INSTRUCTION MANUAL

FOR

VIBRATING LEVEL SENSOR
(SEPARATION TYPE)

MODEL: VLS12
VLS22
(SENSOR)

MODEL: VLS2200
(CONTROLLER)
Read and understand this manual for safely 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 which model is mentioned on 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 followings are the description of the terms in this manual.

| ![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. |
| ![Prohibited] | Indicates prohibited matter. The explanation with this mark shall be followed. |
| ![Instructed] | Indicates 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 is occurred. If installed, the flammable gas or vapor may be ignited, and serious disaster may be occurred. 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 be occurred. (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 be occurred.

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

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

### 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 minor 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.
<table>
<thead>
<tr>
<th>CAUTION</th>
</tr>
</thead>
<tbody>
<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>
<tr>
<td>Check and deeply consider the chemical compatibility for material of product in advance.</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>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>
<tr>
<td>Earth terminal shall be grounded to JIS Class D ground (earth resistance less than 100 Ω ). If not grounded, electric shock may occurred by any accident.</td>
</tr>
<tr>
<td>Provide arrester or surge absorber to avoid electrical impact such as lightning and static electricity. If not provide, the product and connected device May be malfunctioned, damaged, and fired, or miner injury and electric shock may be occurred.</td>
</tr>
<tr>
<td>In case of connecting inductive or lamp load to the product.</td>
</tr>
<tr>
<td>Provide protective circuit to the load to avoid over voltage and over current. If not provide, the contact may be damaged.</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. 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 "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.
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1. PURPOSE OF USE
The vibrating level sensor, model VLS12, 22 is used for level detection of solids, fine powders, granular, pellets and sediments under liquids such as sludge and sand.
The output signal from the sensor is used for the alarm and/or control of valves, pumps, pneumatic systems, and so on.
Do not use in any other applications.

2. DESCRIPTION

2.1 DESCRIPTION
The sensor is installed on the hopper by the mounting flange or the mounting plug. When the detecting pipe(*) is covered with solids, vibration is damped. The electronic circuit detects the damp of vibration and converts into a relay output.

2.2 PRINCIPLE OF OPERATIONS
The detecting pipe vibrates by installing magnet and electromagnet in the detecting pipe. Covered with solids damps vibration of the detecting pipe. The current which flows on an electromagnet changes with the states of vibration. The electronic circuit detects the change of the current which flows on an electromagnet and converts into a relay output.

* : See section 12 on page 25 for the word explanation.
3. SPECIFICATIONS

3.1 MODEL NUMBERING

Model numbering is shown on the nameplate as below:

3.1.1 Sensor:

<table>
<thead>
<tr>
<th>Code</th>
<th>Length of detecting rod and extension part</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>270 mm : Compact type</td>
</tr>
<tr>
<td>22</td>
<td>330 to 4000 mm : Extension pipe type</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Code</th>
<th>Mounting type</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>Threaded type</td>
</tr>
<tr>
<td>F</td>
<td>Flange type</td>
</tr>
<tr>
<td>G</td>
<td>Flange with protective shield(*) (guard) type</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Code</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nothing</td>
<td>Normal type</td>
</tr>
<tr>
<td>T2</td>
<td>Heat-resistant type</td>
</tr>
</tbody>
</table>

3.1.2 Controller: VLS2200

VLS2200T2 [Heat-resistant type]

* : See section 12 on page 25 for the word explanation.
3.2 STANDARD SPECIFICATIONS

<table>
<thead>
<tr>
<th>Model</th>
<th>VLS12N, F, G, (T2)</th>
<th>VLS22N, F, G, (T2) (SENSOR)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring object</td>
<td>Powder, Granular materials, Pellets, Underwater sediments</td>
<td></td>
</tr>
<tr>
<td>Sensitivity</td>
<td>Bulk density : approx. 0.2 g/cm^3 min.</td>
<td></td>
</tr>
<tr>
<td>Vibration frequency</td>
<td>Approx. 300 to 500 Hz</td>
<td></td>
</tr>
<tr>
<td>Withstand pressure</td>
<td>VLS12(T2) : 2 MPa Max. (Except a mounting part)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>VLS22 : 2 MPa Max. (Except a mounting part)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[VLS22 T2 : 1 kPa Max. (Except a mounting part)]</td>
<td></td>
</tr>
<tr>
<td>Concentrated load</td>
<td>0.55 kN Max.</td>
<td></td>
</tr>
<tr>
<td>Operating temperature</td>
<td>Detecting part : -20 to +150°C (Get rid of dew.)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[T2:-20 to +250°C (Get rid of dew)]</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Housing : -20 to + 80°C (Get rid of dew.)</td>
<td></td>
</tr>
<tr>
<td>Operating humidity</td>
<td>95 % RH Max.</td>
<td></td>
</tr>
<tr>
<td>Construction</td>
<td>Detecting part : IP68 or equivalent</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[VLS22 T2 : IP54 or equivalent]</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Housing : IP65 or equivalent</td>
<td></td>
</tr>
<tr>
<td>Materials</td>
<td>Detecting part</td>
<td></td>
</tr>
<tr>
<td></td>
<td>VLS12(T2) : 304 stainless steel</td>
<td></td>
</tr>
<tr>
<td></td>
<td>VLS22 : 304 stainless steel, Silicone</td>
<td></td>
</tr>
<tr>
<td></td>
<td>[VLS22 T2 : 304 stainless steel, PFA]</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Housing : ADC12 (Silver hammerton coating)</td>
<td></td>
</tr>
<tr>
<td>Cable inlet</td>
<td>G 1/2 or equivalent</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Model</th>
<th>VLS2200 (T2) (CONTROLLER)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Indication</td>
<td>By Green LED for Power status</td>
</tr>
<tr>
<td></td>
<td>By Red LED for Relay status</td>
</tr>
<tr>
<td></td>
<td>By Yellow LED for Self-diagnostic status</td>
</tr>
<tr>
<td>Initial reset time</td>
<td>Approx. 15 sec.</td>
</tr>
<tr>
<td>Power</td>
<td>100 to 120 V ±10% AC, 200 to 240 V ±10% AC 50/60 Hz</td>
</tr>
<tr>
<td>Power consumption</td>
<td>5 VA Max.</td>
</tr>
<tr>
<td>Output</td>
<td>Relay contact 1 transfer. Fail-safe switch.</td>
</tr>
<tr>
<td></td>
<td>Switching delay time: Turn-on, approx. 3 to 5 sec.</td>
</tr>
<tr>
<td></td>
<td>Turn-off, approx. 3 to 5 sec.</td>
</tr>
<tr>
<td>Contact rating</td>
<td>250 V 3 A AC, 30 V 3 A DC (Resistive load)</td>
</tr>
<tr>
<td>Diagnosis function</td>
<td>Insulated NPN open collector</td>
</tr>
<tr>
<td></td>
<td>26.4V DC Max. 30 mA Max. (Residual voltage 1 V Max.)</td>
</tr>
<tr>
<td>Withstand voltage</td>
<td>1500 V AC, 1 minute.</td>
</tr>
<tr>
<td></td>
<td>(Between housing and both relay contact and power terminals)</td>
</tr>
<tr>
<td>Insulation resistance</td>
<td>More than 100 MΩ 500 V DC</td>
</tr>
<tr>
<td></td>
<td>(Between housing and both relay contact and power terminals)</td>
</tr>
<tr>
<td>Operating temperature</td>
<td>-20 to +60°C (Get rid of dew.)</td>
</tr>
<tr>
<td>Operating humidity</td>
<td>95 % RH Max.</td>
</tr>
<tr>
<td>Construction</td>
<td>IP54</td>
</tr>
<tr>
<td>Materials</td>
<td>ADC12 (Silver hammerton coating)</td>
</tr>
<tr>
<td>Cable inlet</td>
<td>3×G 1/2 or equivalent</td>
</tr>
<tr>
<td>Separating length</td>
<td>200 m Max. (In case of using 2-cores shielded cable of 1.25mm^2)</td>
</tr>
</tbody>
</table>

*: Connecting cable is not attached
3.3 COMPONENT NAMES

① Detecting Pipe
   Detecting part which touches directly to the powders. It vibrates when there’s no powders, but vibration will be damped or stop when it becomes buried in the measured materials.

② Plug for VLS12N and VLS22N
   Screw to install the sensor to the tank.

③ Flange for VLS12F and VLS22F
   Flange to install the sensor to the tank.

④ Extension Pipe for VLS22N and VLS22F
   Sensor measuring length extension part.

⑤ Housing
   Electronic circuit is placed.

⑥ Cover
   Cover for the sensor.

⑦ Radiation fin
   Board for heat radiation.
Fig. 3-1
4. HANDLING NOTES

Cautions for handling shall be taken as follows. Otherwise the sensor may be damaged.

4.1 When storing, put the sensor on the flat and ample space with the cushion or the tie. Avoid physical shock, bending, dropping and rolling the sensor. If you upright the sensor, provide appropriate means to avoid falling. You especially avoid physical shock to detecting pipe.

4.2 When painting the sensor, do not paint on the nameplate to keep indication for future reference of maintenance.

4.3 Do not use the sensor where corrosive gases generate. The electronics in the housing may be corroded and damaged by the corrosive gases (NH₃, SO₂, Cl₂, and so on).

4.4 Do not use the sensor in the areas of the strong vibration which is invisible of the sensor outline. If inevitable, provide appropriate means to prevent fracture of the sensor.

4.5 Do not place the thing influenced of the magnetic field like a floppy disk near the detecting pipe, since the magnet is in the detecting pipe.
5. INSTALLATION

**WARNING**
Do not use in hazardous locations. VLS12, 22 are not a flame-proof product.

5.1 UNPACKING

5.1.1 When unpacking, take out the sensor carefully. To avoid bending or dropping the sensor, hold the following place:
- **Flange mounting**: cumbersome part around the flange and flange itself.
- **Plug mounting**: cumbersome part around the plug and plug itself.

5.1.2 Extension sensor which is longer than 1500mm should be brought more than two person. Otherwise, the sensor may be damaged or bent.

5.1.3 Avoid physical shock more than 100m/s². Dropping, throwing or bumping shall damage the sensor.

5.1.4 Remove all packing materials such as tape, plastic bags and carton box before using.

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

5.1.6 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.

5.1.7 Check the sensor exterior for damage. If any, ask Nohken or our distributor.
5.2 INSTALLATION LOCATION

5.2.1 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. Refer to Figure 5-1.

Fig.5-1

(1) Pay attention to the angle of repose. (*) Otherwise, the sensor may cause malfunction. Refer to Figure 5-2.

Fig.5-2

(2) Do not install where vibration occurs. Installing near the vibrator(*) or the knocker(*) will cause malfunction and damage the sensor. Refer to Figure 5-3.

Fig.5-3

*: See section 12 on page 25 for the word explanation.
(3) Pay attention to the dead stock. (*)
Otherwise, the sensor may cause malfunction.
Refer to Figure 5-4.

(4) Pay attention to the bridge. (*)
Otherwise, the sensor may cause malfunction and it is damaged by crumble solids.
Refer to Figure 5-5.

(5) Keep the detecting pipe out of the direct flow. Install the protective shield above it or replace to the "G" type sensor if necessary.
Refer to Figure 5-6.

*: See section 12 on page 25 for the word explanation.
(6) Do not install the sensor where the temperature is high. Maximum operating temperature is as below.
  • Housing: 80°C Max.
  • Detecting part: 150°C Max.

(7) Do not locate the sensor where exposed to direct sunlight. Install the sunshade(*) over the housing if necessary.
Refer to Figure 5-7.

(8) The housing protection of the sensor is IP65. The cable inlet and the cover must be properly fitted to protect the sensor from rain, splashing water, and so on.
When side-mounting, make sure the cable gland is pointing down to the ground to prevent from water penetration.
Refer to Figure 5-8.

*: See section 12 on page 25 for the word explanation.
(9) Maximum static lateral load at the tip of the detecting pipe is 0.55 kN. Please secure an appropriate safety rate. Otherwise, the detecting pipe, φ17.3×L270, will bend. Refer to Figure 5-9. Install the protective shield above it if necessary. Refer to Figure 5-6.

(10) The detecting pipe φ17.3×L270mm, shall not contact with hopper wall or bottom.

(11) The VLS22 which is longer than 1000mm shall not install from the side of the hopper. Refer to Figure 5-10.

(12) For the VLS12, maximum length for the mounting nozzle or threaded boss is 70mm. If exceeds 70mm, the sensor will detect dead stock or solid residues. Refer to Figure 5-11.

(13) Do not use the sensor where corrosive gases generate. The electronics in the housing may be corroded and damaged by the corrosive gases (NH3, SO2, Cl2, and so on).

(14) When an extension pipe is fixed for reinforcement in VLS22 type, please contact with us.
5.2.2 Installation

(1) Flange mounting
Make sure that the size of standoff pipe or mating flange is fitted to achieve seal. In case of negative or positive pressure within the hopper, use suitable gasket and bolt and nut with appropriate tool. Locate the sensor at the position where the desired control level will actually make contact with it.

(2) Plug mounting
Make sure that the size of mounting hole or threaded boss is fitted to achieve seal. In case of negative or positive pressure within the hopper, use suitable pipe compound or seal tape. Locate the sensor at the position where the desired control level will actually make contact with it.

⚠️ CAUTION ⚠️
When screw or unscrew the sensor to the hopper, wrench the hex. Part above the thread. Do not hold the housing. Otherwise, the internal wiring and/or the housing protection may be damaged.
6. WIRING

6.1 PREPARATION

6.1.1 Turn off the power.

**WARNING**

To avoid personal injury, the power source shall be always turned off while wiring.

6.1.2 This sensor has no power switch and the fuse. Provide it separately if necessary.

6.1.3 If 100 to 120V AC is used, connect the power line to the 0V and the 100 to 120V terminal. If 200 to 240V AC is used, connect the power line to the 0V and the 200 to 240V terminal.

**WARNING**

Check for miswiring for the power line. Otherwise, the sensor will be damaged.

6.1.4 Output signal is changeable by the fail-safe switch selection. See Figure 6-1.

<table>
<thead>
<tr>
<th>Fail-safe mode</th>
<th>LAMP</th>
<th>Relay contact</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>DETECTION</td>
<td>POWER</td>
</tr>
<tr>
<td>H.ON</td>
<td>☀️</td>
<td>☀️</td>
</tr>
<tr>
<td>L.ON</td>
<td>●</td>
<td>☀️</td>
</tr>
<tr>
<td>H.ON</td>
<td>●</td>
<td>☀️</td>
</tr>
<tr>
<td>L.ON</td>
<td>☀️</td>
<td>●</td>
</tr>
<tr>
<td>POWER OFF</td>
<td>●</td>
<td>●</td>
</tr>
</tbody>
</table>

**CAUTION**

Maximum relay contact is 250V 3A AC or 30V 3A DC (resistive load). Do not connect overload. When load capacity exceeds the contact rating, connect external relays between the load and the sensor.
6.1.5 Self-diagnostic function

The controller is equipped with the self-diagnostic function to breaking of the cable between the sensor and the controller. When the cable is broken, the alarm outputs and yellow LED lights up. In order to cancel an alarm, please reswitch on a power supply in the state where the cable is correct.

![Self-diagnostic function diagram](image)

---

**CAUTION**

Do not connect overload. When load capacity exceeds the contact rating, connect external relays between the load and the sensor.

---

6.1.6 Our recommended connecting cable between sensor and controller is 2-core shielded cable of 1.25mm². Since terminal screws are M3.5, our recommended solderless lugs are R1.25-3.5.

6.1.7 Ground terminal “E” shall be grounded as JIS Class D, Max. 100Ω.

---

**CAUTION**

To avoid electrical shock and sensor’s damage, ground terminal shall be always grounded.

---

6.2 CONDUIT CONNECTION

The electrical wires are led into the housing in the cable inlet method or in the conduit method. In case of the conduit method, sealing compound shall be applied onto the screw of the cable inlet to protect water penetration. In case of the cable inlet method, it must be properly fitted by the appropriate tools to preserve IP65 after wiring. When water or moisture comes into the housing from the conduit, use putty to fill the inside of the conduit.

![Conduit connection diagram](image)
6.3 WIRING
Wiring shall be in accordance with all local codes. Since terminal screws are M3.5, our recommended solderless lugs are R1.25-3.5. See Figure 6-4.

6.4 OPERATION CHECK
6.4.1 Make sure that there are no dust or metallic substances in the housing.
6.4.2 Make sure the sensor operation in the test stage. If the operation is unsuccessful, check wiring and read this manual again.

6.5 COVER INSTALLATION
Tighten the cover onto the housing to prevent from dust or water penetration. Otherwise, malfunction may occur thanks to corrosion or short-circuit.
7. NOMENCLATURE

Refer to Figure 7-1 for nomenclature of the amplifier.

① Power Indicator
   Green lamp lights when the sensor power is on.

② Alarm Indicator
   Red lamp lights when the sensor detects the measuring materials.

③ Self-diagnostic alarm Indicator
   Yellow lamp lights when the cable between SENSOR and CONTROLLER is broken.

④ Sensitivity Setting Switch
   To set the sensor detecting sensitivities. Refer to Figure 7-1.

⑤ Fail-Safe Switch
   To set the high or low fail-safe mode.

⑥ Terminals
   Output terminal for power connection and sensor relay contact signal and so on.

⑦ Sensitivity Setting Volume
   To set the sensor detecting sensitivities.

⑧ Performance Check Point
   Check point for performance.

⑨ Sensitivity Check Point
   Check point for sensitivity.

![Fig. 7-1](image)
8. ADJUSTMENT

The VLS series is generally not necessary for the adjustment. Sensitivity of the VLS series is factory set for use in a wide range of solids. However, in extreme applications, the adjustment may require ensuring correct operations.

8.1 PREPARATION OF THE EQUIPMENT

Prepare the multi-tester or the voltmeter which has 10V DC range (more than 1MΩ input resistance), and small slotted driver which meets 0.7mm×5mm slot.

8.2 TECHNICAL NOTE

Output may chatter during adjustment or inspection. Any devices connected to the VLS will actuate until the adjustment or inspection is finished.

The sensor outputs the detection signal if vibration voltage is less than sensitivity voltage. Because the vibration voltage decreases according to diminution of vibration of detecting pipe, it is set to high sensitivity that the sensitivity voltage is raised, and it is set to lower sensitivity that the sensitivity voltage is lowered.

The sensitivity voltage is adjusted by combining the sensitivity setting switch and sensitivity setting volume, and the sensitivity voltage changes almost as shown in Figure 8-1.

<table>
<thead>
<tr>
<th>Sensitivity setting switch</th>
<th>Sensitivity setting volume</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>0V DC, 2.5V DC, 5V DC</td>
</tr>
<tr>
<td>Standard</td>
<td>0V DC, 1.25V DC, 2.5V DC</td>
</tr>
</tbody>
</table>

Fig. 8-1
8.3 SENSITIVITY SETTING PROCEDURE

**CAUTION**

Adjust the sensitivity after installing the sensor on the hopper which you actually use. Also, use the solids that you actually use. Otherwise, the sensitivity may be changed in accordance with the different of apparent bulk density around the detecting pipe.

(1) Sensitivity can be adjusted under the status of detection or non-detection.
(2) Make sure the power supply is turned on. (Initial reset time: approx. 15 sec.)
(3) Tester should be adjusted to the readable scale of 0.1V between 0 and 5V DC, and connect the positive rod to the sensitivity check point and negative rod to the terminal “E”. Refer to Figure 8-2.

![Fig.8-2](image)

- **a) Standard sensitive setting**
  Set the sensitivity setting switch to down position, and adjust voltage to 1±0.3V DC by sensitivity setting volume.
- **b) High sensitive setting**
  Set the sensitivity setting switch to up position, and adjust voltage to 2V DC by sensitivity setting volume.
- **c) Low-sensitive setting**
  Set the sensitivity setting switch to down position, and adjust voltage to 0.6±0.1V DC by sensitivity setting volume.

**CAUTION**

If set the sensitivity to extremely low, the sensor can not detect the level of solids.
(4) Operation check
Check the operation status by using actual medium.
Connect the positive rod to the performance check point and the negative rod to the terminal "E".

When the detecting pipe is not covered by medium, the 5V DC voltage is outputted with the signal of "non-detection". Refer to Figure 8-3.

![Figure 8-3](image)

When the detecting pipe is covered by medium, between 0 and 0.5V voltage is outputted with the signal of "detection". It means normal operation status. Refer to Figure 8-4.

![Figure 8-4](image)
9. MAINTENANCE & INSPECTION

Inspection shall be done after removing the sensor from the hopper. First, refer to the section "4. HANDLING NOTES". Prepare the ample space for inspection.

9.1 REMOVING

9.1.1 Turn off the power.

⚠️ WARNING

To avoid personal injury, the power source shall be always turned off while removing.

9.1.2 Remove the housing cover and disconnect cables.

⚠️ CAUTION

When screw or unscrew the sensor to the hopper, wrench the hex. Part above the thread.
Do not hold the housing. Otherwise, the internal wiring and/or the housing protection may be damaged.

9.1.3 Loosen or unscrew the flange or the plug part, and remove the sensor from the hopper.

9.1.4 Put the sensor on the flat place.
9.2 MAINTENANCE & INSPECTION
Inspect the sensor semi-annually or annually. Since inspection intervals vary with applications and process conditions such as pressure, temperature and so on. We recommend you to inspect periodically.

9.2.1 Make sure that there is no damage. If necessary, repair or replace parts.

9.2.2 Clean build-up or coating on the detecting pipe.

9.2.3 Check for and clean dirt, dust, moisture and metallic substances in the housing.

9.2.4 Make sure that lead wires are surely connect to terminals. Tighten screws if necessary.

9.2.5 Make sure terminals and lead wires are not corroded. Replace it if necessary.

9.2.6 Connect an ohmmeter to terminals. Check the relay operation by holding the detecting pipe. If correct value is not read, repair or replace it.

9.3 RE-INSTALLATION
Refer to section "5.2 INSTALLATION LOCATION" (page 8 to 11).

9.4 WIRING
Refer to section "6 WIRING" (page 13 to 15).
9.5 REPLACEMENT PARTS & CYCLE
Replace to our special-purpose parts if the following symptoms occur.
When replacing the parts, make sure that the specification is correct.
Some parts are same outlook with different specifications.

9.6 REPLACEMENT PARTS

<table>
<thead>
<tr>
<th>Parts name</th>
<th>Replacement cycle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Housing</td>
<td>When it is damaged or corroded</td>
</tr>
<tr>
<td>P.C. board</td>
<td>When it is damaged or corroded</td>
</tr>
<tr>
<td>Detecting pipe</td>
<td>When it is damaged or corroded</td>
</tr>
</tbody>
</table>

9.7 REPLACEMENT CYCLE OF THE SENSOR
The life expectancy of the sensor may be 5 years due to the deterioration of electric parts or corrosion and abrasion of the detecting pipe.
10. STORING
The sensor shall be stored under the following conditions when it is not used for a long time.

10.1 Environmental conditions are as follows:
- The storing temperature range is -10℃ to +60℃.
- Relative humidity is Max. 85% RH.
- No corrosive gases (such as NH₃, SO₂, C₂H₂, etc.)
- Vibration is low.

10.2 Clean or remove buildup. Otherwise, it may cause malfunction when you use the next time.

10.3 Tighten the cover and the cap to protect the housing from dust and dirt.

10.4 Locate the sensor away from rain and splashing water. Especially the cable gland shall be pointing down.

10.5 Put the sensor on the flat space with the cushion or the tie as shown on the right. Avoid physical shock, bending, dropping and rolling the sensor.

10.6 Do not put things on the sensor. It shall deform or damage the sensor.

REFERENCE
Keep the sensor in sealed plastic bags with desiccant or other moisture-proof packing when it is not used for a long time.
## 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>Problems</th>
<th>Possible causes</th>
<th>Remedies</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>No signal outputs. It overflow.</td>
<td>Bulk density is too small. The VLS series cannot detect less than 0.2 g/cm³.</td>
<td>Set high sensitivity or Replace to other sensors.</td>
<td>Section 8.3(3) (b), Page 18</td>
</tr>
<tr>
<td></td>
<td>Solids has angle of repose.</td>
<td>Install the sensor in a good location.</td>
<td>Section 5.2.1 (1), Page 8</td>
</tr>
<tr>
<td></td>
<td>Solids has bridge.</td>
<td>Install the sensor in a good location.</td>
<td>Section 5.2.1 (4), Page 9</td>
</tr>
<tr>
<td></td>
<td>Solids too fluid.</td>
<td>Set high sensitivity.</td>
<td>Section 8.3(3) (b), Page 18</td>
</tr>
<tr>
<td></td>
<td>Effected by severe hopper vibration.</td>
<td>Install the sensor in a good location.</td>
<td>Section 5.2.1 (2), Page 8</td>
</tr>
<tr>
<td></td>
<td>Supply power is not connected.</td>
<td>Connect the power.</td>
<td>Section 6.1.3 Page 13</td>
</tr>
<tr>
<td>Signal always outputs. Abnormal discharge from the hopper.</td>
<td>Miswiring.</td>
<td>Wire correctly.</td>
<td>Section 6.3, Fig. 6-4, Page 15</td>
</tr>
<tr>
<td></td>
<td>Heavy deposit on the detecting pipe.</td>
<td>Clean it regularly, or set low sensitivity.</td>
<td>Section 8.3(3) (c), Page 18</td>
</tr>
<tr>
<td></td>
<td>Solids has dead stock.</td>
<td>Install the sensor in a good location.</td>
<td>Section 5.2.1 (3), Page 9</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>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flame-proof</td>
<td>Nonflammable devices which is designed to prevent ignition, explosion and fire in a hazardous area. The VLS12, 22, VLS2200 is not a flame-proof product.</td>
</tr>
<tr>
<td>Detecting pipe</td>
<td>The detection part which generates vibration.</td>
</tr>
<tr>
<td>Protective shield</td>
<td>The guard to protect the vibration rod from heavy static load surface of the hopper. Refer to Figure 5-6.</td>
</tr>
<tr>
<td>Angle of repose</td>
<td>Angle of maximum slop at which a heap of any loose solids will and direct flow. Refer to Figure 5-2.</td>
</tr>
<tr>
<td>Vibrator</td>
<td>A mechanical vibrating device to shake and remove the buildup on the inner surface of the hopper.</td>
</tr>
<tr>
<td>Knocker</td>
<td>A pneumatic device to knock and remove the buildup on the inner stand without sliding.</td>
</tr>
<tr>
<td>Dead stock</td>
<td>A space left in the cone of the hopper which varies with the angle of repose. Refer to Figure 5-4.</td>
</tr>
<tr>
<td>Bridge</td>
<td>An obstruction in the hopper to make a bridge by stacking solids. Refer to Figure 5-5.</td>
</tr>
<tr>
<td>Sunshade</td>
<td>A shield or baffle to deflect the direct sunlight from the housing. Refer to Figure 5-7.</td>
</tr>
<tr>
<td>Performance check point voltage (VIBRATION)</td>
<td>VIBRATION voltage is output from 0 to 5 V DC according to state of the vibration of the detecting pipe. Output voltage is 5 V DC with the detection pipe not restrained, and the detecting pipe is restrained with the measurement thing, VIBRATION voltage decreases.</td>
</tr>
<tr>
<td>Sensitivity check point voltage (SENSITIVITY)</td>
<td>SENSITIVITY voltage is output from 0 to 5 V DC according to state of sensitivity. It is set to high sensitivity that SENSITIVITY voltage is raised, and it is set to lower sensitivity that SENSITIVITY voltage is lowered. SENSITIVITY voltage is adjusted by combining the sensitivity setting switch and sensitivity setting volume.</td>
</tr>
</tbody>
</table>
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