NOHKEN

SS02－0329⚠

INSTRUCTION MANUAL

FOR

FLAMEPROOF
MAGNETIC FLOAT SENSOR

MODEL：FR510
MODEL：FR511
MODEL：FR512
MODEL：FR513

Revision ⚠ 2007-03-22
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MUST BE READ BEFORE USING

- This manual is for explosion-proof specifications. Read the other manuals for standard 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:

⚠ WARNING	Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.
⚠ 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.

⚠ WARNING

Do not modify or disassemble the equipment. Otherwise, the ignition to an explosive gas may occur.

⚠ WARNING

Before opening the cover, make sure that the terminal box is cooled down.
Otherwise, the ignition to an explosive gas may occur.

⚠ CAUTIONS

- The allowable hazardous location is Class 1 and 2.
Do not install in Class 0.

- This sensor gives the properties of the flameproofness by strength of housing and the gap and length of path.
Therefore, do not damage the housing, joints and the screwed-in parts. Otherwise, the flameproofness can not be protected.

- For inspection, adjustment and maintenance, any disassembly to joints (housing terminal stand and stem) is prohibited.

- Secure bolts and screws by using spring washers against looseness. Otherwise, the flameproofness can not be protected.

⚠ CAUTIONS

- Adjustment, inspection and maintenance shall be done by the skilled engineer.

- Inspection and maintenance shall be in accordance with the Plant Electrical Equipment Flame-proof guide book published by TIIS and all local codes.

- The electrical instrumentation for maintenance shall also be an explosion-proof construction.

⚠ CAUTIONS

- Turn off the power immediately if there is bad smell and/or the strange sound.
  Do not use until the remedy is administrated.

- Make sure that the wiring is correct.
  Otherwise, the sensors may be damaged, ignited or cause an electric shock.

⚠ CAUTIONS

- For grounding, we recommend to use the earth terminal in the housing to prevent from deterioration by atmospheric condition.

- Use the specified color for grounding to identify easily.
  For example, we recommend to use green.

⚠ NOTES

- Do not give strong shocks to the sensor. Dropping, throwing, striking and dragging the sensor, for example, are to cause strong shocks and damage the sensor.

- The specifications such as ambient temperature, maximum voltage and the power rating shall meet the conditions. Otherwise, the sensor may cause malfunction, damage, ignition, electric shock and injury.
  Read and check the clause of specification in the manual or specification sheets.

- Operating test shall be conducted before practical use.
  If malfunction occurs and the accident is predicted, the remedy shall be administrated by using another sensor with different operating principle in parallel.

- To prevent overvoltage and overcurrent, provide a protective circuit to the load.
  Otherwise, the contact may be damaged.

⚠ NOTES

- When carrying, installing and removing the liquid level switch, hold the flange or the plug part. Otherwise, the flange or the plug may drop off from the housing and be damaged.

- Check the chemical compatibility with the material you want to use.
  A minor corrosion to the float and the thin thickness part may be chemically effected.

- The sensor which is 50cm or longer
  Do not leave the sensor upright, but lay it down on the floor.
  Otherwise, the sensor and/or the surrounding things may be damaged or get injured if the sensor falls.

INTRODUCTION

A. This manual specifies standard specifications of this product. Some specifications may be different from your product if you order the custom-made product.

B. A variety of specifications are available to meet your process conditions, such as installation conditions, chemical compatibility, and so on. We are glad to offer suggestions to assist your decision.

C. If you have any questions or comments for the contents of this manual, ask Nohken's sales office written on the front cover.

D. Nohken Inc. pursues a policy of continuing improvement in design and performance of this product. We will supply the alternative parts or complete new products required to repair or replacement.

E. Specifications are subject to change without any obligation on the part of the manufacturer.

WARRANTY & DISCLAIMER

A. Nohken Inc. warrants this product against defects in design, material and workmanship for a period of 1 (one) year from the date of original factory shipment.

B. If defects occurs during the above-mentioned warranty period, Nohken will, at its option, replace or recondition the product without charge. This shall constitute the exclusive remedy for breach of warranty.

C. Nohken Inc. makes no warranty with respect to:

C-a Failure not to comply with instructions of this manual.

C-b Failure or damage due to improper installation, wiring, operation, maintenance, inspection and storing.

C-c Product which has been in any way repaired, altered or tampered with by others.

C-d Product repaired or modified by using undesignated parts, subassemblies and materials.

C-e Direct incidental or consequential damages or losses or expenses resulting from any defective product or the use of any product.

C-f Objective of the sensor is clearly specified in chapter 1, PURPOSE OF USE.

C-g Inevitable accident such as acts of God, force majeure, radioactive contamination and so on.

THIS WARRANTY IS IN LIEU OF AND EXCLUDES ALL OTHER WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

NOTES TO USERS

1. It is essential that this manual shall be read and understood before installation and use of Model FR Reed type Level Sensors. This manual covers instructions for the installation and adjustment.
2. Specifications are subject to change without any obligation on the part of the manufacturer.

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1. PURPOSE OF USE

NOHKEN has over 20 years of experience in creating custom FR Series level switches for demanding customer requirements. FR Series switches are used extensively in the power, steel, chemical, water treatment and food processing industries.
NOHKEN wants to be your company of choice for liquid level controls.

2. SPECIFICATIONS

2.1 Model

(1) Standard version

FR51□ □□

- Cable inlet
  - 0: Pressure-tight screw-thread coupling method (G3/4)
  - 1: Pressure-tight packing method (G3/4)
  - 2: Pressure-tight screw-thread coupling method (G1/2)
  - 3: Pressure-tight packing method (G1/2)
- Material
  - S: Wetted part material 304 Stainless steel (Priviso Float and Float travel-stop·· 316 Stainless steel)
  - V: Wetted part material PVC
  - P: Wetted part material PP
  - HV: Wetted part material CPVC

(2) Custom switch version

FR51□ □ □□□

- Cable inlet
  - 0: Pressure-tight screw-thread coupling method (G3/4)
  - 1: Pressure-tight packing method (G3/4)
  - 2: Pressure-tight screw-thread coupling method (G1/2)
  - 3: Pressure-tight packing method (G1/2)
- Mounting type
  - 0: Flat face flange
  - 1: Raised face flange
  - 2: Slide flange
  - 3: Sanitary ferrule
  - 4: Plug mounted from outside of tank
  - 9: Others
- Flange and stem material
  - S: 304 Stainless steel
  - S6: 316 Stainless steel
  - S6L: 316L Stainless steel
  - V: PVC
  - HV: CPVC
  - P: PP
  - F2L: PVDF lining
  - F4T: PTFE tubing
  - F6L: FEP lining
  - F6T: FEP tubing
  - Z: Others

2.2 Standard Specifications

(1) Contact Rating

Max. contact capacity	: 110VA	33W	(Inductive load)
Max. working current	: 0.5A AC	0.3A DC	(Inductive load)
Max. working voltage	: 220V AC	110V DC	(Inductive load)

(2) Life expectancy : Min. 1×10^6

(3) Allowable impact : Max. 100 m/s^2

(4) Construction Explosion-proof construction : Class d2G4

(5) Insulation resistance : More than 100MΩ at 500V DC

(6) Withstand voltage : 1500V AC for 1 minute

(7) Others

Table 1

Model	Flange size (JIS B2210)	Maximum pressure(*)	Ambient temperature	Liquid temperature	Construction	Specific gravity as measurement
51□ S	5K 50A	500 kPa	60 ℃ Max.	100 ℃ Max.	IP65	0.7
51□ V	Equivalent 5K80A	200 kPa	50 ℃ Max.	50 ℃ Max.	IP65	0.7
51□ P	Equivalent 5K80A	200 kPa	60 ℃ Max.	80 ℃ Max.	IP65	0.5
51□HV	Equivalent 5K80A	200 kPa	60 ℃ Max.	80 ℃ Max.	IP65	0.7

(*)with static pressure

Table 2

Model	Float	Relation between Float and Liquid Surface(*)
51□ S	ϕ49×H50	22mm upper on and 28mm is under the level
51□ V	ϕ65×H80	33mm upper on and 47mm is under the level
51□ P	ϕ65×H80	45mm upper on and 35mm is under the level
51□HV	ϕ74×H80	31mm upper on and 49mm is under the level

(*)1.0 specific gravity of the liquid

Custom switch versions can select required mountings.

⚠NOTES

In the case of a float made by resin. There is the danger that static electricity is generated on a float part. Please remove static electricity regularly.

3. PRINCIPLE OF OPERATION

FR series units contain hermetically-sealed reed switches in the stem and a permanent magnet in the floats. As the float rises or falls with the level of the liquid, the reed switch is activated by the magnet in the float.

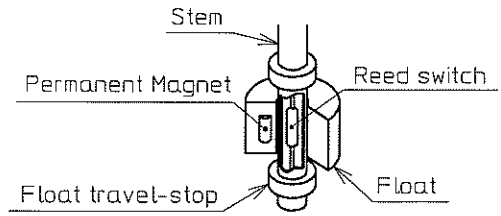


Fig. 1 Construction

4. INSTALLATION

4.1 Unpacking

(1) This unit has been thoroughly inspected and carefully packed at the factory to prevent damage shipment.

(2) When unpacking, exercise due care not to subject the instrument to mechanical shock.

(3) After unpacking, visually check the instrument exterior for damage.

(4) When the length exceeds 1500mm, carry by two or more persons.
Otherwise the switch may be damaged

(5) Keep sensor clean. Otherwise detecting errors may be caused.

(6) It doesn't place in piles.

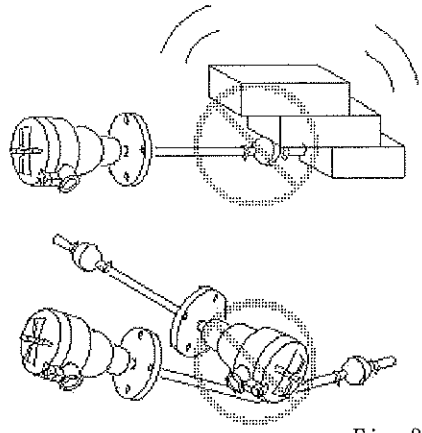


Fig. 2

4.2 Installation site

This unit should be installed in an area which meets the following conditions :

(1) Normal temperatures, with nominal temperature fluctuations.

(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) Ample space for maintenance/inspection.

(6) If there is surface wave motion, use a time-delay relay for chattering the switch action. Otherwise we recommend the installation of a stilling tube. Drill vent holes in the tube and use spacer to keep the float traveling.

(7) This float switch should be located away from strong magnetic fields such as those produced by motors or solenoid valves.

(8) Make sure that the FR should be located away from metallic substances such as steel plate 10cm or more.

(9) Please use caution during installation. Bending or hitting the stem may break the reed switches.

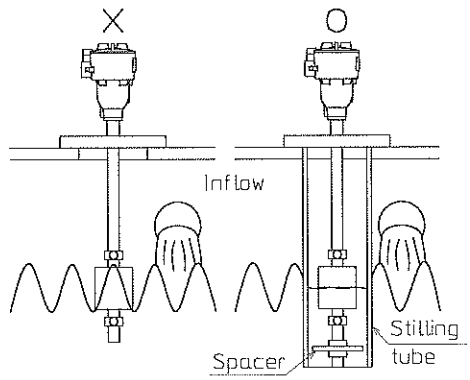


Fig. 3

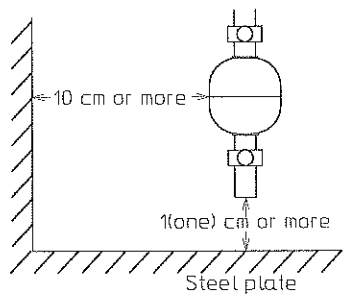


Fig. 4

4.3 Installation method

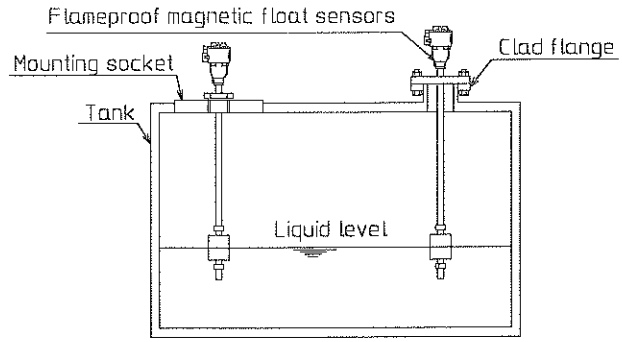


Fig. 5 Example of mounting

(1) In case of flange

Fix with the bolt which was in clad flange and the standard on the side of the tank. When pressure is taken, it makes not leak out with the gasket.

(2) In case of plug

Install to become perpendicular.

> ⚠ CAUTION
>
> Don't turn a terminal box.

5. WIRING

5.1 Terminal blocks and wiring

Table 3

Actuation Levels	Terminal blocks					
	ℓ1	ℓ2	ℓ3	ℓ4	ℓ5	Com.
1	1-2					
2	1-2	3-4				
3	1-2	3-4	5-6			
4	1	2	3	4		6
5	1	2	3	4	5	6

・Terminals, from two actuation levels to three actuation levels, are available with commom terminal.

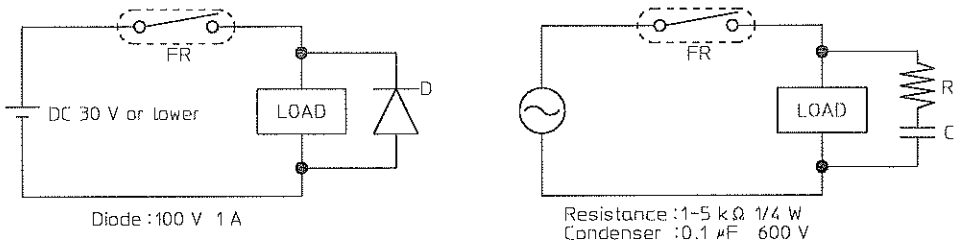
NOTE the following points:

(1) Reed switches are not designed for the direct starting of pumps, valves and alarms. They are susceptible to damage from electric surges.
DO NOT EXCEED THE CONTACT RATINGS.
Contact should be wired to relays or similar devices.

(2) We recommend the use of our relay unit model RE7000.
The latching(holding relay) feature allows pumps, valves and other devices to be turned on at one level and off at another. It also contribute to safety since it allows lower voltage and smaller currents to be used with FR.

⚠ CAUTION

(1) Reed switches are not designed for the direct starting of pumps, valves and alarms. They are susceptible to damage from electric surges.
DO NOT EXCEED THE CONTACT RATINGS.
Contact should be wired to relays or similar devices.
Typical examples are shown below.



(2) If the cable length between the FR and load is too long, such as 50m or more momentary surge current may be produced by stray capacity.
Consequently the reed switch is broken. To suppress the surge, place a 0.5~5mH coil in series with the load for each reed switch near by the FR.

5.2 Model RE7000 relay unit

We recommend the use of our relay unit model RE7000. It is single level (alarm) and/or dual level (empty/fill control) relay.
The latching (holding relay) feature allows pumps, valves and other devices to be turned on at one level and off at another. It also contribute to safety since it allows lower voltage and smaller currents to be used with FR

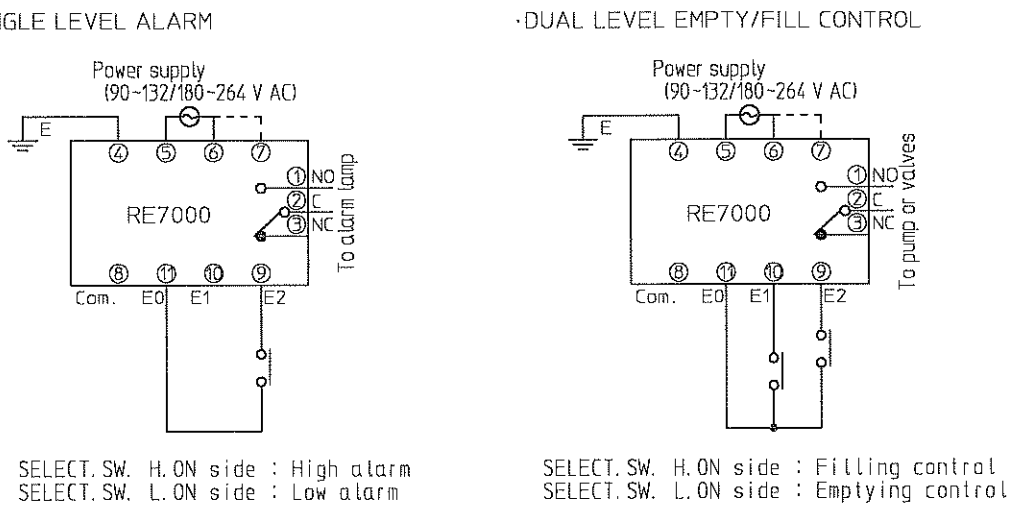


Fig. 6

For the relay unit Model RE, refer to Instruction Manual.

5.3 Electrical connections for Explosion-proof instrument

Of the explosion-proof instrument, the terminal box cover is designed in an anti-rotation clamp structure. After the electrical connections and securely clamp it with the antirotation bolts.

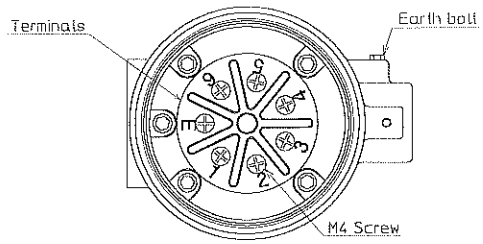


Fig. 7

NOTE the following points:

The electrical wires must be led into the terminal box in the pressure-tight screw-thread couplimg method or in the pressure-tight packing method. (For details, refer to Technical Guidance RIIS-TR-79-1 issued by Ministry of Labour The Research of Industrial Safety, a Japanese Governmental Oraganization.)

> ⚠ WARNING
>
> Earth terminal shall be grounded. If it is not grounded, you will get an electric shock.

6. NOTES OF EXPLOSION-PROOF FEATURE

(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 100m/s². Shocks greater than 100m/s² may damage the switch. The reed switch's enclosure is made from glass. If the FR is dropped to the hard floor from more than 30cm, the reed switch may be damaged.

(3) Please use caution during installation. Bending or hitting the stem or pulling the lead wires may break the reed switches.

(4) The float travel stop settings are based on how the magnetic field influences the reed switches. When you move the float travel stop, check switch action for float overrun.

(5) This float switch should be located away from strong magnetic fields such as those produced by motors or solenoid valves.

7. INSPECTION AND MAINTENANCE

Periodic inspection are necessary means to keep your FR switches in good working order. Please pay attention to the following.

7.1 Remove sensor from the tank.

(1) The power supply is turned off.

> ⚠ CAUTION
>
> In hazardous locations, do not remove the housing cover until atomosphere is determined to be safe, and the power supply is turned off.

(2) It slackens a screw and remove a lock arm. Open a cover and remove wiring.

(3) Remove flange bolts or turn a plug. It pulls a sensor out of the tank.

(4) Put a sensor on the flat place.

7.2 How to inspection and maintenance

Adjustment, inspection and maintenance shall be done by the skilled engineer. Check once or more in the half year or in the year. But, It depends on the use condition.

(1) Never leave the housing cover off. It become damaged or misplaced, order a replacement immediately.

(2) If it has buildup on float and stem, detecting errors may be caused. Keep clean float and stem.

(3) Inspect switches and terminals.

(4) The float travel-stop settings are based on how the magnetic field influences the reed switch. If float overrun, adjust and check the float travel stop.

(5) The life expectancy of reed switches are over 10^6 operations. They are susceptible to damage from electric surges and mechanical shocks. If these conditions exist, order replacements immediately.

(6) If the float is filled with water or damaged, it must be replaced immediately.

(7) Do not attempt to repair a float.

(8) Vibration may sometimes cause terminal screws to work loose. Check all terminals to be certain that screws are tight.

8. TROUBLESHOOTING

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

Table 4

Problems	Possible causes	Remedies
Floats rises or falls with the liquid level switch de-activated	Miswiring	Wire correctly
	Cables broken	Replace cables
	Float travel stop is in improper position	Adjust position of float travel-stop
	Reed switch is in improper position	Adjust position of reed switch or float
	Reed switch is damaged	Replace sensor
	Affected by strong magnetic field	Use shield or install in good location
	Liquid immerse in sensor	Replace sensor
Floats doesn't rises or falls with the liquid level	Buildup on float or stem	Clean float and stem
	Specific gravity of liquid too light	Change the proper float
	Float is filled with water	Replace float
	Install into the stilling tube, no vent holes	Drill vent holes where it is upper side
	Float is in contact with stilling tube	Use spacer
	Float damaged by over-pressure	Replace float
	Float is swelled or corroded	Replace compatible float
Switch chattered	Loose cables	Tighten connections
	Waves or disturbances in tank	Use stilling tube or time-delay relay
	Install in wrong location	Install in good location

9. OPTIONAL PARTS

Table 5

Name	Varieties
Float	51□ S
	51□ V
	51□ P
	51□ HV
Float	316 Stainless steel
travel stop	PVC
	PP
	CPVC

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