INSTRUCTION MANUAL

FOR

MAGNETOSTRICTIVE LEVEL MEASUREMENT

SENSOR MODEL: MS 700
MONITOR UNIT MODEL: MS 2000
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.
<table>
<thead>
<tr>
<th>CAUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>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 minor corrosion.</strong></td>
</tr>
<tr>
<td><strong>Hold the stem very close to the mounting point, when carrying, installing, and removing. If held by the terminal box, it may be taken off from the flange or plug, and the product may be damaged by dropping.</strong></td>
</tr>
</tbody>
</table>
| **The product is 50cm or longer**  
The product shall be kept horizontally. The product and other goods could be damaged, and minor injury may occur by falling. |
| **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 provided, the contact may be damaged. |
| **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.
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1. PURPOSE OF USE

The MS series is designed for level detection of liquids such as water, oil, chemicals, solvents, and so on. It is used for continuous process control and precise inventory control.

2. INTRODUCTION

2.1 Description

The MS continuous level measuring system is constructed from the sensor, Model MS700 and the remote Monitor Unit, Model MS2000 to measure the liquid level in the container.

The sensor is mounted onto the container by the mounting Plug. As the float rises or falls on the stem, continuous electrical signal, 4-20mA DC, is transmitted in proportional to the liquid level.

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

2.2 Principle of Operation

The MS consists of a magnetostrictive wire in the stem and a permanent magnet inside the float. Once a pulse current is induced from the end of the magnetostrictive wire, a tubular magnetic field emanates. As the float travels, torsional vibration is launched by the interaction between the float magnetic field and the magnetostrictive wire.

This is so-called Wiedeman effect. The float position is measured by measuring the lapse of time from the launching of the torsional vibration to the arrival to the pick-up.

2.3 Block Diagram

( * ):See section 12 on page 46 for the word explanation.
2.4 Features of the Monitor Unit

(1) Available wide power supply, 100 to 240 V AC.
(2) Programmable relay outputs for alarm orientation (High and Low), hysteresis, and fail-safe function.
(3) EEPROM stores all parameter value permanently.
(4) Volume conversion for volumetric indications.
(5) Easy-to-read graphic indication and 4-digit LED.
(6) Built-in test circuit for signal (4-20mA DC).
(7) Power supply, inputs and outputs are isolated.

3. SPECIFICATIONS

3.1 Model Numbering

3.1.1 Model Name of the Sensor

M S 7 0 0 0

<table>
<thead>
<tr>
<th>MODEL</th>
<th>MATERIALS</th>
</tr>
</thead>
<tbody>
<tr>
<td>S</td>
<td>304 Stainless Steel 8</td>
</tr>
<tr>
<td></td>
<td>Float:316 Stainless Steel</td>
</tr>
<tr>
<td>S6</td>
<td>316 Stainless Steel 8</td>
</tr>
<tr>
<td>V</td>
<td>PVC 8</td>
</tr>
<tr>
<td></td>
<td>Float:PP</td>
</tr>
<tr>
<td>P</td>
<td>PP 8</td>
</tr>
<tr>
<td>F2</td>
<td>PVDF 8</td>
</tr>
</tbody>
</table>

3.1.2 Model Name of the Monitor Unit  M S 2 0 0 0

* See section 12 on page 46 for the word explanation.
### 3.2 Standard Specifications

#### 3.2.1 Specifications of the Sensor

<table>
<thead>
<tr>
<th>MODEL</th>
<th>Specific Gravity</th>
<th>MS700</th>
</tr>
</thead>
<tbody>
<tr>
<td>OPERATION CHARACTERISTICS</td>
<td>SUS</td>
<td>0.8 or more</td>
</tr>
<tr>
<td></td>
<td>PVC</td>
<td>0.85 or more</td>
</tr>
<tr>
<td></td>
<td>PP</td>
<td>0.9 or more</td>
</tr>
<tr>
<td></td>
<td>PVDF</td>
<td></td>
</tr>
</tbody>
</table>

| ELECTRICAL CHARACTERISTIC | Power Source | Specially for MS2000 |
| | Output Signal | Specially for MS2000 |

| MECHANICAL CHARACTERISTIC | Pressure | SUS:2MPa, PVC、PP、PVDF:1MPa |
| | (Except a mounting part) |
| | SUS | -10 ～ +80 □ |
| | PVC | -5 ～ +50 □ |
| | PP | -10 ～ +80 □ |
| | PVDF | -10 ～ +80 □ |

| ENVIRONMENT | Working Temperature | Wetted Parts | SUS | -10 ～ +80 □ |
| | | PVC | -5 ～ +50 □ |
| | | PP | -10 ～ +80 □ |
| | | PVDF | -10 ～ +80 □ |

| CONSTRUCTION | IP 65 |

| PHYSICAL | Materials | Wetted Parts | Section 3.1.1 |
| | Housing | 304 Stainless Steel |
| | Head | 304 Stainless Steel |
| | Connector | PA |
| | DIN terminal box | PA |
| | Gasket | NBR |

| Dimensions | Plug | G 1 |
| | Stem | □ 8 |

| Float | SUS | □ 28 □ H27 |
| | PVC | □ 25 □ H25 |
| | PP | |
| | PVDF | □ 25 □ H25 |

| Connecting Cable | 3C □ V coaxial cable |
| Separated Length | 500 m Max. □ BC-2V □ |

□ 1 Connecting cable : Customer arrangement
3.2.2 Specifications of the Monitor Unit

<table>
<thead>
<tr>
<th>Model</th>
<th>MS2000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operation characteristics</td>
<td>Accuracy: ±1 mm Input / Output: ±1 mm ±1 digit Display: -999 ~ 9999</td>
</tr>
<tr>
<td></td>
<td>Digits: -999 ~ 9999 Sampling cycle: Approximately 0.12 seconds</td>
</tr>
<tr>
<td>Electrical characteristics</td>
<td>Power supply: 100 ~ 240 V AC ± 10 %, 50/60 Hz Power consumption: 20 VA Max. Power supply for sensor: 15 V DC Input signal: Specially for MS700 Output signal: 4 ~ 20 mA DC Allowable resistive load: 600 Ω Max.</td>
</tr>
<tr>
<td></td>
<td>Alarm Number of contact: 4 alarm points (2 points × 2 circuits) transfer (common use between HH and H, LL and L) Contact rating: 240 V 3 A AC (resistive load) 30 V 3 A DC (resistive load)</td>
</tr>
<tr>
<td></td>
<td>Withstand voltage test: 1500 V AC for one minute (between power supply terminal and earth terminal) 500 V AC for one minute (between output terminal and input terminal) Insulation resistance test: More than 100 MΩ at 500 V DC (between power supply terminal to earth terminal) More than 50 MΩ at 250 V DC (between output terminal and input terminal)</td>
</tr>
<tr>
<td>Environment</td>
<td>Working temperature: -5 ~ +50 °C Working humidity: 85 % RH Max. (No condensing)</td>
</tr>
<tr>
<td>Physical</td>
<td>Material body: ABS front panel: Polyester fittings: ABS mounting screws: SUS Dimension: (H × W × D): 96 mm × 96 mm × 132 mm Except of fittings: (Depth of the panel is 120 mm) Mass: 560 g (except of fittings) Mounting: Panel mount Cut out: in conjunction with DIN 43 700 - 96 × 96 (panel cut-out: 92 × 92 mm)</td>
</tr>
</tbody>
</table>

*1: Accuracy combined the sensor and the Monitor Unit.
4. HANDLING CAUTIONS

4.1 Sensor handling cautions

Following shall be observed when handling the sensor. Otherwise, malfunction or accident may occur.

- 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 500 mm, we highly recommend you to put them 250 mm each.

- When painting the sensor, 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. (\(\text{NH}_3\), \(\text{SO}_2\), \(\text{Cl}_2\), 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.

- Do not use in the liquid which has metallic substances. Otherwise the sensor will cause malfunction.
4.2 Monitor Unit handling cautions

Following shall be observed when handling the Monitor Unit. Otherwise, malfunction or accident may occur.

• Avoid physical shock. Dropping, throwing or bumping will damage the Monitor Unit.

• 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 earthing (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

5.1 Sensor Unpacking

**CAUTIONS**

- The MS700 is not an explosion-proof construction, do not use where flammable gas, explosive gas or the vapor exists.

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

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

- 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

5.2.1 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.

5.2.2 Mounting
Install the sensor to the container using appropriate tool.
If there is a pressure in the container, the appropriate seal gasket shall be provided.

- See section 12 on page 46 for the word explanation.
5.3 Monitor Unit Unpacking

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

(1) Avoid physical shock. Dropping, throwing or bumping will damage the Monitor Unit.

(2) Do not put things on the Monitor Unit. It will deform and damage the product.

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

(4) After unpacking, inspect the Monitor Unit for shipping damage. If there is evidence of damage, notify the carrier and us immediately.

5.4 Monitor Unit Installation

5.4.1 Check of attachment place

Provide ample space for maintenance and inspection. Make sure the following to avoid malfunction.

(1) Ambient temperature range is from -5 ºC to +50 ºC, and humidity is under 85% RH.

(2) The weight of the Monitor Unit is 560 g. Provide Appropriate reinforce for thin panels if necessary.

(3) Locate away from rain and jetting water. The Monitor Unit is not waterproof.
5.4.2 Installation

(1) Drill the mounting panel to mount the Monitor Unit. See the following figure for dimensions and mounting pitches.

(2) Insert the Monitor Unit from the front panel.

(3) Install mounting brackets into the body of the Transmitter from the back side of the mounting panel. See the following figure for mounting procedures.

(4) Tighten mounting brackets with the Philips (+) driver surely.
6. WIRING

6.1 Preparation of the Sensor

Turn off the power supply.

**WARNING**

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

**CAUTIONS**

The cable gland must be properly fitted to preserve IP65 after wiring. In case of the flexible conduit, size of screw is G 1/2. Sealing compound shall be applied onto the screw of the cable inlet to protect water and dust penetration.

As for wiring of the sensor and the transmitter, please use the 3C-2V coaxial cable. Do not lay it in parallel with power cable or control cable for the magnetic switch.

Connect an effective earth wire to the "E" terminal. Otherwise, measuring signal will be unstable or fluctuated due to noise problem.

Ensure that there is no metallic dust in the DIN terminal box.
6.2 Preparation of the Monitor Unit

Turn off the power supply during wiring.

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

- To prevent electrical shock, the earth terminal should be connected to the JIS class D earthing less than 100 ohm.

- Lay the analog output cable away from the power line to prevent noise. Should be done.

- The shield of the input signal cable should be connected to the earth at the sensor side. The earth connection of output and input signal cable shield should be one point.

- Make sure that the supply voltage is sufficient, within 100 to 240 V AC range. Otherwise, the Monitor Unit may cause malfunction or damage.

- Output load (resistive) is 600 ohm maximum. Excessive load cause malfunction.

- Contact rating for relay output is 240 V 3 A AC or 30 V 3A DC. Provide external relays when exceeding.

- When electrical surges are produced, provide appropriate surge absorber or protective circuit.

- Reinstall the protective cover which is placed over the terminal plate to avoid electric shock.
Wiring for sensor

6.3.1 Component of DIN terminal box

6.3.2 Terminal arrangement

6.3.3 Installation of cable

In case of the cable gland, applicable cable diameter is $5 \text{ to } 9.5$. 
Wiring for input signal

Sensor : MS700

Ground (JIS class D or higher)

Monitor Unit : MS2000

Power
100-240V AC
50/60Hz
1W 1.25mm²

Ground
(JIS class D or higher)

Output signal
4-20mA DC
Load resistance 600Ω Max.
Cable 1-2.5mm²

Normal open terminal for L Alarm
Normal Close terminal for L Alarm
Normal open terminal for LL Alarm
Normal close terminal for LL Alarm
Contact terminal for LL or L Alarm
Contact terminal for HH or H Alarm

Contact rating
240V 3A AC (Resistive load)
30V 3A DC (Resistive load)

*: Recommended cable
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 Operation</th>
<th>Without fail-safe mode Operation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Up ON</td>
<td>Down On</td>
</tr>
<tr>
<td><strong>ON</strong></td>
<td>Set point or higher</td>
<td></td>
<td>○</td>
</tr>
<tr>
<td><strong>ON</strong></td>
<td>Set point or lower</td>
<td>○</td>
<td>○</td>
</tr>
<tr>
<td><strong>OFF</strong></td>
<td></td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

6.5 Operational check

Ensure the Monitor Unit operation in the test stage. If the operation is unsuccessful, check wiring, read this manual again, or contact our sales department.
7. NOMENCLATURE

7.1 Sensor parts Name

<table>
<thead>
<tr>
<th>No.</th>
<th>Name</th>
<th>No.</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>DIN Terminal box</td>
<td>2</td>
<td>Plug</td>
</tr>
<tr>
<td>2</td>
<td>Connecter</td>
<td>3</td>
<td>Stem</td>
</tr>
<tr>
<td>3</td>
<td>Earth terminal</td>
<td>4</td>
<td>Float</td>
</tr>
<tr>
<td>4</td>
<td>Housing</td>
<td>5</td>
<td>Float travel stop</td>
</tr>
</tbody>
</table>

![Diagram of sensor parts](image-url)
### 7.2 Control panel Layout of the Monitor Unit

![Control panel Layout of the Monitor Unit](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>H</td>
<td>Lights while H set.</td>
</tr>
<tr>
<td></td>
<td>L</td>
<td>Lights while L set.</td>
</tr>
<tr>
<td></td>
<td>LL</td>
<td>Lights while LL set.</td>
</tr>
<tr>
<td>6</td>
<td>Mode OP.</td>
<td>Lights while measurement mode.</td>
</tr>
<tr>
<td></td>
<td>ADJ.</td>
<td>Lights while adjustment mode.</td>
</tr>
<tr>
<td></td>
<td>(Without zero point mode and span point adjustment mode.)</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>ALARM</td>
<td>Lights while alarm setting mode.</td>
</tr>
<tr>
<td>8</td>
<td>TEST</td>
<td>Lights while test mode.</td>
</tr>
<tr>
<td>9</td>
<td>ZERO</td>
<td>Lights while zero point adjustment mode.</td>
</tr>
<tr>
<td>10</td>
<td>SPAN</td>
<td>Lights while span point adjustment mode.</td>
</tr>
<tr>
<td>11</td>
<td>Unit</td>
<td>Display indication unit.</td>
</tr>
<tr>
<td></td>
<td>(Choose a use unit from the unit seal and set it.)</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Variable data</td>
<td>Display process value, characters identifying the data being set and error massages.</td>
</tr>
<tr>
<td>13</td>
<td>Parameter data</td>
<td>Display parameter data.</td>
</tr>
<tr>
<td>14</td>
<td>Liquid level / contents</td>
<td>Display liquid level / contents</td>
</tr>
<tr>
<td>15</td>
<td>Alarm identification</td>
<td>Display alarm identification.</td>
</tr>
</tbody>
</table>
8. OPERATION

Monitor Unit's 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 MS 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**

- Various setting mode (ADJ.)
- Alarm setting mode (ALARM)
- Test mode (TEST)
- Zero and Span point adjustment mode

**Setting mode**

- Setting mode
- Various setting mode (ADJ.)
- Alarm setting mode (ALARM)
- Test mode (TEST)
- Zero and Span point adjustment mode

**Push**

- for 3sec.
- for 3sec.

**Lighting**

- OP.
8.2 Setting of the 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
- Remove the sensor from the tanks or vessels. (It is not necessary to remove the sensor, if the float can be moved to ZERO and SPAN points at the inside of the tanks or vessels.)
- Move the float to the lowest position, and set ZERO calibration.
- Move the float to the highest position, and set SPAN calibration.
- Reinstall the sensor to the measuring condition.

The setting change procedure (The setting change procedure of the above □ and □ )

<table>
<thead>
<tr>
<th>(1) It begins at the measurement mode.</th>
<th><img src="image" alt="Measurement mode" /></th>
</tr>
</thead>
<tbody>
<tr>
<td>□ push 3sec.</td>
<td>&quot;OP.&quot; lights.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>(2) It pushes 3sec. &quot;ADJ.&quot; blinks.</th>
<th><img src="image" alt="Setting mode" /></th>
</tr>
</thead>
<tbody>
<tr>
<td>□ push 3sec.</td>
<td>&quot;ADJ.&quot; blinks.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>(3) It pushes 3sec. &quot;OP.&quot; blinks.</th>
<th><img src="image" alt="Setting mode" /></th>
</tr>
</thead>
<tbody>
<tr>
<td>□ push &quot;OP.&quot; blinks.</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>(4) It pushes 3sec. &quot;P-01&quot; blinks. (Zero point adjustment)</th>
<th><img src="image" alt="Setting mode" /></th>
</tr>
</thead>
<tbody>
<tr>
<td>□ push 3sec.</td>
<td>&quot;P-01&quot; blinks.</td>
</tr>
<tr>
<td>(5) It pushes edio. The value of the zero point set up now is displayed.</td>
<td></td>
</tr>
<tr>
<td>-------------------</td>
<td>-------------------</td>
</tr>
<tr>
<td>(5) It pushes edio. The value of the zero point set up now is displayed.</td>
<td></td>
</tr>
<tr>
<td>( If there is not a process which zero adjusted before in zero position, &quot;0.000&quot; will blink. )</td>
<td></td>
</tr>
</tbody>
</table>

| (6) Move the float to the lowest position. |
|-------------------|-------------------|-------------------|
| (6) Move the float to the lowest position. |

| (7) In the case except "0.000", push and change  or  into "0.000". |
|-------------------|-------------------|-------------------|
| {If being "0.000" in (5), this work is unnecessary.} |

| (8) It pushes  while the float sets at the lowest position. |
|-------------------|-------------------|-------------------|
| 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  . |
|-------------------|-------------------|-------------------|
| "P-02" blinks. (Span point adjustment) |

| (10) It pushes  . 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) Move the float to the highest position. |
|-------------------|-------------------|-------------------|

| (12) In the case except "100.0", push and change  or  into "100.0". |
|-------------------|-------------------|-------------------|
| {If being "100.0" in (10), this work is unnecessary.} |
(13) It pushes \( \square \) while the float sets at the highest position.
Then, span point signal was memorized at the memory and that "P-02" will be in a blink state. (Span point adjustment's completion)

Float is the highest position

\( \square \) push \( \square \)

Span point signal was memorized at the memory
"P-02" blinks.

\( \square \) push \( \square \) or \( \square \)

"OP." blinks.

(14) It pushes \( \square \) or \( \square \).
"OP." blinks.

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

Measurement mode
"P-02" blinks.
"OP." lights.

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.

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

Setting contents
\( \square \) 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.

Measurement mode
"OP." lights.

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

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

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

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

(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)

(8) It pushes .
"ALARM" blinks.

(9) It pushes or .
"OP." blinks.

(10) When pushing , it returns to the measurement mode.
(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 → 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,  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 keylock will be canceled if 1965 is inputted into a setting value.

《programmable range : 0000 → 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 span point input value of P-02.) Refer to the 8.4 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 → 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 8.4 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 → 200.0》
P-03. Output for Zero point: The output current value in a zero point position is set up.
[default: 04.00]

{programmable range: 02.00 ← 22.00  [unit: mA DC]}

P-04. Output for Span point: The output current value in a span point position is set up.
[default: 20.00]

{programmable range: 02.00 ← 22.00  [unit: mA DC]}

P-05. 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 ← 2000}

P-06. 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>before</th>
<th>after</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zero point display 0.000 output 4.00mA</td>
<td>Zero point display -50.00 output 4.00mA</td>
</tr>
<tr>
<td>Span point display 100.0 output 20.00mA</td>
<td>Span point display 50.00 output 20.00mA</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) + Span suppression(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 8.4 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 on 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 ← 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 output 4.00mA</td>
</tr>
<tr>
<td>Span point</td>
<td>display 100.0 output 20.00mA</td>
</tr>
<tr>
<td>It is set up using P-07 as -1.000.</td>
<td>Zero point display -1.000 output 3.84mA</td>
</tr>
<tr>
<td>Span point display 99.00 output 19.84mA</td>
<td></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.
- 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: -9999 ～ 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.

- 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 ～ 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 \(\sim\) 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 \(\sim\) 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. Please input an input unit on a surface panel.

( programmable range : 0.000 ← 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. Please input an input unit on a surface panel.

( programmable range : 0.000 ← 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 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. Please input an input unit on a surface panel.

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

Relation between a parameter setting value and the display value range
P-16. Damping rate : It is useful to delete an excessive change over pre-setting value to avoid accidental outputs.

- Programmable range : 0.001 ~ 100.0
- Unit : % (Rate to the full scale of an input signal)

P-17. Input filter : Input signal equalization.

- Programmable range : 0, 1, 3, 5, 7

8.3.2 Alarm output operation (P-19 ~ 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.
P-19. Fail-safe : Selectable fail-safe operation mode. (Refer to 6.3)
   【 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 ∼ 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 : -999 ∼ 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 ∼ 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 ∼ 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 ∼ 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 ～ 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: -999 ～ 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 ～ 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 ～ 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 ～ 30)*
  *(unit: seconds)*
【 default : 1 】
   0 : OFF (empty)
   1 : Close ON rising (normally open)
   2 : Close ON falling (normally closed)

   ※ programmable range : 0 ～ 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 : -999 ～ 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 ～ 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 ～ 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 ～ 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  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 : -999  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  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  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  30 》 [ unit : seconds ]
8.3.3 Volume conversion (P-50 → 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.

- Spherical bottom
- Conic bottom
- Pyramidal bottom
- Slanted bottom
- Parabolic ends
- Flat end
- Sphere

The tank form figure and each input size position in capacity conversion

(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 ～ 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 ～ 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 ～ 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 ← 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 ← 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 ← 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 ← 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 ← 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 ← 9999 ≫

P-59. Conversion multiplier P : Enter the multiplier the conversion value must be multiplied to \(1\times10^p\).
   【 default : 0.000 】
   
   ≪ programmable range : 0.000 ← 9999 ≫
8.3.4 Linear profile (P-60 → 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 → 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 : 10.00 ]

   • The range which can be inputted and unit to P-69 to P-79 are as follows.
     - Programmable range : 0.000 ~ 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 ~ 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 \[\text{[1]}\]. You can check all display at the same time by depressing \[\text{[2]}\].

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 ~ 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>
<tbody>
<tr>
<td><code>b o t l</code></td>
<td>Cable of input line is broken</td>
<td>• Check for the rating of input signal.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Check for the operation status of the sensor.</td>
</tr>
<tr>
<td><code>f o t l</code></td>
<td>Unusual torsional vibration</td>
<td>• Make sure the float is in the place.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Make sure the float is in the normal condition.</td>
</tr>
<tr>
<td><code>e r r 1</code></td>
<td>Improper calibration of Zero or Span</td>
<td>• Re-calibrate. Do not key-in same value for both Zero and Span.</td>
</tr>
<tr>
<td><code>e r r 2</code></td>
<td>Measuring computation error</td>
<td>• Check for all input value to correct.</td>
</tr>
<tr>
<td><code>e r r 3</code></td>
<td>Internal MPU malfunction</td>
<td>• Ask to our Service department.</td>
</tr>
</tbody>
</table>

To reset system error:

- **Err 1**: Depress `+` at the same time, and re-calibrate Zero and Span.
- **Err 2**: Depress over 3 seconds, and check for all parameter value.
- **Err 3**: Depress `+` at the same time to delete error message.

If unsuccessful, ask to our Service department.
9. MAINTENANCE AND INSPECTION

9.1 Maintenance and inspection of the sensor

Remove the sensor from the container before maintenance. See section 5, Handling Notes.
Keep the ample space for maintenance.

9.1.1 Removing

(1) Turn off the power supply to the Monitor Unit.

WARNING
To avoid personal injury, leakage current or short circuit, the power supply shall be always turned off while wiring.

(2) Remove the DIN terminal box. Disconnect all wires and the flexible conduit.

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

(3) Loosen the plug and remove the sensor carefully from the container.

(4) Put the sensor on the flat and ample space.

9.1.2 Maintenance and Inspection

Inspect the sensor semi-annually or annually. Since inspection intervals varies with applications and process conditions such as pressure, temperature etc., we recommends periodical inspection.

(1) Check for and replace damaged and collapsed parts.

(2) Clean contaminant or sticky.

(3) Clean dirt, dust and moisture from the DIN terminal box.

(4) Tighten float travel stops using appropriate tool.
9.1.3 Re-Installation
   See section 5.2, Sensor Installation (page 9).

9.1.4 Wiring
   See section 6, Wiring (page 12 and 16).

9.1.5 Replacement Parts and Cycle
   Replace parts if the following symptoms occur. Use a genuine name brand parts carefully.

9.1.6 Replacement Parts
   Float: When it is damaged, collapsed or corroded.

9.1.7 Calibration
   See section 8, Operation (page 19 to 42).

9.2 Maintenance and inspection of the Monitor Unit
   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.

   (1) Please use a tool and check that the Transmitter 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 Transmitter 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 and 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. STORAGE

10.1 Storage of the sensor

(1) The sensor shall be stored under the following conditions when it is not used for a long time.

   Environmental conditions are as follows:
   - temperature: -5 ～ + 50 °C
   - humidity: 85 % RH Max. (No condensing)
   - No excessive vibration.
   - No corrosive atmosphere such as NH₃, SO₂, Cl₂ etc.

(2) Locate away from rain, condensation, dust and foreign matters.

(3) Tighten the DIN terminal box 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.

(4) Do not use in the liquid which has metallic substances. Otherwise the MS will cause malfunction.

(5) 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 500 mm, we highly recommend you to put them 250 mm each.

REFERENCE: Keep the sensor in sealed plastic bags with desiccant or other moisture-proof packing.

10.2 Storage of the Monitor Unit

(1) The Monitor Unit shall be stored under the following conditions when it is not used for a long time.

   Environmental conditions are as follows:
   - temperature: -5 ～ + 50 °C
   - humidity: 85 % RH Max. (No condensing)
   - No excessive vibration.
   - No corrosive atmosphere such as NH₃, SO₂, Cl₂ etc.

(2) Locate away from rain and jetting water. The transmitter is not a drip-proof construction.

(3) Do not put things on the level controller. It will deform and damage the product.

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

### CAUTION

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

<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.</td>
<td>Wire correctly.</td>
<td>6.WIRING P12 ～ P16</td>
</tr>
<tr>
<td></td>
<td>No or insufficient power supplied.</td>
<td>Supply or repair the power.</td>
<td></td>
</tr>
<tr>
<td>Reading does not change, but level does</td>
<td>Loose terminals of the output or miswiring.</td>
<td>Wire correctly.</td>
<td>6.WIRING P12 ～ P16</td>
</tr>
<tr>
<td></td>
<td>Wrong parameter values entered.</td>
<td>Enter correctly.</td>
<td>8.OPERATION P19 ～ P42</td>
</tr>
<tr>
<td>No output alarm</td>
<td>Loose terminals of relay alarms or miswiring.</td>
<td>Wire correctly.</td>
<td>6.WIRING P12 ～ P16</td>
</tr>
<tr>
<td></td>
<td>Wrong parameter values entered.</td>
<td>Enter correctly.</td>
<td>8.OPERATION P19 ～ P42</td>
</tr>
<tr>
<td>No output signal</td>
<td>Loose terminals of the output or miswiring.</td>
<td>Wire correctly.</td>
<td>6.WIRING P12 ～ P16</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 P19 ～ P42</td>
</tr>
</tbody>
</table>

## 12. GLOSSARY

The list of explanation of words on this manual is shown below.

<table>
<thead>
<tr>
<th>Term</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Float</td>
<td>Light objects that floats on the surface of a liquid. It moves as liquid level changes.</td>
</tr>
<tr>
<td>Stem</td>
<td>A protective outer pipe for the magnetostrictive wire, and supports the float movement.</td>
</tr>
<tr>
<td>Magnet</td>
<td>Metallic piece in the float with a magnetic field to distort the magnetostrictive wire.</td>
</tr>
<tr>
<td>Magnetostrictive wire</td>
<td>Nickel wire twisted by the intersection of magnetic field from float magnets. This twist is detected as return pulse to determine the level measurement.</td>
</tr>
<tr>
<td>Float travel-stop</td>
<td>Upper and lower limit to control travel of the float.</td>
</tr>
<tr>
<td>Stilling tube</td>
<td>A depression in a container enough to reduce turbulence or flow of the liquid.</td>
</tr>
<tr>
<td>Spacer</td>
<td>The flat plate to keep the float from contact with the stilling tube.</td>
</tr>
</tbody>
</table>