INSTRUCTION MANUAL

FOR

VIBRATING LEVEL SENSOR
(INTRINSIC SAFETY TYPE)

MODEL: VL612
VL622

MODEL: VL6200

Revision 2014-09-24
Read and understand this manual for safely usage.

- This manual describes the product of explosion-proof construction. Read the other manuals for the product of standard specifications.
- This manual describes the handling, inspection, and adjustment of the product which model is mentioned on the cover page. Read and understand this manual before handling.
- Follow the additional document and/or direction, submitted by NOHKEN INC. and our distributor or agent, even if the terms are mentioned in this manual.
- Save this manual in proper place being available to refer immediately.
- The specification of product mentioned in this manual may not be satisfied by the condition of environment and usage. Check and consider carefully before using.
- Contact to sales office at NOHKEN INC. for any question or comment about this manual and product.

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

<table>
<thead>
<tr>
<th>🔴 DANGER</th>
<th>Indicates a potentially hazardous situation which, if not pay attention, will result in death, serious injury or serious disaster.</th>
</tr>
</thead>
<tbody>
<tr>
<td>🔴 WARNING</td>
<td>Indicates a potentially hazardous situation which, if not pay attention, could result in death, serious injury or serious disaster.</td>
</tr>
<tr>
<td>🔴 CAUTION</td>
<td>Indicates a hazardous situation which, if not pay attention, may result in minor or moderate injury or damage to device.</td>
</tr>
<tr>
<td>🚫</td>
<td>Indicates prohibited matter. The explanation with this mark shall be followed</td>
</tr>
<tr>
<td>⚠️</td>
<td>Indicates instructed matter. The explanation with this mark shall be followed.</td>
</tr>
</tbody>
</table>
DANGER
Do not modify or disassemble the product. Otherwise, the flammable gas or vapor may be ignited.

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

WARNING
Install this product in hazardous location Zone 1 and 2, Do not install Zone 0.
Do not cause damage to the enclosure, joint surface, and thread on the cover. The explosion-protection of this product is retained by the strength of pressure for enclosure, wide and length of clearance.
Follow the description of inspection, adjustment, and maintenance in this manual, and not disassemble the parts except it is necessary. Otherwise, the explosion-protection of this product is not retained.
Ensure small screw for earth ground terminal, cover fixing bolt, and etc. Shall be tighten with spring washer. Otherwise, the explosion-protection of this product is not retained.
**WARNING**

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

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

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

**WARNING**

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

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

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

**WARNING**

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

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

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

CAUTION

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

Follow the specification of operating temperature, operating pressure, switch rating, and etc. Otherwise, the product and connected device may be malfunctioned, damaged, fired, or 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.

In case of connecting inductive or lamp load to the product, provide protective circuit to the load to avoid over voltage and over current. If not provide, the contact may be damaged.
<table>
<thead>
<tr>
<th>CAUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do not grab and turn the terminal box, when the plug mounted product is removed from the tank. It may be cause of cutting internal wiring. The plug shall be loosened by the right tool.</td>
</tr>
<tr>
<td>Hold the stem very close to mounting point, when carrying, installing, and removing. If hold the terminal box, it may be taken off from the flange or plug, and the product may be damaged by dropping.</td>
</tr>
<tr>
<td>Check and deeply consider the chemical compatibility for material of product in advance. The part especially float, which is very thin, may be malfunctioned by miner corrosion.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CAUTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Check and deeply consider the chemical compatibility for material of product in advance.</td>
</tr>
</tbody>
</table>
| The product is 50cm or longer  
The product shall be kept in horizontally. The product and other goods be damaged, and miner injury may be occurred by falling. |
INTRODUCTION
A) This manual specifies the specification of general product. If you order special product, some details of specification may be different with the manual.
B) We are glad to suggest and advice for Model selection and chemical resistant of material, but final decision has to be made by the customer.
C) This manual has prepared with close attention. Ask sales office at NOHKEN INC. for any question or comment about the contents of this manual.
D) For replacement parts
   The quality of product has frequently improved, so same spare part may not be supplied. In this case, replacement part or product may be supplied. Ask sales office at NOHKEN INC. for details.
E) The contents of this manual are subject to change any time without notice due to the improvement of product.

WARRANTY & DISCLAIMER
A) NOHKEN INC. warrants this product against defect in design, material and workmanship for a period of 1(one) year from the date of original factory shipment.
B) The warranty only covers the damage of products. The secondary and third kind disasters are not covered by NOHKEN INC.
C) NOHKEN INC. shall not be liable for the following.
   C-a) Do not follow the description and direction in this manual.
   C-b) Damage due to improper installation, wiring, usage, maintenance, inspection, storing, and etc.
   C-c) Repair and modification are done by the person who is not employee of NOHKEN INC.
   C-d) Improper parts are used and replaced.
   C-e) The damage is occurred by the device or machine except our products.
   C-f) Improper usage. (See "Proper of usage" in chapter 1 in this manual)
   C-g) Force Majeure including, but not limited to, fire, earthquake, tsunami, lightning, riots, revolution, war, radioactive pollution, acts of God, acts of government or governmental authorities, compliance with law, regulation, and order.

THE TERMS OF WARRANTY AND DISCLAIMER SHALL IN NO WAY LIMIT YOUR REGAL LIGHT.
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</table>
1. PURPOSE OF USE
The vibrating level sensor, model VL612, 622, 6200 are 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
VL600 series can be used as intrinsic safety construction by combining sensor, safety barrier, and controller. 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 an relay output.

![Diagram](image)

Fig. 2-1

*: See section 12 on page 26 and 27 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>

3.1.2 Controller: VL6200

3.2 STANDARD SPECIFICATIONS

<table>
<thead>
<tr>
<th>Explosion-proof</th>
<th>Intrinsic safety TIIS certification Exia II CT5 (On condition that safety barrier is put between sensor and controller)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of protection</td>
<td></td>
</tr>
<tr>
<td>Model</td>
<td>VL612N,F,G, VL622N,F,G (SENSOR)</td>
</tr>
<tr>
<td>Measuring object</td>
<td>Powder, Granular materials, Pellets, Underwater sediments</td>
</tr>
<tr>
<td>Sensitivity</td>
<td>Bulk density: approx. 0.2 g/cm³ min.</td>
</tr>
<tr>
<td>Vibration frequency</td>
<td>Approx. 300 to 500 Hz</td>
</tr>
<tr>
<td>Withstand pressure</td>
<td>2 MPa Max. (Except a mounting part)</td>
</tr>
<tr>
<td>Concentrated load</td>
<td>0.55 kN Max.</td>
</tr>
<tr>
<td>Explosion-proof approval temperature</td>
<td>Ambient temperature: -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>Detecting part: IP68 or equivalent Housing : IP65 or equivalent</td>
</tr>
<tr>
<td>Cable inlet</td>
<td>G 3/4 or equivalent</td>
</tr>
</tbody>
</table>

*: See section 12 on page 26 and 27 for the word explanation.
<table>
<thead>
<tr>
<th>Model</th>
<th>VL6200 (CONTROLLER)</th>
</tr>
</thead>
</table>
| Indication          | By Green LED for Power status  
                     | By Red LED for Relay status  
                     | By Yellow LED for Self-diagnostic status |
| Initial reset time  | Approx. 15 sec.      |
| Power               | 100 to 120 V ±10% AC, 200 to 240 V ±10% AC 50/60 Hz |
| Power consumption   | 5 VA Max.            |
| Output              | Relay contact 1 transfer. Fail-safe switch.  
                     | Switching delay time: Turn-on, approx. 3 to 5 sec.  
                     | Turn-off, approx. 3 to 5 sec. |
| Contact rating      | Max. 250 V 3 A AC, 30 V 3 A DC (Resistive load)  
                     | Min. 5 V 10 mA DC (Resistive load) |
| Diagnosis function  | Insulated NPN open collector  
                     | 26.4 V DC Max. 30 mA Max. (Residual voltage 1 V Max.) |
| Withstand voltage   | 1500 V AC, 1 minute  
                     | Between each terminals and controller housing (Except “E” terminal) |
| Insulation resistance | 100 MΩ or more, 500 V DC  
                     | Between each terminals and controller housing (Except “E” terminal) |
| Operating temperature | -20 to +60°C (Get rid of dew.) |
| Operating humidity  | 95 %RH Max.          |
| Construction        | IP54 or equivalent   |
| Materials           | ADC12 (Silver hammertone coating) |
| Cable inlet         | 3×G 1/2 or equivalent |
| Separating length   | 200 m Max. (In case of using 2-cores shielded cable of 1.25mm²) *1 |

*1: Supplied by customer.
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 VL612N and VL622N
Screw to install the sensor to the tank.

③ Flange for VL612F and VL622F
Flange to install the sensor to the tank.

④ Extension Pipe for VL622N and VL622F
Sensor measuring length extension part.

⑤ Housing
Electronic circuit is placed.

⑥ Cover
Cover for the sensor.

⑦ Cable inlet
Entry for the cable.

⑧ External earth terminal
4. HANDLING NOTES

4.1 CAUTIONS FOR HANDLING

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

4.1.1 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.

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

4.1.3 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, CO₂, and so on).

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

4.1.5 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.
4.2 CAUTIONS OF EXPLOSION-PROOF FOR HANDLING

This system, combination of the sensor, the converter and the barrier, is designed as intrinsically safe product, which can be used in the areas classified as Zone 0, Zone 1 and Zone 2. To maintain the explosion protection, the instructions below must be followed to prevent ignition of flammable gases.

4.2.1 A shielded cable should be used between the sensor and the converter.
Care must be taken not to damage the cable sheath. Recommended cable is: 2-core shielded cable, EM-KNPEE-SB / Nihon Electric Wire and Cable Co., Ltd.

4.2.2 The cable between the sensor and the converter should be run in a conduit and separate from other wiring so that electromagnetic or electrostatic inductions do not impair intrinsic safety.

4.2.3 The cable between the sensor and converter should be kept away from the main power or output signal cables to prevent malfunction. Special care must be taken about this especially when multiple sensors and converters are used.

4.2.4 Do not open the panels or remodel the inside of the sensor or the converter.

![Diagram](image)

**Fig. 4-1**

4.2.5 Use the safety barrier that be certificated independently and satisfy the following conditions.

(1) Rating
Maximum voltage of intrinsic safety circuit (Uo) : 28 V or less
Maximum current of intrinsic safety circuit (Io) : 93 mA or less
Maximum power of intrinsic safety circuit (Po) : 651 mW or less

(2) Class : iaIIIC

(3) Allowed inductance and capacitance of intrinsic safety circuit
It assumes as follows.
Inductance of intrinsic safety circuit without sensor is Lw,
Capacitance of intrinsic safety circuit without sensor is Cw,
Allowed inductance of intrinsic safety circuit(*) is Lo,
Allowed capacitance of intrinsic safety circuit(*) is Co.
Lo : (10μH + Lw) or more
Co : (4150pF + Cw) or more

* : See section 12 on page 26 and 27 for the word explanation.
5. INSTALLATION

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.

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

*: See section 12 on page 26 and 27 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 26 and 27 for the word explanation.
(6) Do not install the sensor where the temperature is high. Maximum operating temperature is 60℃ Max.

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

(8) The housing protection of the sensor is IP65. The cable gland 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.

(9) Maximum static lateral load at the tip of the detecting pipe is 0.55kN. 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.

*: See section 12 on page 26 and 27 for the word explanation.
(10) The detecting pipe $\phi 17.3 \times 270$mm, shall not contact with hopper wall or bottom.

(11) The VL622 which is longer than 1000mm shall not install from the side of the hopper. Refer to Figure 5-10.

(12) For the VL612, 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 (NH$_3$, SO$_2$, C O$_2$, and so on).

(14) When an extension pipe is fixed for reinforcement in VL622 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 WIRING BETWEEN SENSOR AND CONTROLLER

6.1.1 Vibrating level sensor VL600 series and safety barrier is constructed as shown in figure 6-1.

![Diagram of VL600 series and safety barrier]

Fig. 6-1

6.1.2 A shielded cable should be used between the sensor and the converter.
Care must be taken not to damage the cable sheath. Recommended cable is: 2-core shielded cable, EM-KNPEE-SB / Nihon Electric Wire and Cable Co., Ltd.

6.1.3 The cable between the sensor and the converter should be run in a conduit and separate from other wiring so that electromagnetic or electrostatic inductions do not impair intrinsic safety.

6.1.4 The cable between the sensor and converter should be kept away from the main power or output signal cables to prevent malfunction.
Special care must be taken about this especially when multiple sensors and converters are used.

6.1.5 Ground the sensor, the controller, and the safety barrier respectively.
When the earth is imperfect, the explosion-proof performance cannot be kept.

--- CAUTION ---

Ground it for the maintenance of the explosion-proof performance and the safety at the leak accident and the short-circuit.
Ground safety barrier at JIS Class A (earth resistance is below 10Ω), and ground sensor and controller at JIS Class D (earth resistance is below 100Ω).

*: See section 12 on page 26 and 27 for the word explanation.
6.1.6 Use the safety barrier that be certificated independently and satisfy the following conditions.

(1) Rating
   Maximum voltage of intrinsic safety circuit (Uo) : 28 V or less
   Maximum current of intrinsic safety circuit (Io) : 93 mA or less
   Maximum power of intrinsic safety circuit (Po) : 651 mW or less

(2) Class : ia II C

(3) Allowed inductance and capacitance of intrinsic safety circuit
   It assumes as follows.
   Inductance of intrinsic safety circuit without sensor is Lw,
   Capacitance of intrinsic safety circuit without sensor is Cw,
   Allowed inductance of intrinsic safety circuit(*) is Lo,
   Allowed capacitance of intrinsic safety circuit(*) is Co.

   \[ \begin{align*}
   \text{Lo} & : (10 \mu\text{H} + Lw) \text{ or more} \\
   \text{Co} & : (4150\text{pF} + Cw) \text{ or more}
   \end{align*} \]

   Example of the safety barrier that satisfies the above-mentioned performance is shown below.

<table>
<thead>
<tr>
<th>Name</th>
<th>Maker</th>
<th>Size(mm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>MTL728+</td>
<td>Cooper Industries Japan K.K.</td>
<td>93.5×61.5×14.2</td>
</tr>
<tr>
<td>MTL7728+</td>
<td>Cooper Industries Japan K.K.</td>
<td>105×90×12.6</td>
</tr>
<tr>
<td>Z728</td>
<td>PEPPERL+FUCHS</td>
<td>115×110×12.5</td>
</tr>
</tbody>
</table>

6.2 WIRING OF CONTROLLER

6.2.1 Turn off the power.

⚠️ WARNING

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

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

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

⚠️ WARNING

Check for mis-wiring for the power line. Otherwise, the sensor will be damaged.
6.2.4 Output signal is changeable by the fail-safe switch selection. See Figure 6-2.

<table>
<thead>
<tr>
<th>Fail-safe mode</th>
<th>Lamp</th>
<th>Power</th>
<th>Relay contact</th>
</tr>
</thead>
<tbody>
<tr>
<td>H.ON</td>
<td>☀</td>
<td>☀</td>
<td>C NO</td>
</tr>
<tr>
<td>L.ON</td>
<td>⬜</td>
<td>☀</td>
<td>C NO</td>
</tr>
<tr>
<td>H.ON</td>
<td>⬜</td>
<td>⬜</td>
<td>C NO</td>
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<tr>
<td>L.ON</td>
<td>☀</td>
<td>⬜</td>
<td>C NO</td>
</tr>
<tr>
<td>POWER OFF</td>
<td>⬜</td>
<td>⬜</td>
<td>C NO</td>
</tr>
</tbody>
</table>

Fig. 6-2

⚠️ 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.

6.2.5 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 re-switch on a power supply in the state where the cable is correct.

Fig. 6-3

⚠️ CAUTION

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

6.2.6 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.
6.2.7 Wiring of controller

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.
6.3 CONDUIT CONNECTION
The size of the cable inlet is G3/4.
There are two ways for connecting the sensor cable. One is fixing the cable with a cable gland. The other is connecting a conduit to the housing. In either case, an adequate sealing should be provided to prevent water or dust ingress into the housing through the sensor cable.
Secure the cable using sealing material for the conduit connection, or a proper tool when the gland is used, to protect the housing inside from dust or water.
When water or moisture comes into the housing from the conduit, use putty to fill the inside of the conduit.

![Diagram showing correct and incorrect conduit connections](image)

Fig.6-5

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. PART NAMES AND FUNCTIONS

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

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

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

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

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

5. Vibration Check Point
   Check point for vibration.

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

7. TP- terminal
   Negative terminal for ⑤ and ⑩ check point.

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

9. Sensitivity Setting Volume
   To set the sensor detecting sensitivities.

10. Sensitivity Check Point
    Check point for sensitivity.

11. Earth terminal
    Terminal for earth.

Fig. 7-1
8. ADJUSTMENT

The VL600 series is generally not necessary for the adjustment. Sensitivity of the VL600 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

*: See section 12 on page 26 and 27 for the word explanation.
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 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 “TP−”. Refer to Figure 8-2.

![Diagram of sensitivity settings](image)

Fig. 8-2

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 “TP-”.

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.

![Fig. 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.

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

Inspection shall be done after removing the sensor from the hopper. First, refer to the section “5. 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

Execute an initial check, a periodic check of equipment, and management by the management representative to maintain the explosion-proof performance.
Inspect the sensor semi-annually or annually. Since inspection intervals varies 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 12).

9.4 WIRING

Refer to section "6 WIRING" (page 13 to 17).

9.5 REPLACEMENT PARTS & CYCLE

As a rule, to maintain the explosion-proof, the exchange of parts descends doing at our factory. Ask Nohken’s sales office when you need the exchange of parts.
9.6 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°C to +60°C.
- Relative humidity is Max. 85% RH.
- No corrosive gases (such as NH₃, SO₂, C₂O₂ 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

<table>
<thead>
<tr>
<th>Problems</th>
<th>Possible causes</th>
<th>Remedies</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Signal always outputs.  Abnormal discharge from the hopper.</td>
<td>Bulk density is too small.</td>
<td>Set high sensitivity or Replace to other sensors.</td>
<td>Section 8.3(3) (b), Page 20</td>
</tr>
<tr>
<td></td>
<td>The VLS series can not detect less than 0.2 g/cm³.</td>
<td></td>
<td></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 20</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 10</td>
</tr>
<tr>
<td></td>
<td>Supply power is not connected.</td>
<td>Connect the power.</td>
<td>Section 6.2.3 Page 14</td>
</tr>
<tr>
<td></td>
<td>Miswiring.</td>
<td>Wire correctly.</td>
<td>Section 6.2.7 Fig. 6-4, Page 16</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 20</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>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>Allowed inductance of intrinsic safety circuit</td>
<td>Necessary inductance for safety barrier. It is more necessary than the total inductance by the sensor eigenvalue(10μH) and wiring(Lw).</td>
</tr>
<tr>
<td>Allowed capacitance of intrinsic safety circuit</td>
<td>Necessary capacitance for safety barrier. It is more necessary than the total capacitance by the sensor eigenvalue(4150pF) and wiring(Cw).</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>
<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>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>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>Sun shield</td>
<td>A shield or baffle to deflect the direct sunlight from the housing. Refer to Figure 5-7.</td>
</tr>
</tbody>
</table>
## Glossary for Explosion proof

<table>
<thead>
<tr>
<th>Hazardous Area</th>
<th>Areas in which dangerous concentrations of flammable gases/vapors are present or the chances are high. In such areas, explosion protection should be implemented on electrical devices.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zone 0</td>
<td>Areas in which dangerous concentrations of flammable gases/vapors are present continuously or long-term under normal operating conditions.</td>
</tr>
<tr>
<td>Zone 1</td>
<td>Areas in which dangerous concentrations of flammable gases/vapors are present occasionally under normal operating conditions.</td>
</tr>
<tr>
<td>Zone 2</td>
<td>Areas in which dangerous concentrations of flammable gases/vapors are present rarely and then only briefly under normal operating conditions.</td>
</tr>
</tbody>
</table>
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