INSTRUCTION MANUAL

FOR

MAGNETOSTRICTIVE LEVEL MEASUREMENT

MODEL: MS210

Revision 2014-08-06

Read and understand this manual for safe 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 whose model is mentioned on the 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 a proper place being available to refer to 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.

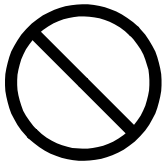
The following are the description of the terms in this manual.

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

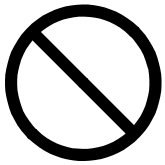
	Indicates a prohibited matter. The explanation with this mark shall be followed.
	Indicates an instructed matter. The explanation with this mark shall be followed.

⚠ WARNING

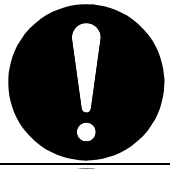
This product is not explosion-proof construction. Do not install this product to the place where the flammable gas or vapor occurs. If installed, the flammable gas or vapor may be ignited, and serious disaster may occur. Use the product of explosion-proof construction in this case.



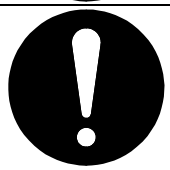
Do not modify or disassemble the product. Otherwise, the product and connected device may be malfunctioned, damaged, fired, or minor injury and electric shock may occur.
(Follow the additional document and/or direction, submitted by NOHKEN INC. and our distributor or agent.)



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



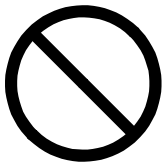
Ensure the wire is properly connected. The product and connected device may be malfunctioned, damaged, fired, or minor injury and electric shock may occur by improper wiring.



Turn off the power immediately, if the smoke, strange smell and sound occur. Do not use it until the problem is solved.

⚠ CAUTION

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



Follow the specification of operating temperature, operating pressure, switch rating, etc. Otherwise, the product and connected device may be malfunctioned, damaged, fired, or minor injury and electric shock may occur. 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 the product, the other operating principle of product shall be installed in parallel.

⚠CAUTION

Check and deeply consider the chemical compatibility for the material of product in advance. The part especially float, which is very thin, may be malfunctioned by miner corrosion.

Hold the stem very close to the mounting point, when carrying, installing, and removing. If held by the housing, 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 horizontally. The product and other goods could be damaged, and minor injury may occur by falling.

Earth terminal shall be grounded to JIS Class D ground (earth resistance less than 100Ω). If not grounded, electric shock may occur by any accident.

Provide arrester or surge absorber to avoid electrical impact such as lightning and static electricity. If not provided, the product and connected device may be malfunctioned, damaged, and fired, or minor injury and electric shock may occur.

INTRODUCTION

A) This manual specifies the specification of a general product.
If you order a special product, some details of specification may be different with the manual.

B) We are glad to suggest and advise for Model selection and chemical resistance of material, but final decision has to be made by the customer.

C) This manual has been 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 parts may not be supplied. In this case, replacement parts or products 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 the 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, etc.

C-c) Repair and modification are done by the person who is not an 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 "Purpose of use" 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 LEGAL RIGHTS.

Table of Contents

1. PURPOSE OF USE

Magnetostrictive Level Measurement MS210 is a level instrument, operating with 24V DC power supply such as Nohken power unit PU2000, for continuous level measurement to send signals to control an alarm, pump or other devices.
Do not use for any other purpose.

2. OPERATION PRINCIPLE

2.1 Operation principle

Fig.1 below is a simple drawing that shows the sensor inside. When current pulse is applied, the magnetostrictive wire(*) generates a magnetic field encompassing the wire (Right-hand grip rule). Applying a longitudinal magnetic field (due to the detection magnet (*)) to this current carrying wire results in twisting of the wire, producing mechanical vibration. (Wiedemann effect)
This vibration travels on the wire at the speed of ultrasound. When it passes through the coil placed at one end of the wire, it changes the magnetic susceptibility of the coil (Villari effect), causing a voltage according to the level of vibration on both coil ends.
The sensor measures the time from the start of current pulse to the arrival of the vibration at the coil, realizing high accuracy level measurement.

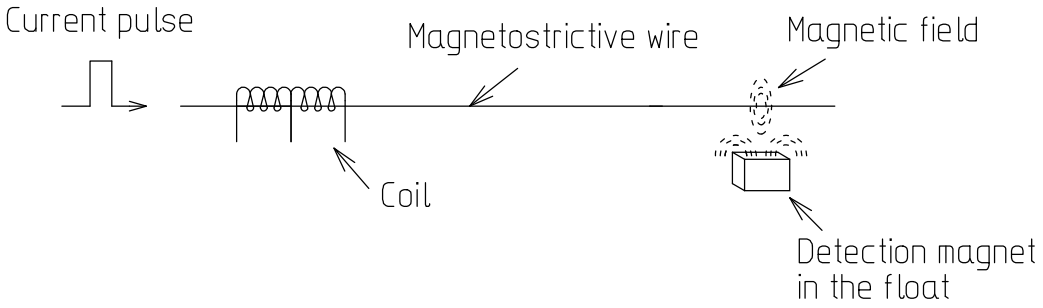


Fig.1: Operation principle

2.2 Block diagram

The circuit board and the housing are isolated to prevent improper grounding.

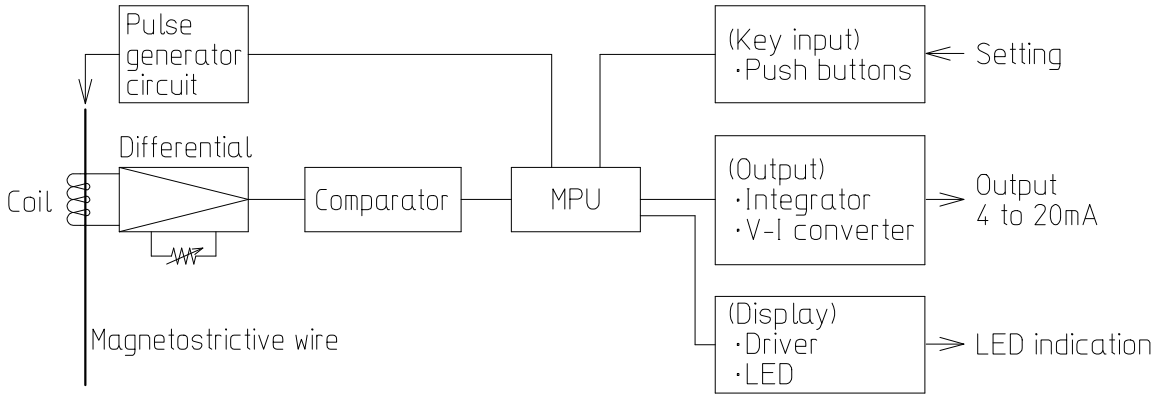


Fig.2: Circuit block diagram

* Refer to 12. GLOSSARY.

3. SPECIFICATIONS

3.1 Model numbering

MS210□

Wetted part material
S: 304 Stainless steel
V: PVC

3.2 Specification

Model	MS210S	MS210V
Measured material	Liquids such as water and chemical that do not corrode the wetted part material.	
Operation characteristics		
Accuracy (the greater)	±1 mm or ±0.1%F.S.	±2 mm or ±0.2%F.S.
Temperature Characteristics	±0.02% F.S./℃	
Specific gravity	0.55 Min.	0.65 Min.
Electric characteristics		
Power supply	24V DC ±10%, 100mA Max.	
Output signal	4 to 20mA DC	
Load	500Ω Max.	
Insulation resistance	500V DC 100MΩ Min., between each terminal (excl. G)and the body	
Mechanical characteristics		
Pressure (static pressure)	2MPa Max. (except mounting part)	200kPa Max. (except mounting part)
Environmental		
Working temperature		
Wetted parts	0 to +100℃	0 to +50℃
Housing	0 to +50℃ (no dew condensation)	
Humidity	85% RH Max. (housing)	
Protection class	IP64	
Others		
Material		
Housing	Aluminum die casting	
Wetted parts	304 Stainless steel, 316 Stainless steel, 316L Stainless steel	PVC
Mounting	Flange(*)	
Size		
Flange	JIS 5K 50A	JIS 5K 80A or equivalent
Float(*)	φ49×H50	φ65×H80
Cable inlet	G 3/4 or equivalent	
Cable *1	3 core shielded cable (CVVS or equivalent)	
Others	RoHS compliant	-----

*1: Cable is customer supplied. (Recommended: CVVS 1.25mm^2, 3 cores)

* Refer to 12. GLOSSARY.

3.3 Outline

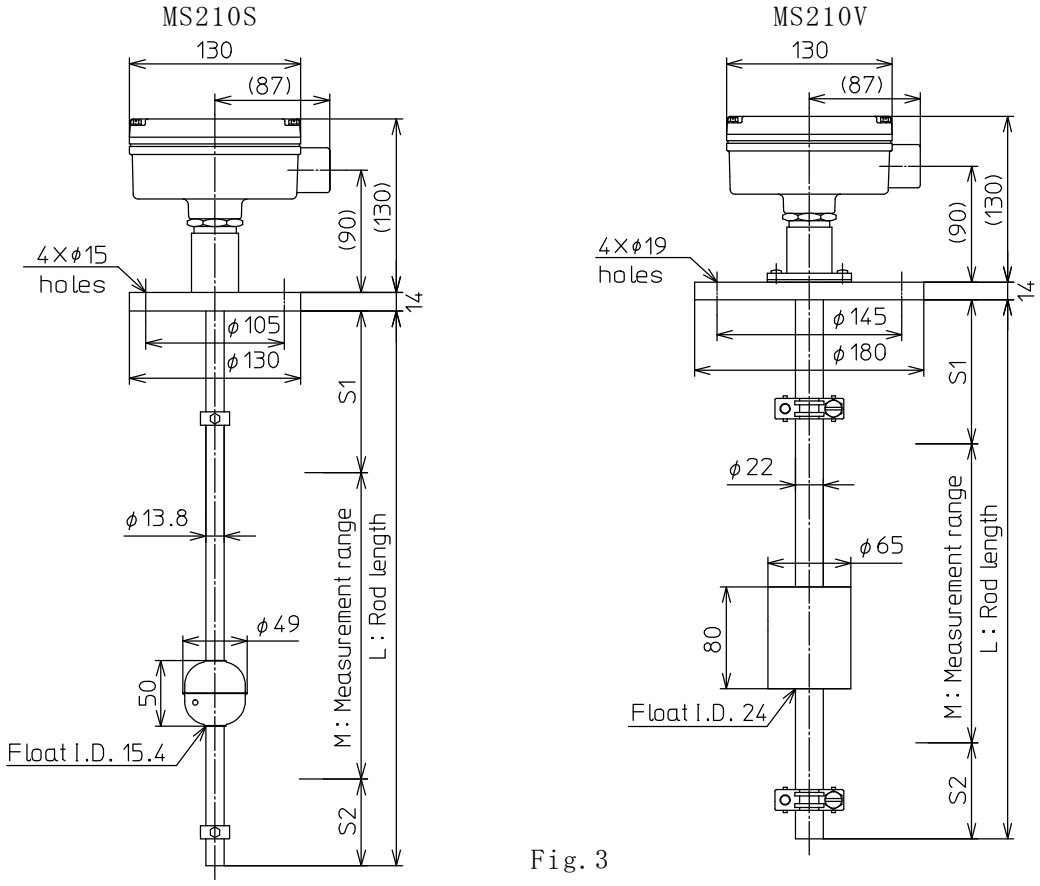


Fig. 3

4. PART NAMES AND FUNCTION

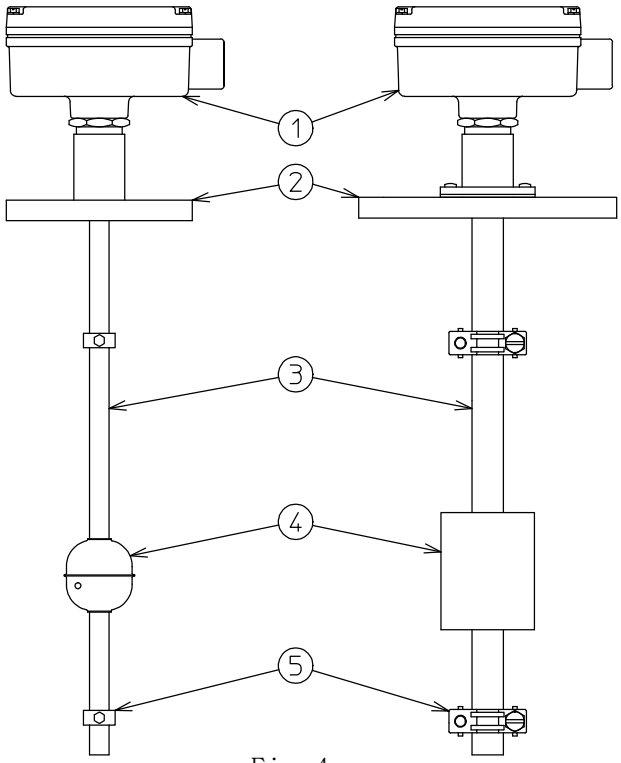


Fig. 4

① Housing
Converts the propagation time of vibration wave generated on the magnetostrictive wire to send 4 to 20mA signals.

② Flange
Connects the sensor to the tank.

③ Stem(*)
Incorporates the magnetostrictive wire

④ Float
Incorporates a magnet for position detection.

⑤ Stopper(*)
Determines the measurement range (float travel range).

* Refer to 12. GLOSSARY.

5. INSTALLATION

5.1 Unpacking

MS210 is carefully wrapped after delivery inspection to protect from shocks during transportation. Do not give shock to the sensor when unpacking. Check for bent or other damage after unpacking.

5.1.1 Notes for unpacking

(1) Be careful not to bend the stem when taking out the sensor. (Fig.5)

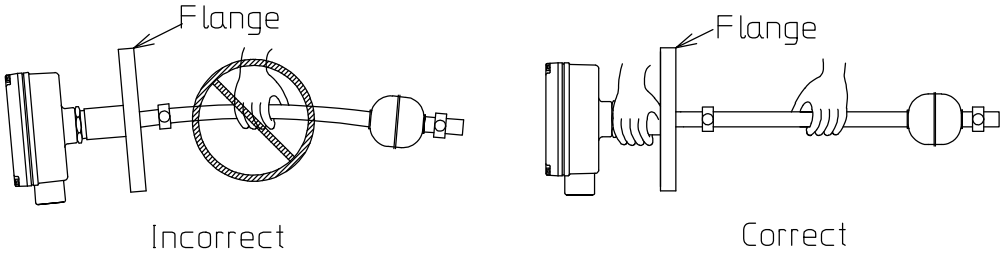


Fig.5

(2) Be careful not to sag the stem when carrying the sensor. Be extracareful with a sensor having a long stem.

(3) Do not make the float fall to strongly hit the flange or the stopper. (Fig. 6)

(4) Do not throw, drag, or give strong shock to the sensor.

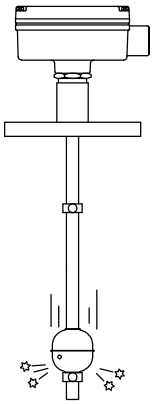


Fig.6

5.2 Mounting location

(1) Avoid areas with corrosive atmosphere (NH_3, SO_2, Cl_2).

(2) Observe the specifications when mounting the sensor where vibration is expected.

(3) When mounting on a tank, ensure ample space above and around the mounting point for easy handling and maintenance. (Fig. 7)

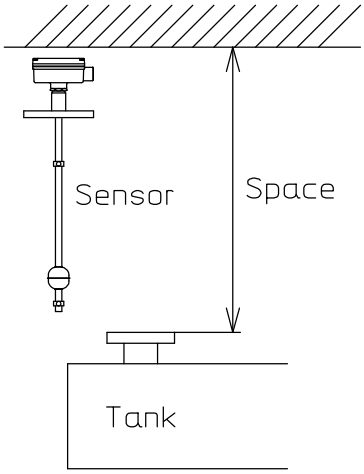


Fig.7

5.3 Mounting the sensor

The sensor is generally mounted on a hole made on a tank top. Insert the stem with float through the hole, and tighten the flange bolts to secure the sensor. Fig.8 below shows a typical mounting example.

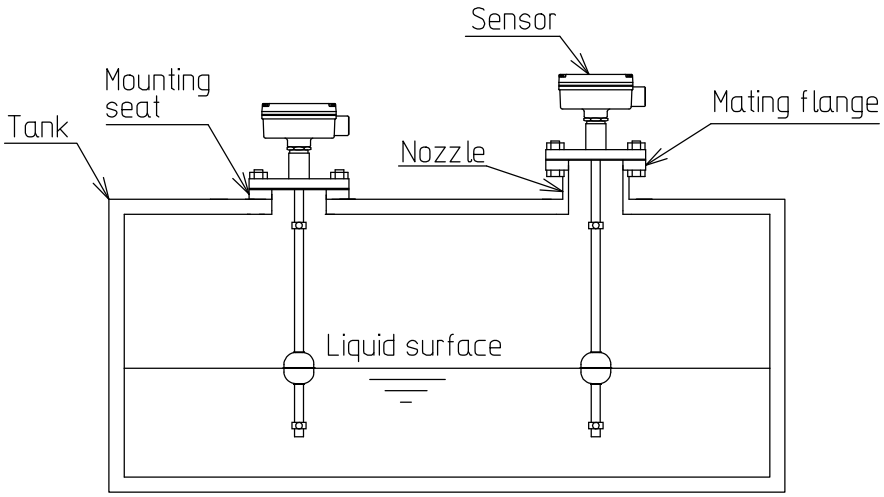


Fig.8: Mounting example

5.3.1 Notes for mounting

(1) Avoid proximity to inlet or agitator where heavy liquid flow or turbulence is expected. If such a location is not avoidable, use a stillpipe(*). (Fig.9)

(2) Use a stillpipe whose inner diameter at least 20mm larger than the float outer diameter. For a long stem, provide a spacer(*) at the end.

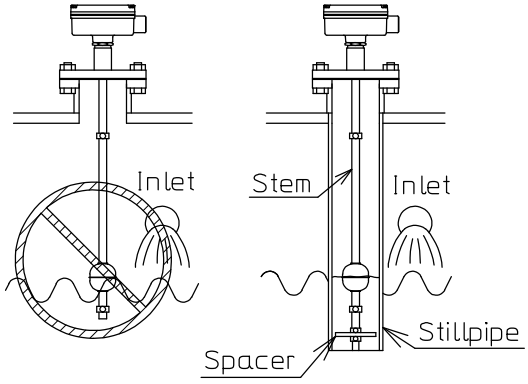


Fig.9

(3) Ensure no obstruction such as piping inside the tank that disturbs float movement.

(4) Avoid proximity to a motor, pump, solenoid valve or other devices containing ferromagnetic material.

(5) Ensure the sensor is mounted vertically when tightening the flange bolts.

(6) Ensure correct wiring for external devices. Tighten the terminal screws properly to avoid contact failure or shortcircuit.

(7) Seal the cable inlet properly to avoid water entry from the conduit.

(8) Ensure no water, dust or metal debris inside the housing.

(9) Place the housing cover properly.

* Refer to 12. GLOSSARY.

6. WIRING

Observe the following sections for wiring. Terminal screws are of M3.5, so use a cable lug of R1.25-3.5.

⚠ CAUTION

The circuit board and the housing are isolated to avoid improper grounding.

6.1 Connection to Nohken power unit PU2000

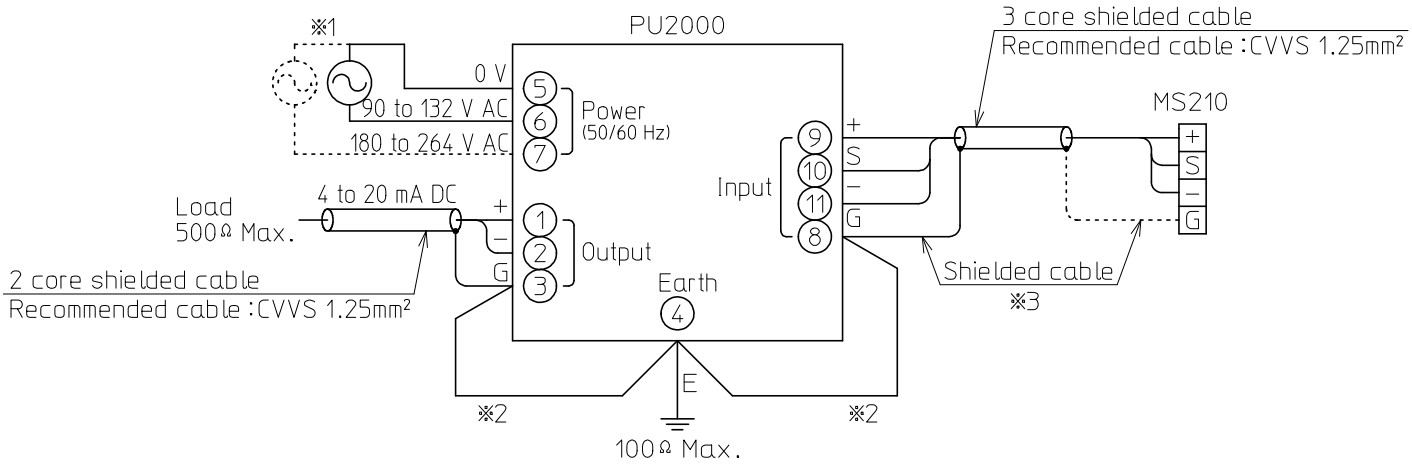


Fig.10

Notes

※1 Use either terminal 6 (90 to 132V AC) or terminal 7 (180 to 264V AC) for power supply wiring.

※2 Connect terminals 3 & 4, and 8 & 4. Ground properly at one point. (Grounding resistance: 100Ω Max.)

※3 Connect shielded cable to either terminal 8 on PU2000 or G on MS210.

6.2 Connection to other power supplies

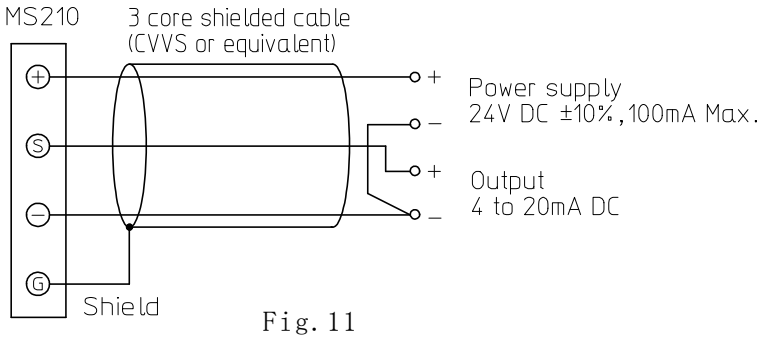


Fig.11

6.3 Notes for wiring

(1) Use shielded cable. Do not run the cable in line with power line or magnetic switch wiring. (Recommended cable: CVVS 1.25mm², 3 cores)

(2) Ground the earth terminal of the power unit properly, with ground resistance of 100Ω Max.

(3) Ground the cable shield at one point only. Improper grounding can cause operation failure due to voltage caused by ground potential difference.

(4) The allowable resistance is 500Ω Max. between the terminals. Be careful with resistance of cable and connected devices.

7. PREPARATION

Before supplying power to the sensor, ensure:

(1) all wiring is correctly done;
(2) the float and stem have no damage, and the float moves smoothly on the stem;
(3) the stopper is at the right position;
(4) no strong noise source exists, when sharing power line with other devices;
(5) polarity of 4 to 20mA signal is correct, and the load resistance is within the specified value.

8. ADJUSTMENT

The sensor is factory adjusted to suit the customer requirements. Do not make adjustments unless the stopper and float is removed for a cleaning purpose and adjustment is required.

8.1 Devices and tools

(1) DC digital ammeter capable of measuring 4.00 to 20.00mA DC.

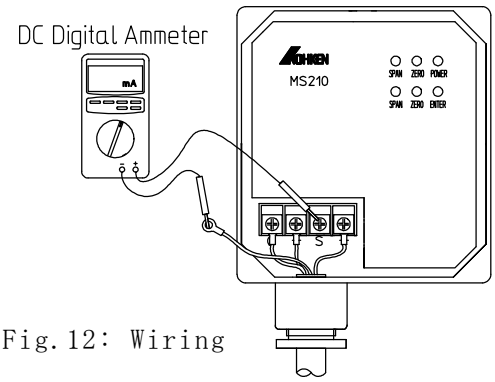


Fig.12: Wiring

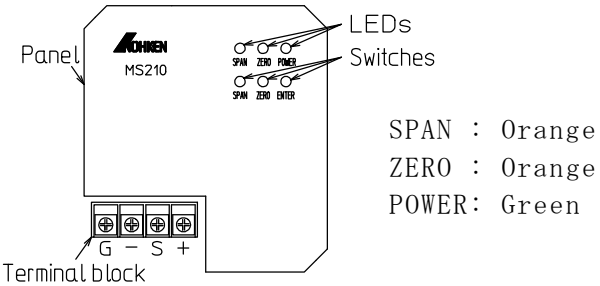
8.2 Operation modes

- Measurement mode : Normal operation mode.
  Sends current signal corresponding to the float position. The senor starts up in this mode when powered.
- Zero setting mode : Determines the float zero position.
- Span setting mode : Determines the float span position.
- Output setting mode : Determines output current value for zero and span points.

⚠CAUTION

When power is supplied, the output will be about 2mA DC for 2 to 3 seconds, regardless of the float position.

8.3 Operation indicator and LED marks



SPAN : Orange
ZERO : Orange
POWER: Green

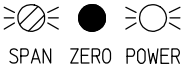
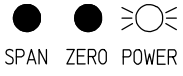
Fig.13: Location of LEDs and switches

Fig.14: LED operation marks

8.4 Zero point setting

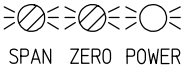
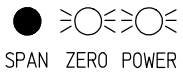
Procedure	LED
(1) Ensure the sensor is in the Measurement mode.	
(2) Place the float at the low limit position.	
(3) Press the ZERO switch for over 3 seconds. ZERO LED will flash, and the sensor will be in the Zero setting mode. ⚠ CAUTION Pressing for less than 3 seconds will leave the sensor in the Measurement mode.	
(4) Press the ENTER switch. Current float position will be the zero point. The ZERO LED will be off and the sensor will return to the Measurement mode. ⚠ CAUTION Failure to press ENTER within 30 seconds will result in the sensor returning to the Measurement mode without completing the setting.	

8.5 Span point setting

Procedure	LED
(1) Ensure the sensor is in the Measurement mode.	
(2) Place the float at the high limit position.	
(3) Press the SPAN switch for over 3 seconds. The SPAN LED will flash, and the sensor will be in the Span setting mode. ⚠ CAUTION Pressing for less than 3 seconds will leave the sensor in the Measurement mode.	
(4) Press the ENTER switch. Current float position will be the span point. The SPAN LED will be off and the sensor will return to the Measurement mode. ⚠ CAUTION Failure to press ENTER within 30 seconds will result in the sensor returning to the Measurement mode without completing the setting.	

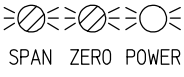
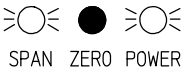
8.6 Output adjustment for zero point

Output adjustment is not affected by the float position. The float does not have to be placed at the zero point.

Procedure	LED
(1) Ensure the sensor is in the Measurement mode. (2) Connect an ammeter using S and − terminals.	
(3) Press the ENTER switch for over 3 seconds. The ZERO and SPAN LEDs will flash, and the sensor will be in the Output setting mode.	
(4) Press the ZERO switch. The ZERO LED will be on continuously and the SPAN LED will be off. **⚠ CAUTION** Failure to press the ZERO switch within 30 seconds will result in the sensor returning to the Measurement mode without completing the setting.	
(5) Adjust the output for zero point with the ZERO and SPAN switches, checking the ammeter. (Adjustable range: approx. 2 to 22mA DC) ・ SPAN increases the value. ・ ZERO decreases the value. **⚠ CAUTION** Failure to press the SPAN or ZERO switch within 30 seconds will result in the sensor returning to the Measurement mode without completing the setting.	
(6) Press the ENTER switch at the desired value. The ZERO LED will be off and the sensor will be in the Measurement mode.	

8.7 Output adjustment for span point

Output adjustment is not affected by the float position. The float does not have to be placed at the span point.

Procedure	LED
(1) Ensure the sensor is in the Measurement mode. (2) Connect an ammeter using S and − terminals.	
(3) Press the ENTER switch for over 3 seconds. The ZERO and SPAN LEDs will flash, and the sensor will be in the Output setting mode.	
(4) Press the SPAN switch. The ZERO LED will be off and the SPAN LED will be on continuously. **⚠ CAUTION** Failure to press SPAN switch within 30 seconds will result in the sensor returning to the Measurement mode without completing the setting.	
(5) Adjust the output for span point with the ZERO and SPAN switches, checking the ammeter. (Adjustable range: approx. 2 to 22mA) ・ SPAN increases the value. ・ ZERO decreases the value. **⚠ CAUTION** Failure to press the SPAN or ZERO switch within 30 seconds will result in the sensor returning to the Measurement mode without completing the setting.	
(6) Press the ENTER switch at the desired value. The SPAN LED will be off and the sensor will be in the Measurement mode.	

9. MAINTENANCE AND INSPECTION

Maintenance is recommended to be performed every half year.
See the notes below on maintenance.

(1) Check for visible damage that may impair performance.
(2) Remove buildup on the float or stem, if any.
(3) Ensure the sensor gives correct outputs. Refer to 8. Adjustment if necessary.
(4) After maintenance or removing the float from the stem, make sure the float is placed in its original orientation.

10. STORING

(1) Avoid locations:
- where high temperature or high humidity is expected;
- where corrosive gases are present;
- susceptible to rainfall;
- where excessive dust or debris exists;
- close to ferromagnetic material.

(2) Do not place anything on the sensor.
(3) Lay the sensor with long stem. Provide supports to prevent it from sagging.
(4) Do not fall or give shock to the sensor.

11. TROUBLESHOOTING

⚠ CAUTION

In the event of trouble, perform the following and nothing else.
If you have any question, please contact our sales office.

Trouble	Possible cause	Corrective action
No output given. POWER LED is off.	Incorrect power.	Use an reliable power source within 24V DC±10%.
	Incorrect wiring.	Wire correctly.
	Failed MS210.	Repair required.
Output fluctuates.	Turbulence	Use a stillpipe.
	Affection from magnetic field.	Provide a shield.
	Input signal of zero and span points are identical.	Re-adjust the zero and span points.
Output does not change.	Float is stuck due to adhesion of suspended solids.	Remove the solids.
Output stays at around 2mA DC.	Max. temperature rating exceeded.	Lower the temperature not to exceed the max. rating.
	Low limit stopper or float fell.	Remove the cause and replace the component.
Output stays at 4mA DC.	Float submerged.	Check the chemical resistance or specific gravity of the liquid.
		Replace the float.

12. GLOSSARY

Terms used in this manual are defined in the chart below. This chart excludes the terms which have already been defined earlier in this manual.

Magnetostrictive wire	Wire made of a material that is twisted by the change of external magnetic field. Component to detect the magnet position.
Magnet	Component to give an external magnetic field to the magnetostrictive wire.
Flange	Component to mount the sensor on a tank using bolts and nuts.
Float	Component that floats on the liquid in a tank whose up and down movements is detected to determine a level.
Stem	Guide along which the float moves up and down. Incorporates the magnetostrictive wire.
Stopper	Component that limits the float travel range.
Stillpipe	Pipe that protects the sensor from excessive turbulence or flow to prevent operation error.
Spacer	Component to prevent float from touching the inside wall of the stillpipe.

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