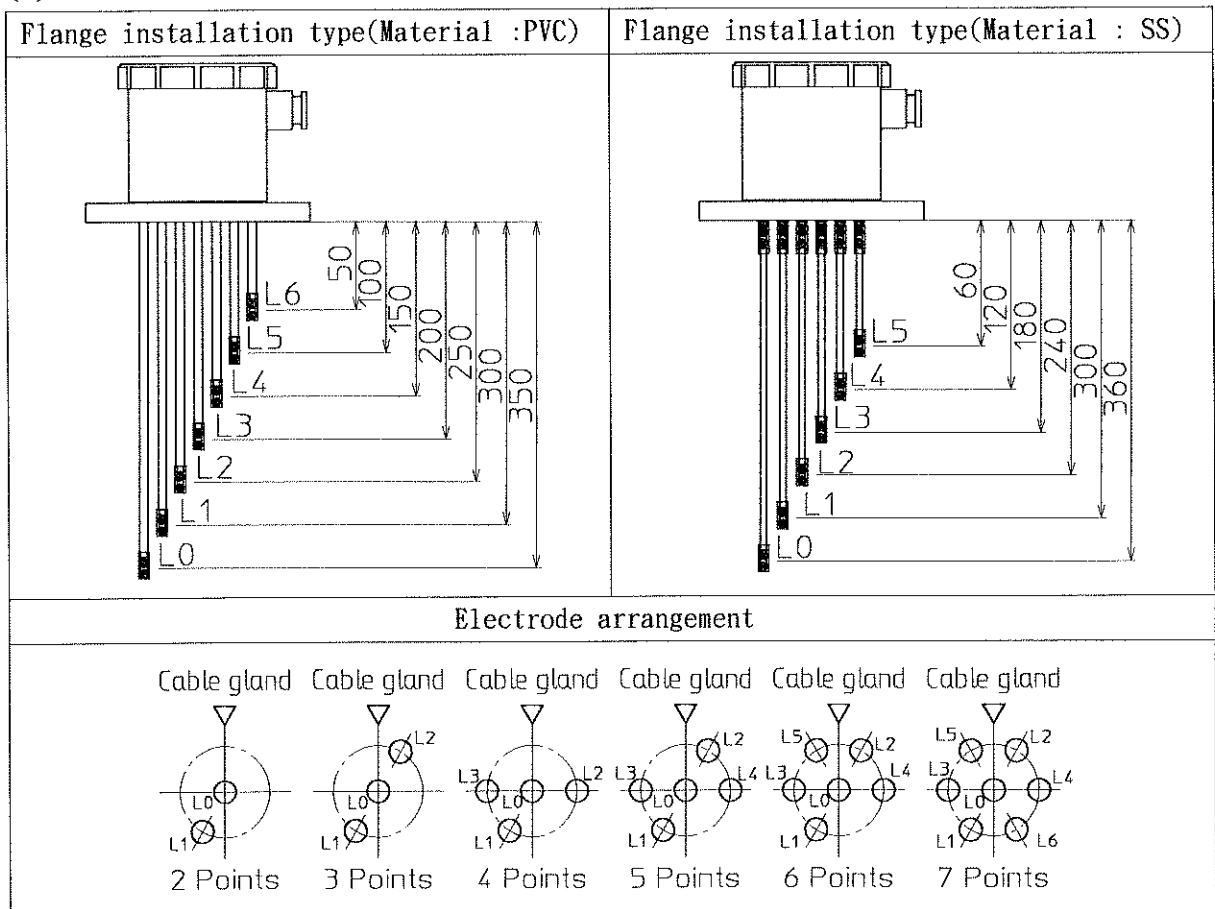


Fig 3

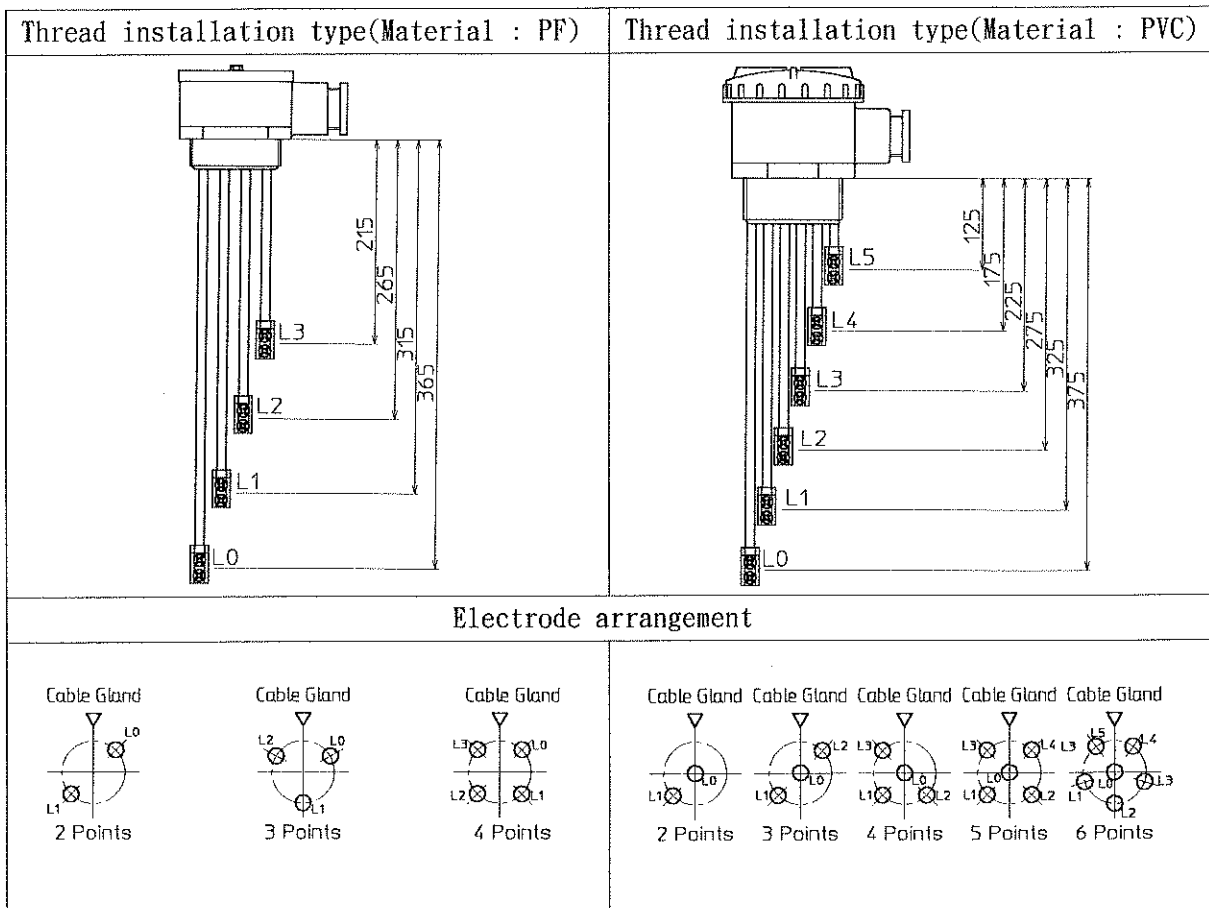


Fig 4

(3) Dimension of relay unit

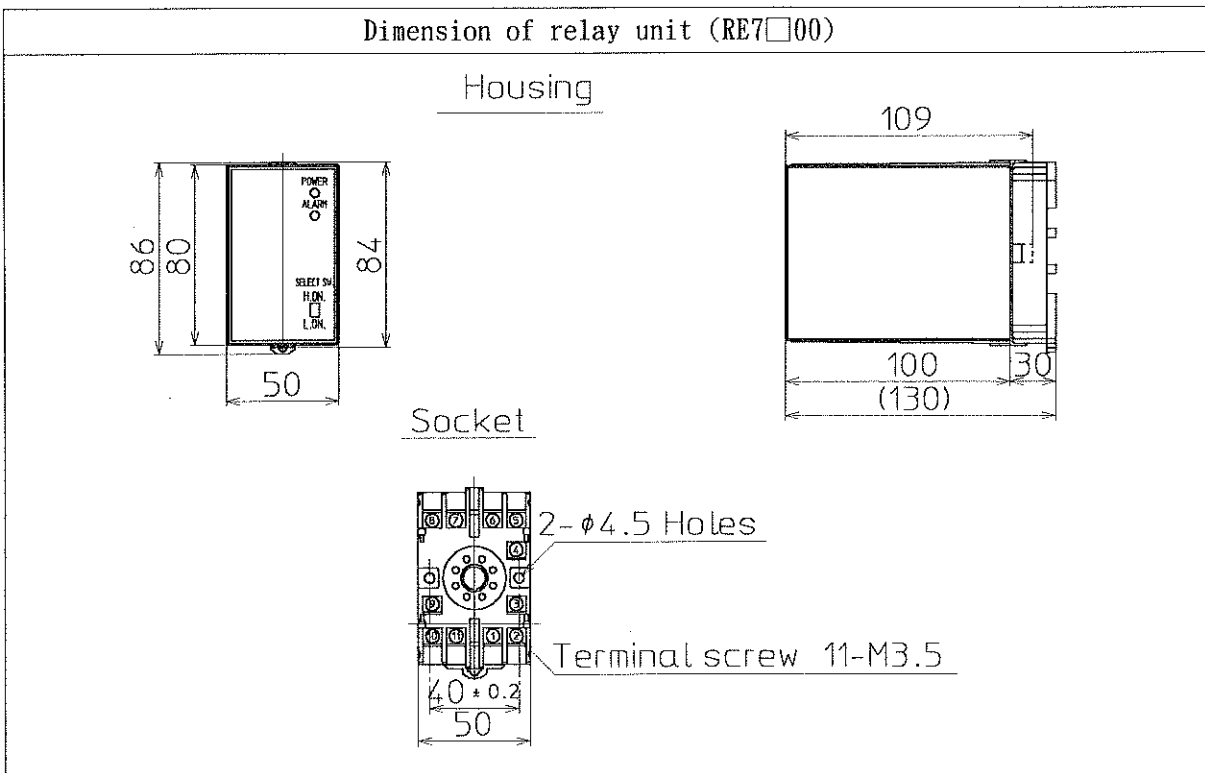


Fig 5

3. PRINCIPLE OF OPERATION

Low AC voltage applied between L_0 electrode and other electrodes. This system may be used to control functions such as latching for pump control or alarm setpoints. AC voltage is utilized to prevent electrical corrosion.

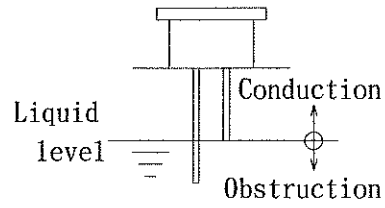


Fig 6

4. COMPONENT NAMES

4.1 Component Names of Sensor

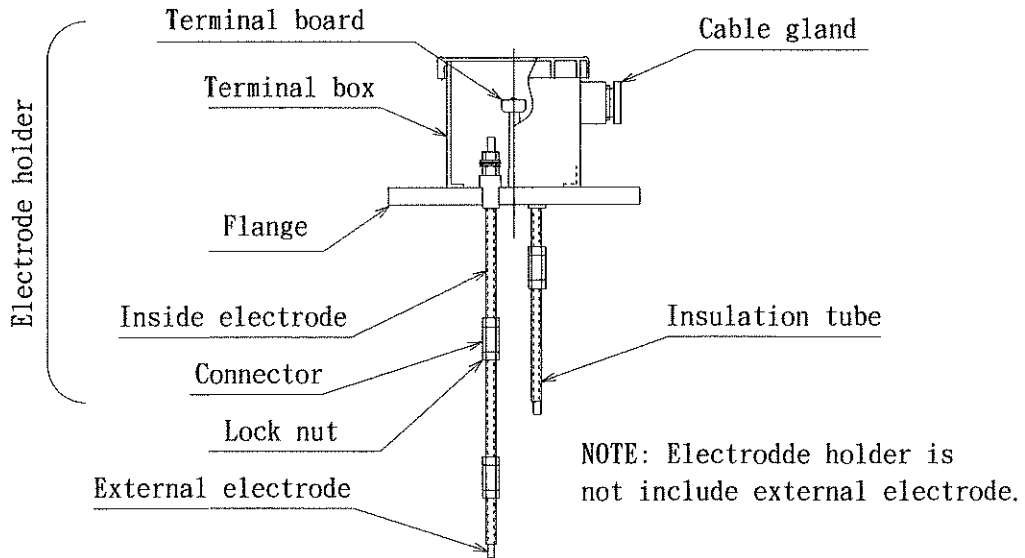


Fig. 7

4.2 Component Names of Relay Unit

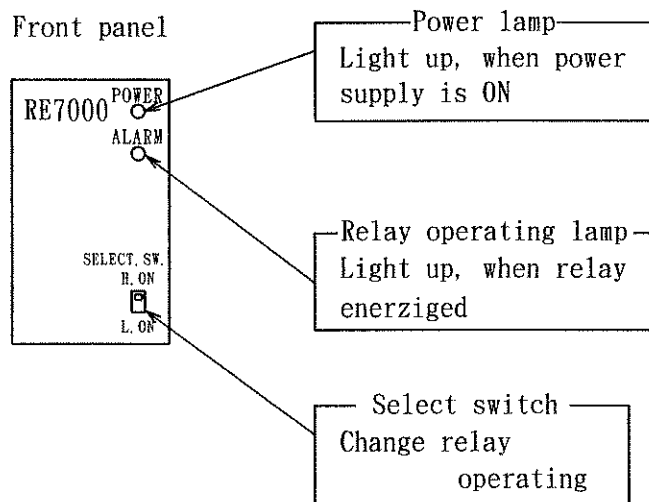


Fig. 8

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, care must be taken not to damage the instrument with mechanical shock. After unpacking, visually check the instrument exterior for damage.

NOTE the following points:

- (1) Electrode rod must be kept from vending during carrying.
- (2) Be sure that the manufacture's serial number of both electrodes and electrode holder are identity.
- (3) Be sure that the parts such as electrode rod, connector and lock nut are attached correctly.

5.2 Sensor Assembly

This sensor makes specified length by connecting external electrodes and electrode holder.

5.2.1 Assembly Procedure

Proceed as follows:

- (1) Take out the external electrodes.
- (2) Remove the terminal box cover.
- (3) Check the terminal blocks and lead wire color.

Actuation level	Terminal blocks	Lead wire color
L ₀	0	Red
L ₁	1	White
L ₂	2	Yellow
L ₃	3	Green
L ₄	4	Blue
L ₅	5	Red
L ₆	6	White

NOTE: Thread type sensor has no terminal board. So that the electrode number (0, 1, 2, ...) marked in the terminal box.

- (4) The leading edge of external electrodes are marked number(0, 1, 2, ...).
- (5) Check the mark on the surface of the electrodes.
- (6) Connect the external electrodes to electrode holder specified length in accordance with electrode arrangement.

NOTE: Insulation tube of leading edge is stripped 10 mm. If the external electrodes are cut to specified length, Insulation tube of L₀ electrode must be stripped clearly and leading edge of other external electrodes must be stripped 10 mm.

- (7) After connecting, reinstall the terminal box cover.

5.2.2 Connecting Method

(1) In case of 316 stainless steel (See Fig. 9)

- (a) Loosen the lock screws on the connector with phillips screwdriver.
- (b) Screw the lock nut into the end of the electrode.
- (c) Insert the electrode into the connector.
- (d) Tighten the lock nut with spanner (width across flat 10 mm) to make contact with the electrode.
- (e) Retighten the lock screws securely.

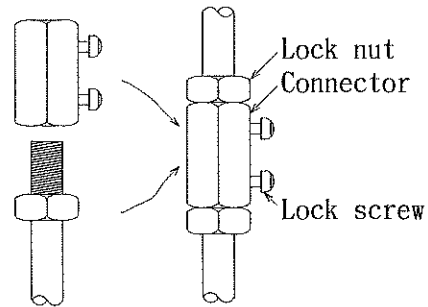


Fig. 9

(2) In case of Hastelloy (See Fig. 10)

- (a) Screw the lock nut into the end of the electrode.
- (b) Insert the electrode into the connector.
- (c) Tighten the lock nut with spanner (width across flat 10 mm) to make contact with electrode.

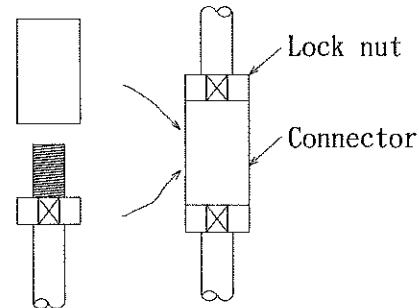


Fig. 10

(3) In case of Titanium (See Fig. 11)

- (a) Screw the lock nut into the end of the electrode.
- (b) Insert the electrode into the connector.
- (c) Tighten the lock nut with spanner (width across flat 10 mm) to make contact with electrode.

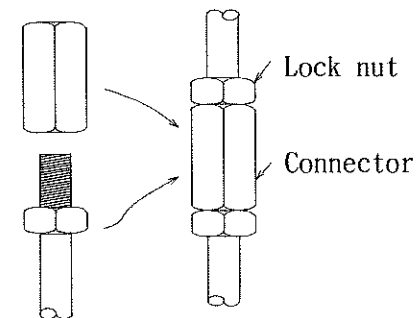


Fig. 11

NOTE the following points:

- (1) When tighten the lock nut, the connector must be secured with plier or spanner to avoid inside electrodes loosen. (See Fig. 12)

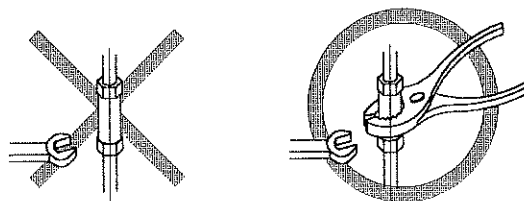


Fig. 12

- (2) If the inside electrodes turned, retighten the hex. nut inside terminal box.
 (See Fig. 13)

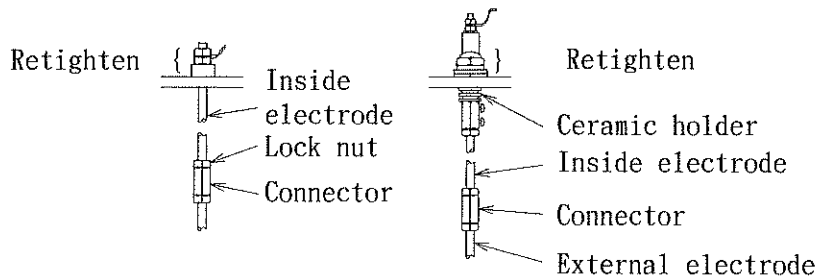


Fig. 13

5.3 Installation Location

This level sensor should be installed in an area where the following conditions:

- (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.

5.4 Installation of Sensor

This Level sensor installation method depend on flange or thread type. (See Fig. 14)

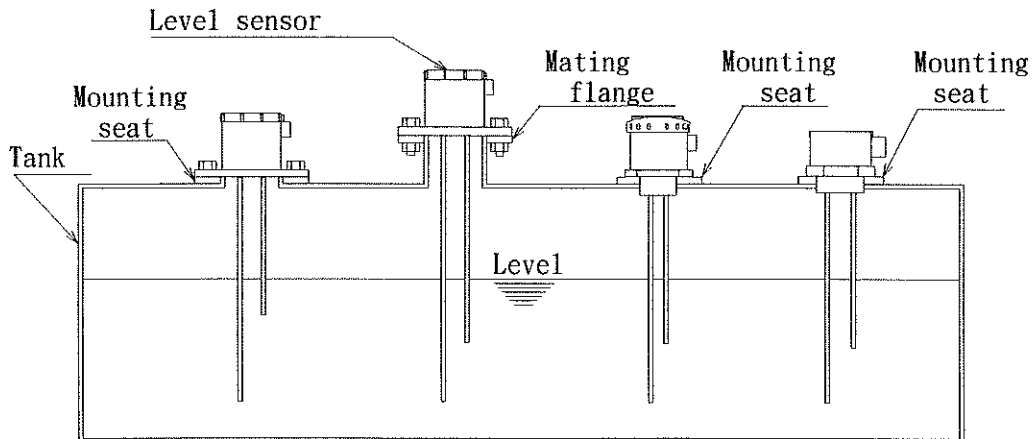


Fig. 14

NOTE the following points:

- (1) This sensor should be installed in an area where the ambient temperature range is -20 to 50 °C (FE-7 series : -20 to 60 °C).

CAUTION: Install a sun shield over the terminal box if temperature is high. Provide appropriate means to guard against moisture if temperature is low. Otherwise, the sensor may be damage.

- (2) Keep the electrode out of the direct flow of liquid. Failure to do this may cause the electrode to break. If necessary, install a baffle in order to divert the liquids.
- (3) Locate the sensor keep away from inlets or outlets, where excessive turbulence may exist. If necessary, install a stilling tube in order to divert the liquids.
- (4) When a electrode is extended 2000 mm, use a separator in order to prevent a short-circuit between electrodes.

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

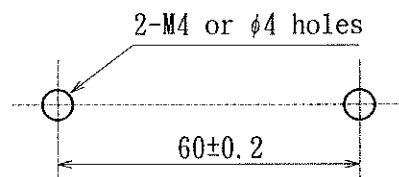
5.5 Installation of Relay Unit

This relay unit installation method depend on plug-in type. The socket(OMRON made, Model 11PFA equivalent) must be prepared to install the relay unit.

The socket for relay unit is option. (Reffer to 「10. OPTIONAL PARTS」)

5.5.1 Installation of Socket

- (1) Wall installation



- (2) Rail installation

Use the DIN rail(35 mm).

6. WIRING

6.1 Sensor Wiring

Proceed as follows:

- (1) Remove the terminal box cover.
- (2) Bring the cable into the terminal box.
- (3) Connect the cable to the terminals as shown Fig. 15.
- (4) Make sure that there are no miswiring.
- (5) Reinstall the terminal box cover in accordance with protection category IP45 (FE2 series) or IP43(FE7, FE8 series).
- (6) The cable inlet must be protected the sensor from rain splashing water and so on.

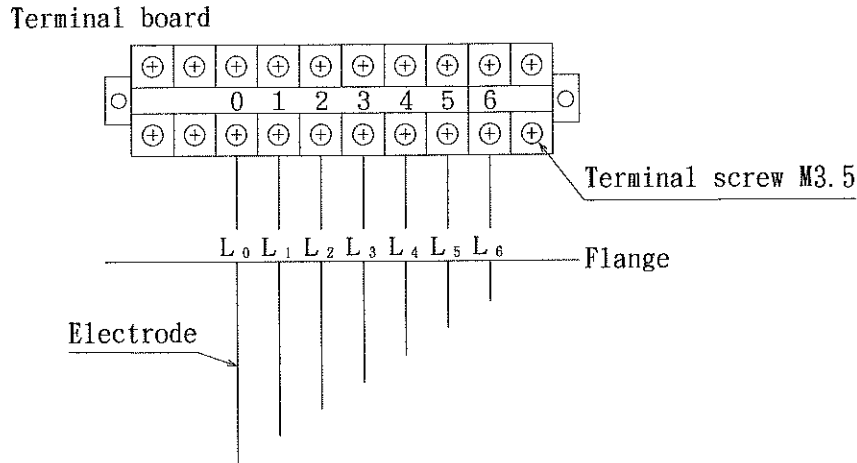


Fig. 15

NOTE: (1) Install solderless lugs fitted to M3.5 screw to end of lead wire.
 (2) Thread type sensor has not terminal board. Connect the cables to the inside electrodes directly. (Screw size of inside electrode is M6)

6.2 Wiring Diagram

6.2.1 Wiring diagram for high or low level alarm (See Fig. 16)

(1) High level alarm (SELECT. SW. H. ON side)

- (a) When the liquid level reaches L₁ electrode, relay energize.
- (b) When the liquid level falls below L₁ electrode, relay de-energize.

(2) Low level alarm (SELECT. SW. L. ON side)

- (a) When the liquid level falls below L₁ electrode, relay energize.
- (b) When the liquid level reaches L₁ electrode, relay de-energized.

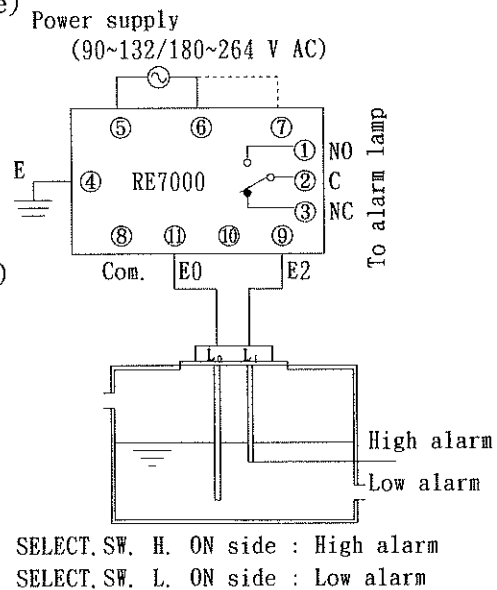
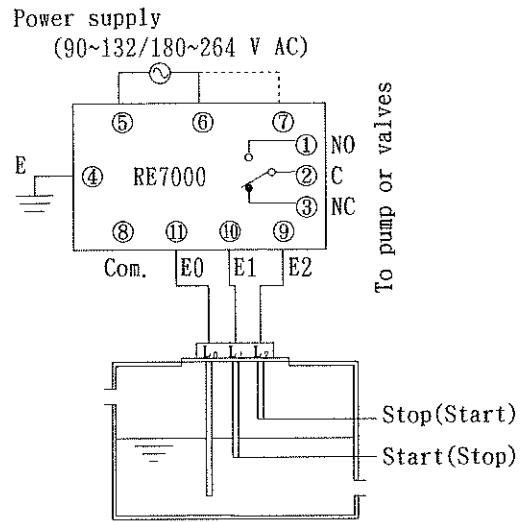


Fig. 16

6.2.2 Wiring diagram for latching(inflow or outflow control) See Fig. 17

(1) Outflow control(SELECT. SW. : H. ON)

- (a) When the liquid level reaches L_2 electrode, relay energize.
- (b) When the liquid level falls below L_2 electrode, relay energize.
- (c) When the liquid level falls below L_1 electrode, relay de-energize.
- (d) When the liquid level reaches L_1 electrode, relay de-energize.
- (e) When the liquid level reaches L_2 electrode, relay energize.



SELECT. SW. H. ON side : Outflow control
SELECT. SW. L. ON side : Inflow control

Fig. 17

(2) Inflow control(SELECT. SW. : L. ON)

- (a) When the liquid level falls below L_1 electrode, relay energize.
- (b) When the liquid level reaches L_1 electrode, relay energize.
- (c) When the liquid level reaches L_2 electrode, relay de-energize.
- (d) When the liquid level falls below L_2 electrode, relay de-energize.
- (e) When the liquid level falls below L_1 electrode, relay energize

6.2.3 Wiring diagram for liquid level control with high and low level alarms

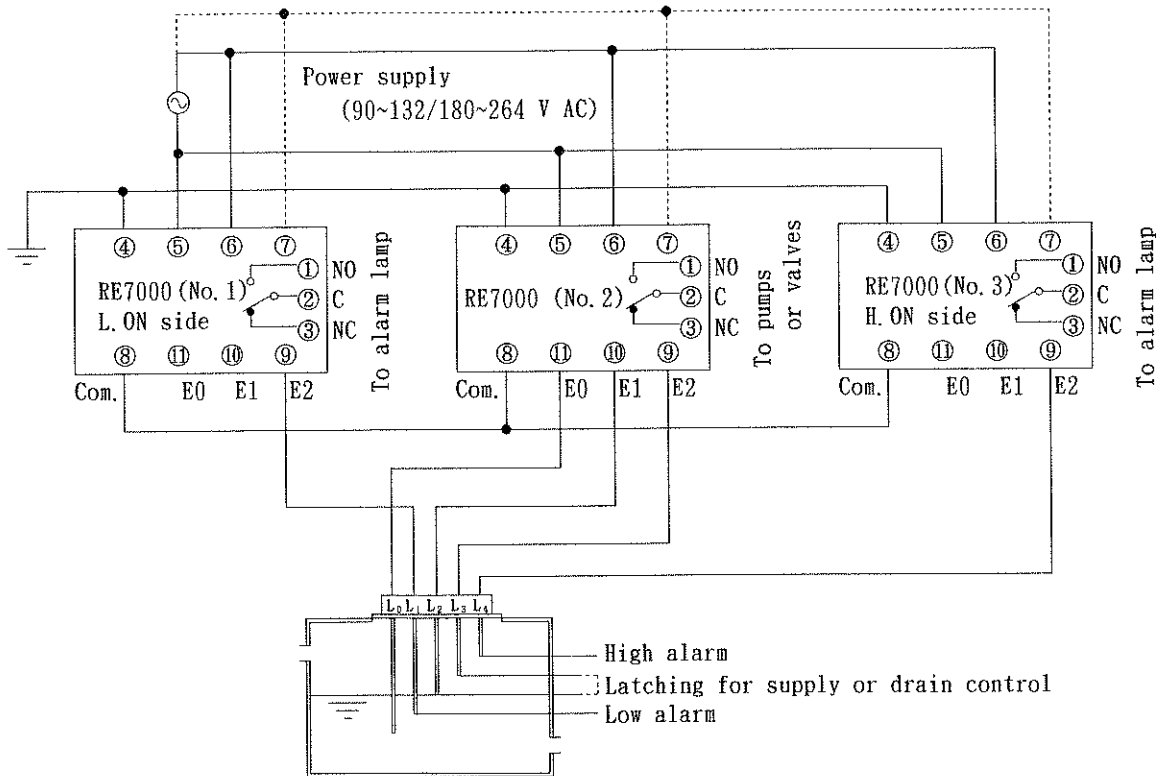


Fig. 18

- (1) When the liquid level reaches L_4 electrode, relay(No.3) energize.
- (2) When the liquid level falls below L_1 electrode, relay(No.1) energize.
- (3) Relay unit(No.2) may be used for control functions such as latching for pump control.

⚠ WARNING

Earth terminal '④' shall be grounded. If it is not grounded, you will get an electric shock.

NOTE the following points:

- (1) When connect the cable to terminals with solderless lugs, the outline diameter of solderless lug must be used 7 mm or less.
- (2) Thread type level sensor has no terminal board. When connect the cable to electrode directly, the solderless lugs must be used size of 1.25-6(Round type).
- (3) Do not connect the plural relay unit to identical electrode. Otherwise, the relay unit may be malfunction. (See Fig. 19)

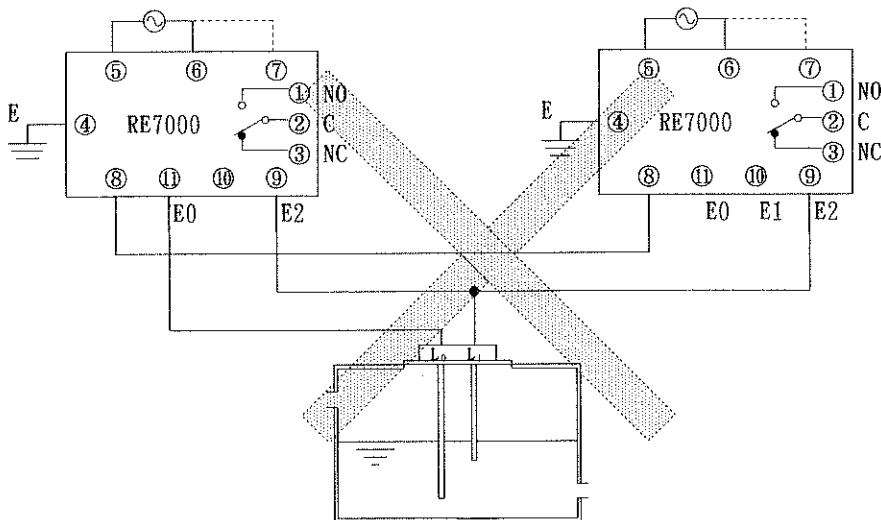


Fig. 19

- (4) Power supply must be connected in phase. (See Fig. 20)

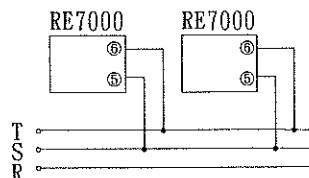


Fig. 20

- (5) To avoid malfunction, the wiring distance should be used within specifications. (Refer to 「2. SPECIFICATION」) If the wiring distance exceed specifications, the relay unit may be malfunction by stray capacitance between cables or noise.

6. 3 Conduit Connection

The electrical wires are led into the housing in the cable gland method or in the conduit method. In case of the conduit method, sealing compound shall be applied onto the screw of the cable inlet to protect water penetration. In case of the cable gland method, it must be properly fitted by the appropriate tools to preserve IP45 (FE7* and FE8* are IP43) after wiring.

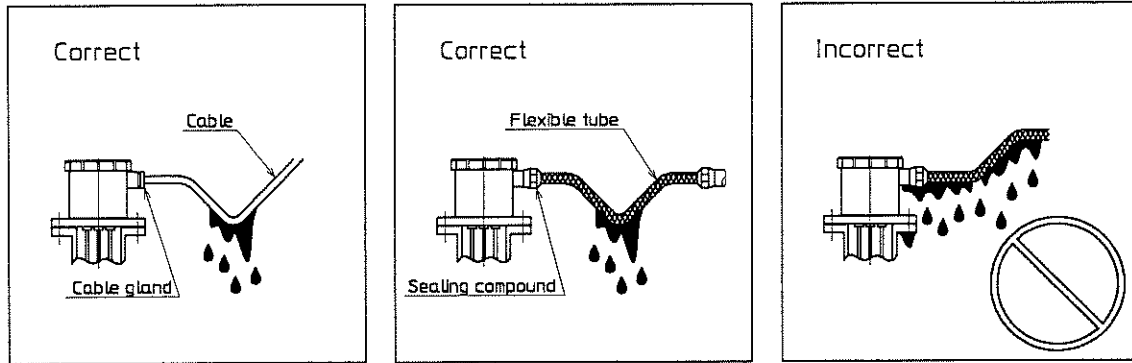


Fig. 21

7. TECHNICAL NOTE

- (1) This relay unit can not detect the level of non-conductive liquids, such as oil, gasoline, and distilled water.
- (2) Inside of level sensor and relay unit shall be kept free from rain, splashing water, liquid, dust, dirt, metallic substances, and any other foreign matter.
- (3) In order to prevent a short-circuit between electrodes, it is recommended that a separator be used. When a electrode is extended with connectors, always use a separator for safety. (Reffer to 「10. OPTIONAL PARTS」)
- (4) This products must be stored in a dry, warm place where condensation of humidity will not occur.

8. INSPECTION/MAINTENANCE

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

- (1) Remove the sensor from tank carefully.
- (2) Ensure there is no damage.
- (3) If sediment or other foreign matters are stained between electrodes, clean the electrode.
- (4) Make contact between electrodes, and check the relay unit operation.
- (5) Spare parts and optional parts should be ordered from NOHKEN Inc. whose address appears on the title page.

9. TROUBLESHOOTING

Use the following chart to troubleshoot a malfunctioning.

Problems	Possible causes	Remedies
Relay unit de-energize	Setting for improper length of electrodes	Adjust electrodes length
	Miswiring between sensor and relay unit	Ensure the wiring correctly
	Short-circuit between electrodes	Clean electrodes and use separator
	Insulation failure	Check the insulation
	Affection by stray capacitance	Re-wire as short as possible
	Loosing terminal screws	Tighten terminal screws
	Loosing connectors	Tighten connectors
	Affection by deposit or oil film	Clean electrodes
Install in improper stilling tube	Drill vent holes in the stilling tube	

Problems	Possible causes	Remedies
Relay unit de-energize	Resistivity of liquid is high	Strip the insulation tube of electrodes
	Settin for improper select switch (SELECT. SW.) mode of relay unit	Change the select switch mode(H ON/L ON).
Relay chatter	Loosing terminal screws	Tighten terminal screws
	Loosing connectors	Tighten connectors
	Miswiring between sensor and relay unit	Ensure the wiring correctly

If above remedies are unsuccessful, ask NOHKEN Inc. to repair and replace.

10. OPTIONAL PARTS

Optional parts should be ordred from NOHKEN Inc. whose address appears on the title page. Please consult your local stocking distributor, or contact the factory, for farther information.

10.1 Electrode

Standard length of electrode is 1 m.

Standard material of electrode is 316 Stainless Steel.

If necessary for chemical resistance, use other material electrodes(Hastelloy, Titanium). When connecting the electrode, fix them with lock nut and connector.

NOTE: Use same material of them in order to keep chemical compatability.

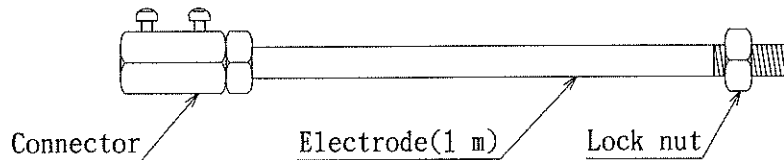


Fig. 22

10.2 Separator

In order to prevent a short-circuit between electrodes, it is recommended that a separator be used. When a electrode extended with connecting, use a separator for safety.

For one electrode	For number of electrodes	
Flange installation type	Flange installation type	Thread installation type
<p style="text-align: center;">$\phi 36$</p>	<p style="text-align: center;">$\phi 85$</p>	<p style="text-align: center;">$\phi 55$</p>

Fig. 23

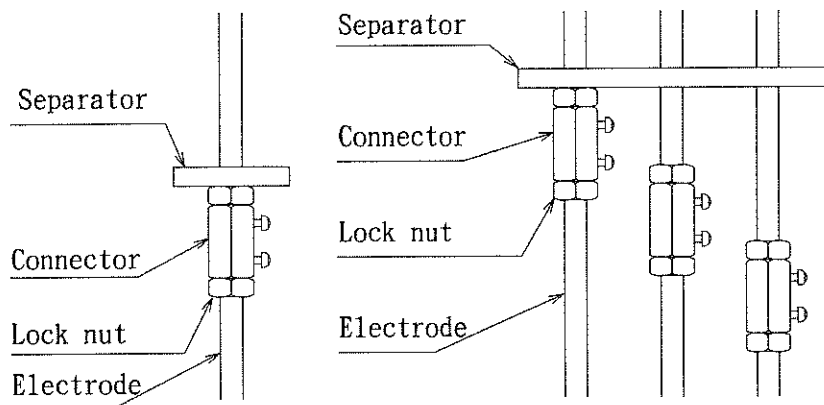


Fig. 24

10.3 Socket

The relay unit must be plugged into socket. Socket should be ordered from NOHKEN Inc. or prepare socket equivalent OMRON made(Model 11PFA) by customer.

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