INSTRUCTION MANUAL

FOR

FLAMEPROOF

RESISTIVE LEVEL MEASUREMENT

MONITOR UNIT

MODEL: LR 5 □□ series
MODEL: MP 2000
Read and understand this manual for safely usage.

- This manual describes the product of explosion-proof construction. Read the other manuals for the product of standard specifications.
- This manual describes the handling, inspection, and adjustment of the product which 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 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 following are the description of the terms in this manual.

| **DANGER** | Indicates a potentially hazardous situation which, if not pay attention, will result in death, serious injury or serious disaster. |
| **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. |
⚠️ DANGER

Do not modify or disassemble the product. Otherwise, the flammable gas or vapor may be ignited.

⚠️ DANGER

Do not open the terminal cover when powered. Leave terminal box more than 3 minutes to cool down after turn off the power. Otherwise, the flammable gas or vapor may be ignited.

⚠️ WARNING

Install this product in hazardous location Zone 1 and 2, Do not install Zone 0.

Do not cause damage to the enclosure, joint surface, and thread on the cover. The explosion-protection of this product is retained by the strength of pressure for enclosure, wide and length of clearance.

Follow the description of inspection, adjustment, and maintenance in this manual, and not disassemble the parts except it is necessary. Otherwise, the explosion-protection of this product is not retained.

Ensure small screw for earth ground terminal, cover fixing bolt, and etc. Shall be tighten with spring washer. Otherwise, the explosion-protection of this product is not retained.
## WARNING

Adjustment, inspection, and maintenance for explosion-proof shall be done by the skilled person who has been educated and experienced.

Inspection and maintenance except visual check for this product shall be done where flammable gas or vapor is not occurred.

The electrical instrument for maintenance at hazardous location shall be approved as explosion-proof construction.

## WARNING

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

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.

Don’t use the sensor which is made from resin, when the sensor measures materials with volume resistivity equal to or more than $10^9 \, \Omega \cdot \text{cm}$. 

## WARNING

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

Recommend to use the earth terminal inside of the terminal box for grounding. The earth terminal at the surface of terminal box may be deteriorated by the environmental condition of usage.

The wire or cable for grounding shall be green color or stripe of green and yellow color (compliant with JIS). If not prepared, green color tape shall be installed at the tip of wire or cable to indicate for grounding.

### 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.

In case of connecting inductive or lamp load to the product. Provide protective circuit to the load to avoid over voltage and over current. If not provide, the contact may be damaged.
<table>
<thead>
<tr>
<th>CAUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do not grab and turn the terminal box, when the plug mounted product is removed from the tank. It may be cause of cutting internal wiring. The plug shall be loosened by the right tool.</td>
</tr>
<tr>
<td>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.</td>
</tr>
<tr>
<td>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.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CAUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Check and deeply consider the chemical compatibility for material of product in advance.</td>
</tr>
<tr>
<td>The product is 50cm or longer</td>
</tr>
<tr>
<td>The product shall be kept in horizontally. The product and other goods be damaged, and miner injury may be occurred by falling.</td>
</tr>
</tbody>
</table>
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.
   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.

— ADD6 —
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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 LR5 □ □ series) and the monitor unit (Model MP2000) that serves as a converter. The monitor unit converts the total resistance value of the sensor into an electrical signal and output signal 4 to 20 mA DC.

2. 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.

![Diagram of LR series level sensor](image)

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 monitor unit connected with the sensor, the monitor unit converts total resistance value of sensor into output signal 4 to 20 mA DC. See Fig. 2 Block diagram.

Monitor unit MP2000-2 is a microprocessor-based (MPU) and compact. It provides easy calibration, volume conversion, linearization, and analog output (4-20mA DC) and relay outputs.

(*): See section 12, Glossary.
3. SPECIFICATIONS

3.1 Model and Suffix Codes

(1) Sensor model

- d2G4 type

<table>
<thead>
<tr>
<th>Code</th>
<th>Wetted parts material</th>
</tr>
</thead>
<tbody>
<tr>
<td>S</td>
<td>Stainless Steel*¹</td>
</tr>
<tr>
<td>V</td>
<td>PVC</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Code</th>
<th>Cable inlet</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Flameproof Threaded-joint metal conduit type (G3/4)</td>
</tr>
<tr>
<td>1</td>
<td>Explosion proof packing type cable gland (G3/4)</td>
</tr>
<tr>
<td>2</td>
<td>Flameproof Threaded-joint metal conduit type (G1/2)</td>
</tr>
<tr>
<td>3</td>
<td>Explosion proof packing type cable gland (G1/2)</td>
</tr>
</tbody>
</table>

*¹ Detail of wetted parts material depends on 3.2 Standard Specifications.

- d2G3 type

<table>
<thead>
<tr>
<th>Code</th>
<th>Wetted parts material</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Stainless steel (φ 13.8)</td>
</tr>
<tr>
<td></td>
<td>PVC (φ 22)</td>
</tr>
<tr>
<td>2</td>
<td>Stainless steel (φ 27.2)</td>
</tr>
<tr>
<td></td>
<td>PVC (φ 34)</td>
</tr>
</tbody>
</table>

(*) See section 12, Glossary.
(2) Monitor unit model

MP2000-2

<table>
<thead>
<tr>
<th>Input Signal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resistance signal with regular current signal</td>
</tr>
<tr>
<td>6 kΩ Max. (Rated current: 0.58 mA DC)</td>
</tr>
<tr>
<td>More than 6 kΩ and 12 kΩ Max. (Rated current: 0.29 mA DC)</td>
</tr>
<tr>
<td>More than 12 kΩ and 22 kΩ Max. (Rated current: 0.14 mA DC)</td>
</tr>
</tbody>
</table>

3.2 Type of Protection

(1) d2G4 type
   - LR51 □ : Flameproof TIIS certification d2G4
   - LR52 □ : Flameproof TIIS certification d2G4

(2) d2G3 type : Flameproof TIIS certification d2G3

(*) : See section 12, Glossary.
### 3.3 Standard Specifications

(1) Sensor

<table>
<thead>
<tr>
<th>Model</th>
<th>LR52 □ S</th>
<th>LR51 □ S</th>
<th>LR53 □ S</th>
<th>LR52 □ V</th>
<th>LR51 □ V</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flange size</td>
<td>JIS 5K100A</td>
<td>JIS 5K 50A</td>
<td>JIS 5K 50A</td>
<td>JIS 5K100A or equivalent</td>
<td>JIS 5K 80A or equivalent</td>
</tr>
<tr>
<td>Stem diameter</td>
<td>φ 27.2 mm</td>
<td>φ 13.8 mm</td>
<td>φ 13.8 mm</td>
<td>φ 34 mm</td>
<td>φ 22 mm</td>
</tr>
<tr>
<td>Float dimension</td>
<td>φ 90mm ×H100mm</td>
<td>φ 49mm ×H50mm</td>
<td>φ 49mm ×H50mm</td>
<td>φ 89mm ×H150mm</td>
<td>φ 65mm ×H80mm</td>
</tr>
<tr>
<td>Maximum pressure</td>
<td>500 kPa</td>
<td>500 kPa</td>
<td>500 kPa</td>
<td>200 kPa</td>
<td>200 kPa</td>
</tr>
<tr>
<td>Allowable impact</td>
<td>100 m/s^2 Max.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Explosion proof approval</td>
<td>Temperature -10 to 60 °C 100 °C</td>
<td>-10 to 60 °C 100 °C</td>
<td>-10 to 60 °C 120 °C</td>
<td>-10 to 50 °C 50 °C</td>
<td>-10 to 50 °C 50 °C</td>
</tr>
<tr>
<td>Ambient temperature</td>
<td>100 °C</td>
<td>100 °C</td>
<td>120 °C</td>
<td>50 °C</td>
<td>50 °C</td>
</tr>
<tr>
<td>Process temperature</td>
<td>100 °C</td>
<td>100 °C</td>
<td>120 °C</td>
<td>50 °C</td>
<td>50 °C</td>
</tr>
<tr>
<td>Construction</td>
<td>IP65</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minimum S.G.</td>
<td>0.7</td>
<td>0.8</td>
<td>0.8</td>
<td>0.85</td>
<td>0.7</td>
</tr>
<tr>
<td>Resolution *2</td>
<td>10 mm</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Accuracy</td>
<td>±0.5 % F.S.(Measuring length &lt; 3000 mm) ±0 mm</td>
<td>±0 mm (Measuring length &gt; 3000 mm) ±0 mm</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hysteresis</td>
<td>±10 mm</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total resistance value</td>
<td>(Measuring length mm / Resolution mm) × 20 Ω</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max. overall length of stem</td>
<td>3900 mm</td>
<td>3000 mm</td>
<td>3000 mm</td>
<td>3900 mm</td>
<td>3000 mm</td>
</tr>
<tr>
<td>Material</td>
<td>Terminal box</td>
<td>Aluminum die casting</td>
<td>PVC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flange</td>
<td>304 Stainless Steel</td>
<td>304 Stainless Steel</td>
<td>304 Stainless Steel</td>
<td>PVC</td>
<td></td>
</tr>
<tr>
<td>Stem</td>
<td>304 Stainless Steel</td>
<td>304 Stainless Steel</td>
<td>304 Stainless Steel</td>
<td>PVC</td>
<td></td>
</tr>
<tr>
<td>Float</td>
<td>316 Stainless Steel</td>
<td>316 Stainless Steel</td>
<td>316 Stainless Steel</td>
<td>PVC</td>
<td></td>
</tr>
<tr>
<td>Float-travel stop</td>
<td>316 Stainless Steel</td>
<td>316L Stainless Steel</td>
<td>316L Stainless Steel</td>
<td>PVC</td>
<td></td>
</tr>
<tr>
<td>Insulation resistance test</td>
<td>1 × 10^8 Ω or more with 500 V DC (Between 1, 2 terminal and E terminal or Non-charge part)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Withstand voltage test</td>
<td>1500 V AC, 1 Minute (Between 1,2 terminal and E terminal or Non-charge part)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**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.
<table>
<thead>
<tr>
<th>Operation characteristics</th>
<th>Model</th>
<th>M P 2 0 0 0</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accuracy</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Display</td>
<td>Max. ±0.5 % F.S.</td>
<td></td>
</tr>
<tr>
<td>Digits</td>
<td>-999 to 9999</td>
<td></td>
</tr>
<tr>
<td>Sampling cycle</td>
<td>Approximately 0.3 seconds</td>
<td></td>
</tr>
<tr>
<td>Electrical characteristics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Power supply</td>
<td>100 to 240 V AC, 50/60 Hz ±10 % (Allowable resistive load)</td>
<td></td>
</tr>
<tr>
<td>Power consumption</td>
<td>20 VA Max.</td>
<td></td>
</tr>
<tr>
<td>Input signal</td>
<td>Resistance</td>
<td></td>
</tr>
<tr>
<td>Output signal</td>
<td>4 to 20 mA DC</td>
<td></td>
</tr>
<tr>
<td>Allowable resistive load</td>
<td>600 Ω Max.</td>
<td></td>
</tr>
<tr>
<td>Alarm Number</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of contact</td>
<td>4 alarm points (2 points × 2 circuits) transfer</td>
<td></td>
</tr>
<tr>
<td>Contact rating</td>
<td>(common use between HH and H, LL and L)</td>
<td></td>
</tr>
<tr>
<td>Withstand voltage test</td>
<td>1500 V AC for 1 minute</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(between power supply terminal and input terminal)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>500 V AC for 1 minute</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(between output terminal and input terminal)</td>
<td></td>
</tr>
<tr>
<td>Insulation resistance test</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>More than 100 MΩ at 500 V DC</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(between power supply terminal to grand terminal)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>More than 50 MΩ at 250 V DC</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(between output terminal and input terminal)</td>
<td></td>
</tr>
<tr>
<td>Environment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Working temperature</td>
<td>-5 to +50 °C</td>
<td></td>
</tr>
<tr>
<td>Working humidity</td>
<td>85 % RH Max. (No condensing)</td>
<td></td>
</tr>
<tr>
<td>Physical</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Material</td>
<td></td>
<td></td>
</tr>
<tr>
<td>body</td>
<td>A B S</td>
<td></td>
</tr>
<tr>
<td>front panel</td>
<td>P E T</td>
<td></td>
</tr>
<tr>
<td>fittings</td>
<td>A B S</td>
<td></td>
</tr>
<tr>
<td>mounting screws</td>
<td>S U S</td>
<td></td>
</tr>
<tr>
<td>Dimension</td>
<td>(H × W × D): 96 mm × 96 mm × 132 mm</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(Depth of the panel is 120 mm)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>520 g (except of fittings)</td>
<td></td>
</tr>
<tr>
<td>Mounting</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Panel mount</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cut out: in conjunction with DIN 43 700 - 96 × 96 (panel cut-out: 92 × 92 mm)</td>
<td></td>
</tr>
</tbody>
</table>

* 3 Accuracy shows resistance (0-6 kΩ, 0-12kΩ, or 0-22kΩ) for MP2000-2.
4. HANDLING NOTES

Handle the sensor and the monitor unit carefully. Otherwise, the sensor and/or the monitor unit may cause malfunction, or you may suffer from personnel injury.

(1) Following shall be observed when handling the LR.

- When keeping in stock the sensor in your inventory, lay the sensor horizontally. Put the wood piece or adequate materials under the sensor to avoid rolling, bending, scoring the sensor. If the stem length is longer than 2000mm, we highly recommend you to put them 1000mm each.

- When painting the sensor and/or the monitor unit, do not paint on the nameplate to keep the indication of serial number for future reference when ordering parts.

- Do not use or store in a corrosive atmosphere (NH₃, SO₂, Cl₂ etc.). Internal circuit shall be corroded and conduction failure may occur.

- Do not use or store where vibration occurs. If inevitable, provide appropriate means to prevent from vibration.

- Locate away from the noise generator such as motors, pump, inverter and so on or high-frequency electric field. The sensor may cause malfunction.
(2) Following shall be observed when handling the MP.

- Avoid physical shock. Dropping, throwing or bumping will damage the MP.

- Do not put the Monitor Unit where it will be exposed to direct sunlight. Locate away from condensation, dust and foreign matters.

- Do not put the Monitor Unit in puddles to avoid insulation failure.

- Do not use in a corrosive atmosphere such as NH₃, SO₂, Cl₂, etc. Internal circuit board will be corroded through radiation slots.

- Keep the Monitor Unit in sealed plastic bags with desiccant or other moisture proof packing. Put it indoor when storing.

- Operational test should be performed to avoid malfunction when it is not used over one year.

- To avoid personal injury, JIS Class D grounding (less than 100 ohm) should be done.

- Key switches on the front panel are cushion switches. Push them surely.

- Do not push the front panel with sharp objects.

- Wipe the front panel clean of dirt with a clean dry cloth. Do not use solvents.
5. INSTALLATION

⚠️ CAUTIONS

Turn the mounting plug only when installing. Do not turn the housing. Otherwise, the housing connection to the mounting plug will be broken.

5.1 Sensor Unpacking

- When unpacking, grab the flange or the stem base near by the flange to keep the balance of mass. Otherwise, you will drop the sensor or bend the stem.

- Avoid physical shock for the stem tip or the enclosure. We recommend to handle at least two person for the long stem, more than 1500 mm.
• Avoid physical shock. Dropping, throwing or bumping shall damage the sensor.

• Remove all sealed plastic bags or tapes from the sensor. After removing and tilting the stem, avoid physical shock to the float due to slip on the stem. Otherwise, magnetic strength of the float will vary or the float will collapsed.

• Do not put on the sensor. It shall damage and deform the sensor.

• Make sure that it is the right product you required. Model numbering of the sensor is indicated on the nameplate. If incorrect, ask Nohken or our distributor.

• After unpacking, inspect the sensor for shipping damage. If there is evidence of damage, notify the carrier immediately and ask Nohken.
5.2 Sensor Installation

(1) Location
Before installing the sensor, provide ample space for installation, maintenance and inspection. Especially keep the enough overhead space for top mounting.
This sensor shall be installed in an area which meets the following conditions.

- Do not locate near liquid inlets or outlets. Optimally provide a stilling tube(*).
  Inner diameter of the stilling tube should be larger than 20 mm of the float outside diameter.
  Drill vent holes in the tube and use the spacer(*) to keep the float travelling.

- Locate away from the obstruction (pipe, plumbing, pump, and so on) to the float travelling.

(2) Mounting
Provide the compatible mating flange on the container top. Install the sensor to the container using appropriate tool and suitable bolt and nuts.
If there is a pressure in the container, the appropriate seal gasket shall be provided.
Bolt, nuts, and gasket shall be ordered separately if necessary.

(3) The sensor coated with resin should not be used for measuring materials of volume resistivity greater than $10^8 \ \Omega \cdot \text{cm}$ (electron conductivity smaller than $10^{-7}$) to prevent generating electrostatics. During maintenance or cleaning works, a wet cloth should be used to prevent generating and charging electrostatics.

(*) See section 12, Glossary.
5.3 Monitor Unit Unpacking

CAUTIONS
Since this Monitor Unit is not an explosion-proof construction, do not use where flammable gas, explosive gas or the vapor exists.

- Avoid physical shock. Dropping, throwing or bumping will damage the MP.

- Do not put things on the Monitor Unit. It will deform and damage the product.

- Inspect the model numbering on the name plate to meet your order. If incorrect, ask to our sales department or our distributor.

- After unpacking, inspect the MP for shipping damage. If there is evidence of damage, notify the carrier and us immediately.

5.4 Monitor Unit Installation

(1) Location
Provide ample space for maintenance and inspection. Make sure the following to avoid malfunction.

- Ambient temperature range is from -5 °C to +50 °C, and humidity is under 85% RH.

- The weight of the MP is 520 g. Provide Appropriate reinforce for thin panels if necessary.

- Locate away from rain and jetting water. MP is not waterproof.
(2) Installation

- Drill the mounting panel to mount the Monitor Unit. See the following figure for dimensions and mounting pitches.
- Insert the MP from the front panel.
- Install mounting brackets into the body of the MP from the back side of the mounting panel. See the following figure for mounting procedures.
- Tighten mounting brackets with the Philips (+) driver surely.
6. WIRING
6.1 Sensor Wiring
(1) Preparation

Normally, wiring data is indicated to the back of terminal box cover. The sensor wiring should be connected in accordance with the method of wiring flameproof wiring provided in the "Recommended Practice for Explosion-Protected Electrical Industries" published by the Labor Ministry's Industrial Safety Research Institute (RIIS-TR-79-1, Japan). Also, the precautions given in this manual must be strictly observed. Proceed as follows:

(1) Loosen setscrew with an allen wrench for M4, and remove Anti-rotation clamp.
(2) Remove the terminal box cover.
(3) Bring the cable into the terminal box.
(4) Connect the cables to the terminals as shown Fig. 3.
(5) Make sure that there is no miswiring.
(6) Reinstall the terminal box cover in accordance with protection category IP65.
(7) Tighten the setscrew securely.

![Fig. 3 - Electrical connections for Explosion-proof instrument](image1)

(2) 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 anti-rotation bolts.

![Fig. 4](image2)
NOTE the following points:
(1) The gasket size built-in flameproof packing depend on cable outside diameter. Please specify this when you order. (Refer to Table 3)

<table>
<thead>
<tr>
<th>Model</th>
<th>LR5 □ 0</th>
<th>LR5 □ 2</th>
<th>LR5 □ 1</th>
<th>LR5 □ 3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cable outside diameter</td>
<td>φ 12.1 to φ 16.0 mm</td>
<td>φ 7.0 to φ 12.0 mm</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(2) Install solderless lugs fitted to M3.5 (Monitor unit side) and M4 (Sensor side) screw to the end of lead wires.

(3) The cable inlet must be protected the sensor from rain, splashing water and so on.

CAUTION
Wiring shall be in accordance with all electrical codes. Connect an effective earth wire to the "E" terminal. This earth should be JIS Class D ground (less than 100 ohm) or better. Otherwise, you may get an electrical shock.

(3) Technical notes
- Do not kink the CVVS cable. Damage can occur causing the sensor and the monitor 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 monitor unit may be damaged by induced current.
- 2-core CVVS(1.25 mm²) connecting cable shall be used between the sensor and the monitor 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 gland.
- Both the sensor and the monitor unit shall be grounded individually.

(4) Covering
- Re-install the cover. Ensure that there is no metallic dust in the housing. The housing cover shall be tightened to protect from rain, splashing water, dust, and so on. Do not mix covers more than two sensors on the same location.
6.2 Monitor Unit Wiring

(1) Preparation

- Turn off the power supply.

**CAUTIONS**

- Turn off the power before wiring, maintenance or inspection. Otherwise, the electric leakage, electric shock and ignited by short circuit may be occurred.

(2) Wiring

Fig. 5 is the figure which was seen from above by removing a terminal box cover. Connect the cables to the terminals as shown Fig. 5. The terminal screws are used M3.5 screw.

Connect the cables to the terminals

MP2000 15 terminal ----- sensor 1 terminal
MP2000 16 terminal ----- sensor 2 terminal
<table>
<thead>
<tr>
<th>CAUTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>• To avoid personal injury, JIS Class D grounding (less than 100 ohm) should be done.</td>
</tr>
<tr>
<td>• Lay the analog output cable away from the power line to prevent noise. Should be done.</td>
</tr>
<tr>
<td>• The shielded cable for both input and output line shall be one-point grounded. Two-point grounding may cause malfunction.</td>
</tr>
<tr>
<td>• Make sure that the supply voltage is sufficient, within 100 to 240 V AC range. Otherwise, the MP may cause malfunction or damage.</td>
</tr>
<tr>
<td>• Output load (resistive) is 600 ohm maximum. Excessive load cause malfunction.</td>
</tr>
<tr>
<td>• Contact rating for relay output is 240 V 3 A AC or 30 V 3A DC. Provide external relays when exceeding.</td>
</tr>
<tr>
<td>• When electrical surges are produced, provide appropriate surge absorber or protective circuit.</td>
</tr>
<tr>
<td>• Reinstall the protective cover which is placed over the terminal plate to avoid electric shock.</td>
</tr>
</tbody>
</table>
Fail-safe mode is programmable for alarm outputs.
Relay operations are completely changed when you choose the fail-safe mode.
The default is without fail-safe mode. See the below table for operating differences.

<table>
<thead>
<tr>
<th>Power</th>
<th>Liquid level</th>
<th>Fail-safe mode</th>
<th>Without fail-safe mode</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Operation</td>
<td>Operation</td>
</tr>
<tr>
<td></td>
<td>Up ON</td>
<td>Down On</td>
<td>Up ON</td>
</tr>
<tr>
<td>ON</td>
<td>Set point or higher</td>
<td>❌</td>
<td>❌</td>
</tr>
<tr>
<td>ON</td>
<td>Set point or lower</td>
<td>❌</td>
<td>❌</td>
</tr>
<tr>
<td>OFF</td>
<td>—</td>
<td>❌</td>
<td>❌</td>
</tr>
</tbody>
</table>

Wiring shall be in accordance with all local codes. Since the terminal screw is M 3.5, we recommend to use shielded control cable of 1.25mm² with R1.25-3.5 (JIS C 2805) solderless rugs.

Reinstall the protective cover which is placed over the terminal plate.

(3) Operational check
Ensure the MP operation in the test stage. If the operation is unsuccessful, check wiring, read this manual again, or contact our sales department.
7. COMPONENT NAMES

7.1 Sensor

<table>
<thead>
<tr>
<th>No.</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>①</td>
<td>Earth terminal</td>
</tr>
<tr>
<td>②</td>
<td>Terminal box</td>
</tr>
<tr>
<td>③</td>
<td>Flameproof packing</td>
</tr>
<tr>
<td>④</td>
<td>Cable inlet</td>
</tr>
<tr>
<td>⑤</td>
<td>Flange</td>
</tr>
<tr>
<td>⑥</td>
<td>Float travel-stop</td>
</tr>
<tr>
<td>⑦</td>
<td>Stem</td>
</tr>
<tr>
<td>⑧</td>
<td>Float</td>
</tr>
<tr>
<td>⑨</td>
<td>Internal circuit</td>
</tr>
<tr>
<td>⑩</td>
<td>Permanent magnet</td>
</tr>
</tbody>
</table>

Fig. 7
## 7.2 Monitor Unit

![Diagram](image)

<table>
<thead>
<tr>
<th>No.</th>
<th>Name</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>①</td>
<td>Mode key</td>
<td>Used to change the items to be set.</td>
</tr>
<tr>
<td>②</td>
<td>Enter key</td>
<td>Enters the data value.</td>
</tr>
<tr>
<td>③</td>
<td>Up key</td>
<td>Used to change the data value.</td>
</tr>
<tr>
<td>④</td>
<td>Down key</td>
<td>Used to change the data value.</td>
</tr>
<tr>
<td>⑤</td>
<td>Alarm</td>
<td>HH Lights while HH set.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>H  Lights while H set.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>L  Lights while L set.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>LL Lights while LL set.</td>
</tr>
<tr>
<td>⑥</td>
<td>Mode</td>
<td>OP. Lights while measurement mode.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ADJ. Lights while adjustment mode. (Without zero point mode and span point adjustment mode.)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ALARM Lights while alarm setting mode.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TEST Lights while test mode.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>ZERO Lights while zero point adjustment mode.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SPAN Lights while span point adjustment mode.</td>
</tr>
<tr>
<td>⑦</td>
<td>Unit</td>
<td>Display indication unit.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Choose a use unit from the unit seal and set it.)</td>
</tr>
<tr>
<td>⑧</td>
<td>Variable data</td>
<td>Display process value, characters identifying the data being set and error massages.</td>
</tr>
<tr>
<td>⑨</td>
<td>Parameter data</td>
<td>Display parameter data.</td>
</tr>
<tr>
<td>⑩</td>
<td>Liquid level / contents</td>
<td>Display liquid level / contents.</td>
</tr>
<tr>
<td>⑪</td>
<td>Alarm identification</td>
<td>Display alarm identification.</td>
</tr>
</tbody>
</table>
8. OPERATION

Monitor Unit operation, setting and calibration are done by depressing the keypad on the front panel as MODE key, ENTER key, UP key, and DOWN key.

Once you entered your desired value to the parameter, it will be saved until Change or initialization. When the MP is powered up, it automatically starts up the setting mode. Parameter's value are programmable after changing to the setting mode.

Incidentally, when ordering a sensor and Monitor Unit by the set, it sets to the electric current output by 4-20mA and 0 - 100 displays in the early stages to zero - the span point.

8.1 OPERATION

The mode composition of Monitor Unit is divided into the measurement mode and the setting mode.

Measurement mode is the mode which processes the display according to the signal of a sensor, an alarm output, a current signal, etc., and is the mode which operates in the case of use.

Setting mode is the mode which performs a display setup in measurement mode, an alarm output setup, an output test, etc. When dividing a setting mode mainly, it is divided into the following four.

- **Measurement mode**
- **Setting mode**

### Various setting mode (ADJ.)
- The setting of measurement display (Parameter No. P-10-P-17, but, P-12 is an empty number)
- The setting of alarm output operation (Parameter No. P-19-P-39 ) *
- The setting of volume conversion (Parameter No. P-50-P-79)
- The setting of lock parameters (Parameter No. P-00)

### Alarm setting mode (ALARM)
- The setting of alarm output operation (Parameter No. P-20-P-39 ) *

### Test mode (TEST)
- Manual test (Parameter No. P-90)
- Auto-test (Parameter No. P-91)
- Display test (Parameter No. P-92)

### Zero and Span point adjustment mode
- The input signal setting by zero and the span point (Parameter No. P-01, P-02)
- The output signal setting by zero and the span point (Parameter No. P-03, P-04)
- The setting of resolution (Parameter No. P-05)
- The setting of display offset (Parameter No. P-06)
- The setting of elevation function (Parameter No. P-07)
- The setting of cut of the display and the output (Parameter No. P-08)
- Default all data to the factory setting value (Parameter No. P-99)

* Parameter No. P-20-P-39 can be changed in either of various setting mode (ADJ.), Alarm setting mode (ALARM) setting.
The flow of the display contents and the changing operation

**Measurement mode**

- Measurement mode
- OP lighting
- push for 3sec.

**Setting mode**

- Various setting mode (ADJ.)
  - reference setting
  - ADJ. blinking

**Alarm setting mode (ALARM)**

- reference setting
- ALARM blinking

**Test mode (TEST)**

- reference setting
- TEST blinking

**Zero and Span point adjustment mode**

- push for 3sec.
  - OP. blinking
  - (It cancels setting and it returns.)

- push for 3sec.
  - OP. lighting
8.2 SETTING OF MONITOR UNIT

Incidentally, when ordering a sensor and Monitor Unit by the set, it sets to the electric current output by 4-20mA and 0 - 100 displays in the early stages to zero - span point. Therefore, it is possible to use in basically setting the alarm output to hope for. A way of zero and span point adjustment and the alarm output setting is shown below.

8.2.1 ZERO AND SPAN POINT ADJUSTMENT

When ordering a sensor and Monitor Unit by the set, zero and span point adjustment has completed in for warding. Therefore, there is not re-adjustment's necessity.

Setting example

When the necessity which does zero and span point adjustment once again occurs with the size change by the sensor.

Setting contents

① It makes a sensor the condition that zero signal and the span point signal can be output.
② It makes the condition to output zero signal from the sensor and it does zero adjustment (P-01).
③ It makes the condition to output a span point signal from the sensor and it does span point adjustment (P-02).
④ It returns a sensor to the measurement condition.

The setting change procedure (The setting change procedure of the above ② and ③)

<table>
<thead>
<tr>
<th>(1) It begins at the measurement mode.</th>
<th>![Image 1] (Measurement mode) &quot;OP.&quot; lights.</th>
</tr>
</thead>
<tbody>
<tr>
<td>(2) It pushes for 3 seconds.</td>
<td>![Image 2] (Setting mode) &quot;ADJ.&quot; blinks.</td>
</tr>
<tr>
<td>&quot;ADJ.&quot; blinks.</td>
<td>↓ push for 3sec.</td>
</tr>
<tr>
<td>(3) It pushes [t].</td>
<td>![Image 3] (&quot;OP.&quot; blinks. )</td>
</tr>
<tr>
<td>&quot;OP.&quot; blinks.</td>
<td>↓ push [t]</td>
</tr>
<tr>
<td>(4) It pushes for 3 seconds.</td>
<td>![Image 4] (Zero and Span point adjustment mode)</td>
</tr>
<tr>
<td>&quot;P-01&quot; blinks.</td>
<td>↓ push for 3sec.</td>
</tr>
<tr>
<td>(Zero point adjustment)</td>
<td>&quot;P-01&quot; blinks.</td>
</tr>
</tbody>
</table>
(5) It pushes \( \square \). The value of the zero point set up now is displayed.
   (If there is not a process which zero adjusted before in zero position, "0.000" will blink.)

(6) It outputs zero point signal from the sensor.

(7) In the case except "0.000", push and change \( \uparrow \) or \( \downarrow \) into "0.000".
   (If being "0.000" in (5), this work is unnecessary.)

(8) It pushes \( \square \) while the zero point signal had been made to output from a sensor.
    Then, zero point signal was memorized at the memory and that "P-01" will be in a blink state. (Zero point adjustment's completion)

(9) It pushes \( \uparrow \).
    "P-02" blinks. (Span point adjustment)

(10) It pushes \( \square \). The value of the span point set up now is displayed.
     (If there is not a process which span adjusted before in span position, "100.0" will blink.)

(11) It outputs span point signal from the sensor.

(12) In the case except "100.0", push and change \( \uparrow \) or \( \downarrow \) into "100.0".
    (If being "100.0" in (10), this work is unnecessary.)
(13) It pushes \( \triangleleft \) while the span point signal had been made to output from a sensor. Then, span point signal was memorized at the memory and that "P-02" will be in a blink state. (Span point adjustment's completion)

(14) It pushes \( \triangledown \) or \( \downarrow \).
"OP." blinks.

(15) When pushing \( \triangledown \), it returns to the measurement mode. (Zero and span point adjustment's completion)

8.2.2 ALARM OUTPUT SETTING

As follows, in the early stage setting, because a alarm value is set, when changing into the setting value except this, do this setting.

Since a relay alarm operates as compared with a display value, in case it changes the parameter about display values, such as display offset (P-06) and measurement length (P-14), please re-set up the parameter about the alarm output of P-19 to P-39.

Setting example
It changes L alarm into ON at less than 30 from ON at less than 40.

Setting contents
① It changes P-26 (the caution value of the L alarm) into 30.00 from 40.00.

The setting change procedure
(1) It begins at the measurement mode.

(2) It pushes \( \triangledown \) for 3 seconds.
"ADJ." blinks.
It pushes \( \downarrow \).
"Alarm." blinks.
(3) It pushes ↓. "P-20" blinks.

\[
\text{↓ push ↓}
\]

Alarm setting mode
"P-20" blinks.
(L.L. alarm relay operation)

(4) ↑ is pushed several times and please blink "P-26". (L. alarm relay setting value)

\[
\text{↓ push ↑ several times}
\]

"P-26" blinks.
(L. alarm relay setting value)

(5) It pushes ↓. The setting value set up now is displayed.

\[
\text{↓ push ↓}
\]

"40.00" blinks.

(6) It pushes ↑ or ↓ several times and it makes display "30.00".

\[
\text{↓ push ↑ or ↓}
\]

"30.00" blinks.

(7) It pushes ↓. Then, setting value was memorized at the memory and that "P-26" will be in a blink state.
(L. alarm relay setting value is completion)

\[
\text{↓ push ↓}
\]

Setting value was memorized at the memory "P-26" blinks.

(8) It pushes ↓. "ALARM" blinks.

\[
\text{↓ push ↓}
\]

"ALARM" blinks.

(9) It pushes ↑ or ↓. "OP." blinks.

\[
\text{↓ push ↑ or ↓}
\]

"OP." blinks.

(10) When pushing ↓, it returns to the measurement mode.
(Setting change's completion)

\[
\text{↓ push ↓}
\]

Measurement mode
"OP." lights.
(Setting change's completion)

* When changing the other caution value continuously, return to (4) after (7) ends and operate a parameter in the change by the similar procedure.
8.3 CONTENTS OF PARAMETER

All the parameters of Monitor Unit are shown below. Contents about the various setting such as the change operation confirmation test of the change of the way of displaying and the alarm output operation are shown.

8.3.1 INPUT AND OUTPUT (P-00 to P-17)

P-00. Lock: It prevents from a not carefully depending parameter change.

- Default: 1965

Parameter No.00 are called and setting values other than 1965 are inputted. A parameter will be in a lock state and it will become impossible to perform a setup and reference of a parameter. When canceling a keylock, key is pushed for 3 seconds at the time of measurement mode, and it shifts to the setting mode of a parameter P-00, and a key lock will be canceled if 1965 is inputted into a setting value.

(′programmable range: 0000 to 9999′)

P-01. Zero point adjustment: The zero point signal of a connection sensor is recognized.

- Default: 0.000

It changes into the state where the signal of a connection sensor is inputted, and it is made to recognize by carrying out an input setup that the signal of the connection sensor is an input signal value in the setting position (comparatively at the time of setting the full scale of a sensor signal to 100). (Keep in mind that the error of Err1 will occur if it sets up by the same input signal as the zero point input value of P-01.) Refer to the 9.4 clause for the release method. Fundamentally, the input signal of a connection sensor is in the state which inputted the signal in the zero point position of a sensor, and please set up the setting value 0.000.

(′programmable range: 0.000 to 200.0′)

P-02. Span point adjustment: The span point signal of a connection sensor is recognized.

- Default: 100.0

It changes into the state where the signal of a connection sensor is inputted, and it is made to recognize by carrying out an input setup that the signal of the connection sensor is an input signal value in the setting position (comparatively at the time of setting the full scale of a sensor signal to 100). (Keep in mind that the error of Err1 will occur if it sets up by the same input signal as the zero point input value of P-01.) Refer to the 9.4 clause for the release method. Fundamentally, the input signal of a connection sensor is in the state which inputted the signal in the span point position of a sensor, and please set up the setting value 100.0.

(′programmable range: 0.000 to 200.0′)
Output for Zero point: The output current value in a zero point position is set up.
【default : 04.00】

(programmable range : 02.00 to 22.00) [unit : mA DC]

Output for Span point: The output current value in a Span point position is set up.
【default : 20.00】

(programmable range : 02.00 to 22.00) [unit : mA DC]

Resolution: Change display at desired resolution.
【default : 0000】

It is made the output change for every resolution which set up the measurement value and the current output value.

Each resolution = Total measuring range / numbers of resolution
"0" means without resolution display.

(programmable range : 0000 to 2000)

Display value offset: It is used when indicating the display value by offset on the whole. The display which made the center standard zero as main uses is attained.
【default : 0.000】

Setting example

<table>
<thead>
<tr>
<th></th>
<th>before</th>
<th>after</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zero point</td>
<td>display 0.000</td>
<td>Zero point</td>
</tr>
<tr>
<td></td>
<td>output 4.00mA</td>
<td>display -50.00</td>
</tr>
<tr>
<td>Span point</td>
<td>display 100.0</td>
<td>Span point</td>
</tr>
<tr>
<td></td>
<td>output 20.00mA</td>
<td>display 50.00</td>
</tr>
</tbody>
</table>

※ Span suppression (P-15):0.000, Measuring range (P-14):100.0, Zero elevation (P-13):0.000

- Please input an input value to become "Display value offset (P-06) + Offset range (P-15) + Measuring range (P-14) + Zero elevation (P-13)." When not satisfied, "Err2" is displayed and it becomes impossible to shift to measurement mode. Refer to the 9.4 clause for the release method.
- Since it is dependent on the numerical value set up by measurement range (P-14), an input value should surely input this parameter after a setup of P-14.
- Since it depends for an alarm setup on a display value, please be sure to reconfirm the parameter setting value about alarm output operation of P-19 to P-39 after a setup.
- This parameter cannot indicate the display value by offset to the measurement mode (P-10 = 1 (deposition volume) or 3 (space volume)) of volume conversion.

(programmable range : 0.000 to 9999) [unit : The unit on a surface panel (arbitrary display units) ]
P-07. Elevation function: It is used when making a display value and a current output value slide on the whole. 

Setting example

<table>
<thead>
<tr>
<th>before</th>
<th>after</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zero point</td>
<td>display 0.000</td>
</tr>
<tr>
<td>output</td>
<td>output</td>
</tr>
<tr>
<td>4.00mA</td>
<td>3.84mA</td>
</tr>
<tr>
<td>Span point</td>
<td>display 100.0</td>
</tr>
<tr>
<td>output</td>
<td>output</td>
</tr>
<tr>
<td>20.00mA</td>
<td>19.84mA</td>
</tr>
</tbody>
</table>

※ Span suppression (P-15):0.000, Measuring range (P-14):100.0, Zero elevation (P-13):0.000

- Since it is dependent on the numerical value set up by measurement range (P-14), an input value should surely input this parameter after a setup of P-14.
- Since it depends for an alarm setup on a display value, please be sure to reconfirm the parameter setting value about alarm output operation of P-19 to P-39 after a setup.
- It becomes effective to the total setting value of a setup (P-10) in measurement mode elevation functioning this parameter.

《programmable range: -9999 to 9999》
[ unit: The unit on a surface panel (arbitrary display units) ]

P-08. Cut function: The display and current output below a zero point and beyond a span point are cut.

0 : Standard
1 : It cuts below a zero point.
2 : It cuts beyond a span point.
3 : It cuts below a zero point and beyond a span point.

example）Span suppression (P-15)=0.000, Measuring range (P-14)=100.0, Zero elevation (P-13) = 0.000. In this setup, if P-08 = 3 are inputted, in below a zero point, as for a display, 0.000 and a current output will be 4.00mA, and, in beyond a span point, as for a display, 100.0 and a current output will be 20.00mA. (A current value shows a calculation value.)

- When this parameter is changed, the measurement mode of volume conversion is also influenced. When a volume conversion setup is carried out, please re-set up the value of P-50 to P-59.

《programmable range: 0 to 3》
P-10. Measuring mode: It chooses a measurement object.
    【default : 0 】
    It calculates in the set-up measurement mode and a display, a current output, and an alarm output are performed to an operation result. A current output full scale serves as the range of measurement range (P-14) in a level display (0 or 2) at the time of selection, and, in selection of a volume display (1 or 3), even a top position serves as a range from a bottom position.

    0 : Material level
    1 : Material volume
    2 : Space level
    3 : Space volume

    《programmable range : 0 to 3》

P-11. Decimal points: Selectable display decimal points.
    【default : 1 】
    0 : no digits after the decimal point
    1 : 1 digit after the decimal point
    2 : 2 digits after the decimal point
    3 : 3 digits after the decimal point
    4 : floating point

    《programmable range : 0 to 4》
P-13. Zero elevation: The display level from 0% position to the bottom point of a sensor input
【default: 0.000】 signal is inputted.

It is used when performing the case where carry out the uniform increase of the material level
display value, and it is displayed, and a material volume conversion display.

《programmable range: 0.000 to 9999》
[ unit: The unit on a surface panel (arbitrary display units) ]

P-14. Measuring range: The display level of 0 - 100% position of full-scale one of a sensor input
【default: 100.0】 signal is inputted.

The amount of change of a display level is inputted.

《programmable range: 0.000 to 9999》
[ unit: The unit on a surface panel (arbitrary display units) ]

P-15. Span suppression: The amount of display levels from 100% position to the top point of a sensor
【default: 0.000】 input signal is inputted.

It is used when performing the case where carry out the uniform increase of the space level
display value, and it is displayed, and a space volume conversion display.

《programmable range: 0.000 to 9999》
[ unit: The unit on a surface panel (arbitrary display units) ]
P-16. Damping rate: It is useful to delete an excessive change over pre-setting value to avoid accidental outputs.

【default : 5.000】

programmable range : 0.001 to 100.0
[unit : % (Rate to the full scale of an input signal)]

P-17. Input filter: Input signal equalization.
【default : 0】

0 : Equalize 10 signals
(The value which averaged the last measurement value for 10 time is updated and outputted every about 0.3 seconds.)

1 : Equalize 100 signals tracking speed becomes slow
(The last measurement value for 10 time is summarized to one block, and the value which averaged the value of the last block for ten pieces is updated and outputted every about 3 seconds.)

3 : Equalize 30 signals tracking speed becomes slow
(The last measurement value for 10 time is summarized to one block, and the value which averaged the value of the last block for three pieces is updated and outputted every about 3 seconds.)

5 : Equalize 50 signals tracking speed becomes slow
(The last measurement value for 10 time is summarized to one block, and the value which averaged the value of the last block for five pieces is updated and outputted every about 3 seconds.)

7 : Equalize 70 signals tracking speed becomes slow
(The last measurement value for 10 time is summarized to one block, and the value which averaged the value of the last block for seven pieces is updated and outputted every about 3 seconds.)

《programmable range : 0, 1, 3, 5, 7》

8.3.2 ALARM OUTPUT OPERATION (P-19 to P-39)

1) Programmable alarm relays with reference to material level of the measuring mode (0 or 1, P-10).

2) If you choose space level, note to the different display and setting value for alarm points.

<table>
<thead>
<tr>
<th>Operation</th>
<th>Setting value</th>
<th>Hysteresis</th>
<th>ON delay timer</th>
<th>OFF delay timer</th>
</tr>
</thead>
<tbody>
<tr>
<td>LL alarm relay</td>
<td>P-20</td>
<td>P-21</td>
<td>P-22</td>
<td>P-23</td>
</tr>
<tr>
<td>L alarm relay</td>
<td>P-25</td>
<td>P-26</td>
<td>P-27</td>
<td>P-28</td>
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<tr>
<td>H alarm relay</td>
<td>P-30</td>
<td>P-31</td>
<td>P-32</td>
<td>P-33</td>
</tr>
<tr>
<td>HH alarm relay</td>
<td>P-35</td>
<td>P-36</td>
<td>P-37</td>
<td>P-38</td>
</tr>
</tbody>
</table>
P-19. Fail-safe : Selectable fail-safe operation mode. (Refer to 7.2.)
   【default : 0】
   0 : Fail-safe off
   1 : Fail-safe on

   （programmable range : 0 , 1）

P-20. LL alarm relay operation : Programmable operation for the LL alarm relay.
   【default : 2】
   0 : OFF (empty)
   1 : Close ON rising (normally open)
   2 : Close ON falling (normally closed)

   （programmable range : 0 to 2）

P-21. LL alarm relay setting value : Key-in desired setting value for the LL alarm relay.
   【default : 20.00】（A bottom position is inputted as a standard position.）

   （programmable range : -9999 to 9999）
   [ unit : The unit on a surface panel (arbitrary display units) ]

P-22. LL alarm relay hysteresis : Key-in desired hysteresis for the LL alarm relay.
   【default : 0.000】

   （programmable range : 0.000 to 9999）
   [ unit : The unit on a surface panel (arbitrary display units) ]

P-23. LL alarm relay ON delay timer : Key-in desired ON state delay time for the LL alarm relay.
   【default : 0】

   （programmable range : 0 to 30） [ unit : seconds ]

P-24. LL alarm relay OFF delay timer : Key-in desired OFF state delay time for the LL alarm relay.
   【default : 0】

   （programmable range : 0 to 30） [ unit : seconds ]
P-25. L alarm relay operation: Programmable operation for the L alarm relay.
   【default : 2】
   0 : OFF (empty)
   1 : Close ON rising (normally open)
   2 : Close ON falling (normally closed)

   《programmable range : 0 to 2》

P-26. L alarm relay setting value: Key-in desired setting value for the L alarm relay.
   【default : 40.00】 (A bottom position is inputted as a standard position.)

   《programmable range : -9999 to 9999》
   [unit : The unit on a surface panel (arbitrary display units)]

P-27. L alarm relay hysteresis: Key-in desired hysteresis for the L alarm relay.
   【default : 0.000】

   《programmable range : 0.000 to 9999》
   [unit : The unit on a surface panel (arbitrary display units)]

P-28. L alarm relay ON delay timer: Key-in desired ON state delay time for the L alarm relay.
   【default : 0】

   《programmable range : 0 to 30》 [unit : seconds]

P-29. L alarm relay OFF delay timer: Key-in desired OFF state delay time for the L alarm relay.
   【default : 0】

   《programmable range : 0 to 30》 [unit : seconds]
   【default: 1】
   0: OFF (empty)
   1: Close ON rising (normally open)
   2: Close ON falling (normally closed)
   《programmable range: 0 to 2》

P-31. H alarm relay setting value: Key-in desired setting value for the H alarm relay.
   【default: 60.00】 (A bottom position is inputted as a standard position.)
   《programmable range: -9999 to 9999》
   [unit: The unit on a surface panel (arbitrary display units)]

P-32. H alarm relay hysteresis: Key-in desired hysteresis for the H alarm relay.
   【default: 0.000】
   《programmable range: 0.000 to 9999》
   [unit: The unit on a surface panel (arbitrary display units)]

P-33. H alarm relay ON delay timer: Key-in desired ON state delay time for the H alarm relay.
   【default: 0】
   《programmable range: 0 to 30》 [unit: seconds]

P-34. H alarm relay OFF delay timer: Key-in desired OFF state delay time for the H alarm relay.
   【default: 0】
   《programmable range: 0 to 30》 [unit: seconds]
P-35. HH alarm relay operation : Programmable operation for the HH alarm relay.
    【default : 1】
    0 : OFF (empty)
    1 : Close ON rising (normally open)
    2 : Close ON falling (normally closed)

    《programmable range : 0 to 2》

P-36. HH alarm relay setting value : Key-in desired setting value for the HH alarm relay.
    【default : 80. 00】 (A bottom position is inputted as a standard position.)

    《programmable range : −9999 to 9999》
    [unit : The unit on a surface panel (arbitrary display units) ]

P-37. HH alarm relay hysteresis : Key-in desired hysteresis for the HH alarm relay.
    【default : 0. 000】

    《programmable range : 0. 000 to 9999》
    [unit : The unit on a surface panel (arbitrary display units) ]

P-38. HH alarm relay ON delay timer : Key-in desired ON state delay time for the HH alarm relay.
    【default : 0】

    《programmable range : 0 to 30》 [unit : seconds ]

P-39. HH alarm relay OFF delay timer : Key-in desired OFF state delay time for the HH alarm relay.
    【default : 0】

    《programmable range : 0 to 30》 [unit : seconds ]
8.3.3 VOLUME CONVERSION (P-50 to P-59)

1. A display is provided which is proportional to the level of the tank for those seven common tank shapes. You just input parameters related to your desired tank shape. We recommend to keep default volume for P-58 (conversion factor "C") and P-59 (Conversion multiplier "P") if unnecessary.

2. Total of P-13, P-14, and P-15 should be equal to total length of the tank.

3. Choose your suitable tank shape below.

4. For the tank number 3, enter carefully to P-55 ("D1") and P-56 ("D2"). Check the correct orientation with the drawing.
(5) Following are automatically converted when you enter the half paraborized end of tank number 4. Since it becomes a factor with error when conditions differ, please examine using a linear display etc.

Diameter of the cylinder: \( DD = (\text{Zero elevation}) + (\text{Measuring range}) + (\text{Span suppression}) \)
Radius of the half paraborized end: \( RR \)
Rounded corner of the half paraborized end: \( rr \) (Note: \( RR:rr = 2:1 \))
Height of the half paraborized end: \( hh \) (Note: \( hh = 1/4DD \))

(6) If capacity conversion are performed, the full scale of a current output will be changed into a top position from a bottom position. Keep in mind that it differs from the case of level conversion (a sensor measurement region is made into a full scale).

P–50. Selectable tank shape: Choose your desired tank from those seven common tank shapes.
【default : 0】

When performing a volume conversion setup, it is necessary to change a setup of P-10 (measurement mode) into 1 (or 3) simultaneously.

0: Spherical bottom
1: Conic bottom
2: Pyramidal bottom
3: Sloped bottom
4: Parabolic ends
5: Flat end
6: Sphere
9: Linear

《programmable range : 0 to 9》

P–51. Tank dimension D: Enter the diameter of the tank if P-50 = 0 or 1.
【default : 1.000】

《programmable range : 0.000 to 9999》
[ unit : The unit inputted by P-14 (measurement range) ]

P–52. Tank dimension R: Enter the radius of the parabolic bottom if P-50 = 0.
【default : 1.000】

《programmable range : 0.000 to 9999》
[ unit : The unit inputted by P-14 (measurement range) ]
P-53. Tank dimension r : Enter the radius of rounded ends of the tank if P-50 = 0.
   【 default : 0.100 】

   《programmable range : 0.000 to 9999》
   [ unit : The unit inputted by P-14（measurement range） ]

P-54. Tank dimension h : Enter the height of bottom section of the tank if P-50 = 1,2,3.
   【 default : 0.500 】

   《programmable range : 0.000 to 9999》
   [ unit : The unit inputted by P-14（measurement range） ]

P-55. Tank dimension D1 : Enter the depth of tank if P-50 = 2,3.
   【 default : 1.000 】

   《programmable range : 0.000 to 9999》
   [ unit : The unit inputted by P-14（measurement range） ]

P-56. Tank dimension D2 : Enter the depth of tank if P-50 = 2,3.
   【 default : 1.000 】

   《programmable range : 0.000 to 9999》
   [ unit : The unit inputted by P-14（measurement range） ]

P-57. Tank dimension L : Enter the horizontal length of tank if P-50 = 4,5.
   【 default : 1.000 】

   《programmable range : 0.000 to 9999》
   [ unit : The unit inputted by P-14（measurement range） ]

P-58. Conversion factor C : Enter the factor the conversion value to be multiplied.
   【 default : 1.000 】

   《programmable range : 0.000 to 9999》

P-59. Conversion multiplier P : Enter the multiplier the conversion value must be multiplied to 1×10^p.
   【 default : 0.000 】

   《programmable range : 0.000 to 9999》
8.3.4 LINEAR PROFILE (P-60 to P-79)

(1) If your tank design does not match one of the seven common tank shapes, it can be programmed as eleven separate breakpoint settings, including zero point and span point. Parameter number from P-60 to P-79 is those breakpoint settings.

(2) The tank profile is achieved by entering the level (linearization "X") and corresponding volume (linearization "Y") for each breakpoint.

(3) If capacity conversion are performed, the full scale of a current output will be changed into a top position from a bottom position. Keep in mind that it differs from the case of level conversion (a sensor measurement region is made into a full scale).

Relation between the linearization "X" and the linearization "Y"
P-60. Level breakpoint X1: Enter the level data X1.
[default : 10.00]

P-61. Level breakpoint X2: Enter the level data X2.
[default : 20.00]

P-62. Level breakpoint X3: Enter the level data X3.
[default : 30.00]

P-63. Level breakpoint X4: Enter the level data X4.
[default : 40.00]

P-64. Level breakpoint X5: Enter the level data X5.
[default : 50.00]

P-65. Level breakpoint X6: Enter the level data X6.
[default : 60.00]

P-66. Level breakpoint X7: Enter the level data X7.
[default : 70.00]

P-67. Level breakpoint X8: Enter the level data X8.
[default : 80.00]

P-68. Level breakpoint X9: Enter the level data X9.
[default : 90.00]

- The range which can be inputted and unit to P-60 to P-68 are as follows.
  ≪programmable range : 0.000 to 9999≫
  [ unit : The unit inputted by P-14 (measurement range) ]
- In addition, data inputs a value including Zero elevation (P-13) and the Span suppression (P-15).
P-69. Breakpoint volume Y0 : Enter the volume data for Zero point.
   [default : 0.000]

P-70. Breakpoint volume Y1 : Enter the volume data for breakpoint X1.
   [default : 1.000]

P-71. Breakpoint volume Y2 : Enter the volume data for breakpoint X2.
   [default : 2.000]

P-72. Breakpoint volume Y3 : Enter the volume data for breakpoint X3.
   [default : 3.000]

   [default : 4.000]

P-74. Breakpoint volume Y5 : Enter the volume data for breakpoint X5.
   [default : 5.000]

P-75. Breakpoint volume Y6 : Enter the volume data for breakpoint X6.
   [default : 6.000]

P-76. Breakpoint volume Y7 : Enter the volume data for breakpoint X7.
   [default : 7.000]

P-77. Breakpoint volume Y8 : Enter the volume data for breakpoint X8.
   [default : 8.000]

P-78. Breakpoint volume Y9 : Enter the volume data for breakpoint X9.
   [default : 9.000]

P-79. Breakpoint volume Y10 : Enter the volume data for Span point.
   [default : 10.000]

- The range which can be inputted and unit to P-69 to P-79 are as follows.
  "programmable range : 0.000 to 9999"
  [unit : The unit inputted by P-14 (measurement range)]
- In addition, data inputs a value including Zero elevation (P-13) and the Span suppression
  (P-15).
8.3.5 CHECK TEST OF OPERATION (P-90 to P-92)


Output should be in proportional to your input value.
Enter desired numeric value within the range of from Zero to Span.
Do not enter below Zero or over Span.

P-91. Auto-test mode: Output current and relay repeatedly from zero and span.

P-92. Display test: The display test of LED is performed.

"P-92" indication and all display on LED are alternately flashed. You can check each one segment by depressing . You can check all display at the same time by depressing .

8.3.6 INITIALIZATION (P-99)

P-99. Initialization: A parameter is returned to a setup of factory shipments.

【default : 1999】

Initialize all parameters to default (factory setting) by entering 1965. It returns to the setting value specified when the contents of a parameter of a monitor unit were specified in advance.
When there is no specification especially, it returns to the initial value of standard of our company.

《programmable range : 0000 to 9999》
### 8.４ ERROR MESSAGE

If an error arises, an error massage appears as follows.

<table>
<thead>
<tr>
<th>Display</th>
<th>Message</th>
<th>Action</th>
</tr>
</thead>
</table>
| **b o u t** | • Cable of input line is broken  
• Input value is overflow | • Wire correctly  
• Check for the rating of input signal.  
• Check for the operation status of the sensor. |
| **E r r 1** | • Improper calibration of Zero or Span | • Re-calibrate. Do not key-in same value for both Zero and Span. |
| **E r r 2** | • Measuring computation error | • Check for all input value to correct. |
| **E r r 3** | • Internal MPU malfunction | • Ask to our Service department. |

To reset system error:

**b o u t** : Wire correctly for the input line, or repair input signal correctly.  
(NOTE: bout does not appear when you choose analog input as 4-20 mA DC.)

**E r r 1** : Depress  +  at the same time, and re-calibrate Zero and Span.  
**E r r 2** : Depress  over 3 seconds, and check for all parameter value.  
**E r r 3** : Depress  +  at the same time to delete error message.  
If unsuccessful, ask to our Service department.
### 8.5 PARAMETER LIST

Please use it as a write-in paper at the time of setting up a parameter.

<table>
<thead>
<tr>
<th>PNo.</th>
<th>Parameter item</th>
<th>[default]</th>
<th>setting value</th>
<th>P-No.</th>
<th>Parameter item</th>
<th>[default]</th>
<th>setting value</th>
</tr>
</thead>
<tbody>
<tr>
<td>P-01</td>
<td>Zero point adjustment</td>
<td>[0.000]</td>
<td></td>
<td>P-50</td>
<td>Selectable tank shape</td>
<td>[ 0 ]</td>
<td></td>
</tr>
<tr>
<td>P-02</td>
<td>Span point adjustment</td>
<td>[100.0]</td>
<td></td>
<td>P-51</td>
<td>Tank dimension D</td>
<td>[1.000]</td>
<td></td>
</tr>
<tr>
<td>P-03</td>
<td>Output for Zero point</td>
<td>[04.00]</td>
<td></td>
<td>P-52</td>
<td>Tank dimension R</td>
<td>[1.000]</td>
<td></td>
</tr>
<tr>
<td>P-04</td>
<td>Output for Span point</td>
<td>[20.00]</td>
<td></td>
<td>P-53</td>
<td>Tank dimension r</td>
<td>[0.100]</td>
<td></td>
</tr>
<tr>
<td>P-05</td>
<td>Resolution</td>
<td>[ 0 ]</td>
<td></td>
<td>P-54</td>
<td>Tank dimension h</td>
<td>[0.500]</td>
<td></td>
</tr>
<tr>
<td>P-06</td>
<td>Display value offset</td>
<td>[0.000]</td>
<td></td>
<td>P-55</td>
<td>Tank dimension D1</td>
<td>[1.000]</td>
<td></td>
</tr>
<tr>
<td>P-07</td>
<td>Elevation function</td>
<td>[0.000]</td>
<td></td>
<td>P-56</td>
<td>Tank dimension D2</td>
<td>[1.000]</td>
<td></td>
</tr>
<tr>
<td>P-08</td>
<td>Cut function</td>
<td>[ 0 ]</td>
<td></td>
<td>P-57</td>
<td>Tank dimension L</td>
<td>[1.000]</td>
<td></td>
</tr>
<tr>
<td>P-09</td>
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<td></td>
<td></td>
<td>P-58</td>
<td>Conversion factor C</td>
<td>[1.000]</td>
<td></td>
</tr>
<tr>
<td>P-10</td>
<td>Measuring mode</td>
<td>[ 0 ]</td>
<td></td>
<td>P-59</td>
<td>Conversion multiplier P</td>
<td>[0.000]</td>
<td></td>
</tr>
<tr>
<td>P-11</td>
<td>Decimal points</td>
<td>[ 1 ]</td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>P-12</td>
<td>Zero elevation</td>
<td>[0.000]</td>
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<td>P-60</td>
<td>Level breakpoint X1</td>
<td>[10.00]</td>
<td></td>
</tr>
<tr>
<td>P-13</td>
<td>Measuring range</td>
<td>[100.0]</td>
<td></td>
<td>P-61</td>
<td>Level breakpoint X2</td>
<td>[20.00]</td>
<td></td>
</tr>
<tr>
<td>P-14</td>
<td>Span suppression</td>
<td>[0.000]</td>
<td></td>
<td>P-62</td>
<td>Level breakpoint X3</td>
<td>[30.00]</td>
<td></td>
</tr>
<tr>
<td>P-15</td>
<td>Damping rate</td>
<td>[5.000]</td>
<td></td>
<td>P-63</td>
<td>Level breakpoint X4</td>
<td>[40.00]</td>
<td></td>
</tr>
<tr>
<td>P-16</td>
<td>Input filter</td>
<td>[ 0 ]</td>
<td></td>
<td>P-64</td>
<td>Level breakpoint X5</td>
<td>[50.00]</td>
<td></td>
</tr>
<tr>
<td>P-17</td>
<td>Fail-safe</td>
<td>[ 0 ]</td>
<td></td>
<td>P-65</td>
<td>Level breakpoint X6</td>
<td>[60.00]</td>
<td></td>
</tr>
<tr>
<td>P-18</td>
<td></td>
<td></td>
<td></td>
<td>P-66</td>
<td>Level breakpoint X7</td>
<td>[70.00]</td>
<td></td>
</tr>
<tr>
<td>P-19</td>
<td>LL alarm relay operation</td>
<td>[ 2 ]</td>
<td></td>
<td>P-67</td>
<td>Level breakpoint X8</td>
<td>[80.00]</td>
<td></td>
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<tr>
<td>P-20</td>
<td>LL alarm relay setting value</td>
<td>[20.00]</td>
<td></td>
<td>P-68</td>
<td>Level breakpoint X9</td>
<td>[90.00]</td>
<td></td>
</tr>
<tr>
<td>P-21</td>
<td>LL alarm relay hysterisis</td>
<td>[0.000]</td>
<td></td>
<td>P-69</td>
<td>Breakpoint volume Y0</td>
<td>[0.000]</td>
<td></td>
</tr>
<tr>
<td>P-22</td>
<td>LL alarm relay ON delay timer</td>
<td>[ 0 ]</td>
<td></td>
<td>P-70</td>
<td>Breakpoint volume Y1</td>
<td>[1.000]</td>
<td></td>
</tr>
<tr>
<td>P-23</td>
<td>LL alarm relay OFF delay timer</td>
<td>[ 0 ]</td>
<td></td>
<td>P-71</td>
<td>Breakpoint volume Y2</td>
<td>[2.000]</td>
<td></td>
</tr>
<tr>
<td>P-24</td>
<td>L alarm relay setting value</td>
<td>[20.00]</td>
<td></td>
<td>P-72</td>
<td>Breakpoint volume Y3</td>
<td>[3.000]</td>
<td></td>
</tr>
<tr>
<td>P-25</td>
<td>L alarm relay hysterisis</td>
<td>[0.000]</td>
<td></td>
<td>P-73</td>
<td>Breakpoint volume Y4</td>
<td>[4.000]</td>
<td></td>
</tr>
<tr>
<td>P-26</td>
<td>L alarm relay ON delay timer</td>
<td>[ 0 ]</td>
<td></td>
<td>P-74</td>
<td>Breakpoint volume Y5</td>
<td>[5.000]</td>
<td></td>
</tr>
<tr>
<td>P-27</td>
<td>L alarm relay OFF delay timer</td>
<td>[ 0 ]</td>
<td></td>
<td>P-75</td>
<td>Breakpoint volume Y6</td>
<td>[6.000]</td>
<td></td>
</tr>
<tr>
<td>P-28</td>
<td>H alarm relay operation</td>
<td>[ 1 ]</td>
<td></td>
<td>P-76</td>
<td>Breakpoint volume Y7</td>
<td>[7.000]</td>
<td></td>
</tr>
<tr>
<td>P-29</td>
<td>H alarm relay setting value</td>
<td>[60.00]</td>
<td></td>
<td>P-77</td>
<td>Breakpoint volume Y8</td>
<td>[8.000]</td>
<td></td>
</tr>
<tr>
<td>P-30</td>
<td>H alarm relay hysterisis</td>
<td>[0.000]</td>
<td></td>
<td>P-78</td>
<td>Breakpoint volume Y9</td>
<td>[9.000]</td>
<td></td>
</tr>
<tr>
<td>P-31</td>
<td>H alarm relay ON delay timer</td>
<td>[ 0 ]</td>
<td></td>
<td>P-79</td>
<td>Breakpoint volume Y10</td>
<td>[10.00]</td>
<td></td>
</tr>
<tr>
<td>P-32</td>
<td>H alarm relay OFF delay timer</td>
<td>[ 0 ]</td>
<td></td>
<td>P-80</td>
<td>Manual test mode</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P-33</td>
<td>HH alarm relay operation</td>
<td>[ 1 ]</td>
<td></td>
<td>P-81</td>
<td>Auto-test mode</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P-34</td>
<td>HH alarm relay setting value</td>
<td>[80.00]</td>
<td></td>
<td>P-82</td>
<td>Display test</td>
<td></td>
<td></td>
</tr>
<tr>
<td>P-35</td>
<td>HH alarm relay hysterisis</td>
<td>[0.000]</td>
<td></td>
<td>P-83</td>
<td>Initialization</td>
<td>[1999]</td>
<td></td>
</tr>
<tr>
<td>P-36</td>
<td>HH alarm relay ON delay timer</td>
<td>[ 0 ]</td>
<td></td>
<td>P-84</td>
<td>Lock</td>
<td>[1965]</td>
<td></td>
</tr>
<tr>
<td>P-37</td>
<td>HH alarm relay OFF delay timer</td>
<td>[ 0 ]</td>
<td></td>
<td>P-85</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
9. MAINTENANCE

Please perform maintenance check once in one year from half a year. However, this frequency is a standard to the last. If there is a difference in operating frequency, temperature, an operating condition, etc., it is necessary to carry out more frequently than this.

9.1 Sensor Periodic Maintenance

The following manual servicing tasks should be carried out on the sensor and monitor 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.

<table>
<thead>
<tr>
<th>Float size</th>
<th>Type of marking</th>
<th>Direction</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\phi \times H80$</td>
<td>'SWITCH ON'</td>
<td>The marked side must be installed the tip of the stem side (bottom)</td>
</tr>
<tr>
<td>marked float</td>
<td>groove</td>
<td>The marked side must be installed the tip of the stem side (bottom)</td>
</tr>
<tr>
<td>another float</td>
<td></td>
<td>Do not prescribe</td>
</tr>
</tbody>
</table>

Fig. 9
(3) Sensor operating (See Fig. 10)

After removing the terminal box cover, check switch actuation as follows.
(a) Remove the connection from the converter unit.
(b) Connect an 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.

![Ohmmeter](image1)

Fig. 10

### 9.2 Monitor Unit Maintenance

(1) Please use a tool and check that the Monitor Unit is being firmly fixed by the attachment implement. When you are loosening, please refasten by the tool.

(2) Please check that the actual measurement of a surface and the display value of a Monitor Unit are in agreement in the state of measurement. When a value shifts, please perform zero span point adjustment, and check that directions are in agreement.

(3) Please call the test parameter of P-90 (or P-91), and check the display value by variable. Since this display value is interlocked with an output current value and an alarm output operate, please also check the state of the load to connect of operation and check that there is no incorrect operation.

(4) Please call the display test of P-92 and check whether there are any abnormalities in the display of LED.
10. STORING

The LR shall be stored under the following conditions when it is not used for a long time.

- Environmental conditions are as follows:
  - The sensor storing temperature range is -20 °C to +70 °C.
  - The monitor unit storing temperature range is -5 °C to +50 °C.
  - Relative humidity is Max. 85% RH.
  - No corrosive gases (such as NH₃, SO₂, Cl₂, etc.).
  - Vibration is low.

- Locate away from rain, condensation, dust and foreign matters.

- Tighten the housing cover and the cable gland. Do not remove the blind plate from the cable gland to protect from dust or moisture. We recommend to put the cable gland pointing down.

- Do not use in the liquid which has metallic substances. Otherwise the LR will cause malfunction.

- When keeping in stock the sensor in your inventory, lay the sensor horizontally. Put the wood piece or adequate materials under the sensor to avoid rolling, bending, scoring the sensor. If the stem length is longer than 2000mm, we highly recommend you to put them 1000mm each.

- Locate away from rain and jetting water. The MP is not a drip-proof construction.

- Do not put things on the level controller. It will deform and damage the product.

REFERENCE: Keep the sensor and the transmitter in sealed plastic bags with desiccant or other moisture proof packing.
11. TROUBLESHOOTING

--- CAUTION ---

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

11.1 Sensor

<table>
<thead>
<tr>
<th>Problems</th>
<th>Causes</th>
<th>Solutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>The indicator is inoperative.</td>
<td>Power supply wiring is loosened or is mistaking wiring.</td>
<td>Wire correctly.</td>
</tr>
<tr>
<td></td>
<td>There are short-circuit in the wire between the sensor and the monitor unit</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Reed switch's contact sticking (*) by noise and wiring mistake.</td>
<td>Because it is necessary to exchange a reed switch, contact to Nohken.</td>
</tr>
<tr>
<td></td>
<td>Reed switch's contact always becomes OFF with the impact.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Float is filled with liquid because the float was damaged by the abrasion and the impact and so on.</td>
<td>Change an installation position into the place with ruffle and little flow. Incidentally, because it is necessary to exchange a float, contact to Nohken.</td>
</tr>
<tr>
<td></td>
<td>Float is filled with liquid because the pin hall occurred to the float by float corroded.</td>
<td>The material doesn't suit measurement liquid. Change the specification of the sensor.</td>
</tr>
<tr>
<td>The indicator swing over.</td>
<td>The wiring is loosened or is mistaking wiring.</td>
<td>Wire correctly.</td>
</tr>
<tr>
<td></td>
<td>There are break in the wire between the sensor and the monitor unit.</td>
<td></td>
</tr>
</tbody>
</table>

(*) : See section 12, Glossary.
### Problems

<table>
<thead>
<tr>
<th>Problems</th>
<th>Causes</th>
<th>Solutions</th>
</tr>
</thead>
<tbody>
<tr>
<td>The indicator shut off at specific point.</td>
<td>Sediment or other foreign matters on float.</td>
<td>Clean float and stem.</td>
</tr>
<tr>
<td>The indicator move irregularly during the measurement.</td>
<td>Sediment or other foreign matters on float. Reed switch's contact is sticking or melting (*) by noise and wiring mistake. Reed switch's contact always becomes OFF with the impact.</td>
<td>Clean float and stem. Because it is necessary to exchange a reed switch, contact to Nohken.</td>
</tr>
<tr>
<td>Not adjustable the adjusting volume.</td>
<td>Power supply wiring is loosened or is mistaking wiring. There are break in the wire between the sensor and the monitor unit.</td>
<td>Wire correctly.</td>
</tr>
<tr>
<td>The monitor unit shut off.</td>
<td>Power supply wiring is mistaking.</td>
<td>There is fear which monitor unit damages. Contact to Nohken.</td>
</tr>
</tbody>
</table>

### 11.2 Monitor Unit

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Possible causes</th>
<th>Remedies</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>No display</td>
<td>Loose terminals of the power supply or miswiring. No or insufficient power supplied.</td>
<td>Wire correctly. Supply or repair the power.</td>
<td>「6.2 Monitor Unit Wiring」</td>
</tr>
<tr>
<td>Reading does not change, but level does</td>
<td>Loose terminals of the output or miswiring. Wrong parameter values entered.</td>
<td>Wire correctly. Enter correctly.</td>
<td>「6.2 Monitor Unit Wiring」 「8.OPERATION」</td>
</tr>
<tr>
<td>No output alarm</td>
<td>Loose terminals of relay alarms or miswiring. Wrong parameter values entered.</td>
<td>Wire correctly. Enter correctly.</td>
<td>「6.2 Monitor Unit Wiring」 「8.OPERATION」</td>
</tr>
<tr>
<td>No output signal</td>
<td>Loose terminals of the output or miswiring.</td>
<td>Wire correctly.</td>
<td>「6.2 Monitor Unit Wiring」</td>
</tr>
<tr>
<td>Output signal does not change, but level does</td>
<td>Wrong parameter values entered.</td>
<td>Enter correctly.</td>
<td>「8.OPERATION」</td>
</tr>
</tbody>
</table>

(*) : See section 12, Glossary.
12. GLOSSARY
The list of explanation of words on this manual is shown below.

| Float          | Light objects that floats on the surface of a liquid.  
|               | It moves as liquid level changes.                      |
| Magnet        | In the part to make a reed switch drive. In the float it enters. |
| Stem          | It is the guide when the float goes up and down and also it is a detection part.  
|               | The part to put a reed switch, a resistance receptacle. |
| Reed Switch   | The magnetic drive type switch which was enclosed with the glass pipe.  
|               | It works in the magnetic force of the magnet.          |
| Float travel- stop | Upper and lower limit to control travel of the float. |
| Total resistance value | The resistance value which is output among the 1-2 terminals of the sensor. |
| Stilling tube | A depression in a container enough to reduce turbulence or flow of the liquid. |
| Spacer        | The flat plate to keep the float from contact with the stilling tube. |
| Sticking      | The malfunction that the reed switch always becomes ON because the excessive electric current flows through the reed switch and the point of tact has melted. |
| Melting       | The malfunction that the reed switch always becomes OFF because the excessive electric current flows through the reed switch and the point of tact has melted. |

**Glossary for Explosion proof**

<table>
<thead>
<tr>
<th>Flameproof Explosion Type</th>
<th>Parts which could ignite are enclosed in a housing which is designed such that transfer of the explosion to the environment is prevented in the event of an ignition.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Explosion Proof Packing Type Cable Gland</td>
<td>A cable gland equipped with a packing and a clamp for use as a flameproof gland.</td>
</tr>
<tr>
<td>Hazardous Area</td>
<td>Areas in which dangerous concentrations of flammable gases/vapors are present or the chances are high. In such areas, explosion protection should be implemented on electrical devices.</td>
</tr>
<tr>
<td>Zone 0</td>
<td>Areas in which dangerous concentrations of flammable gases/vapors are present continuously or long-term under normal operating conditions.</td>
</tr>
<tr>
<td>Zone 1</td>
<td>Areas in which dangerous concentrations of flammable gases/vapors are present occasionally under normal operating conditions.</td>
</tr>
<tr>
<td>Zone 2</td>
<td>Areas in which dangerous concentrations of flammable gases/vapors are present rarely and then only briefly under normal operating conditions.</td>
</tr>
<tr>
<td>Sealing Fitting</td>
<td>The sealing fitting is an accessory for a conduit whose inside is filled with fireproof or flame-resistant material to prevent flowage of flammable gases through the conduit.</td>
</tr>
<tr>
<td>Flexible Fitting</td>
<td>A conduit accessory made flexible to connect an electric device and a fixed conduit.</td>
</tr>
<tr>
<td>Sealing</td>
<td>The sealing is to seal up and block off an area to prevent leakage of flammable gases to non-hazardous areas.</td>
</tr>
</tbody>
</table>
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