



## INSTRUCTION MANUAL

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### PADDLE TYPE LEVEL SWITCH

MODEL: DPL

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Meanings of indications for safety used in this Instruction Manual are as follows.



**WARNING:** Indicates that improper handling assumes the risk of a fatal or serious injury.



**CAUTION:** Indicates that improper handling assumes the risk of injury or damage to property only.

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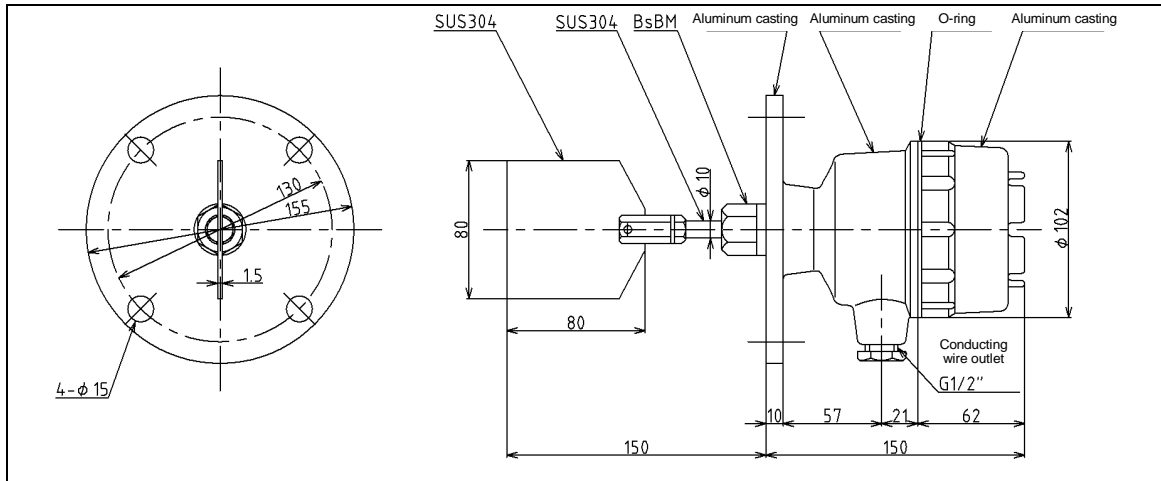
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## DPL Model Instruction Manual

### Outline drawing (Model: DPL-100)



#### [1] Operating Principle

This product a blade attached to the main shaft is rotated by a motor. When there is no load applied to the blade by an object to be measured, it is always rotating, however, when the rotation of the blade is stopped by the object to be measured, the rotation of the motor is electrically stopped and the contact output is issued.

In addition, when the force to stop the rotation of the motor is removed, the motor starts rotation again, and the contact output is changed over. Existence of an object to be measured is detected by such action.

#### [2] Standard Specifications

Power voltage	24V DC +/- 10%
Attaching method	Flange attachment JIS 5K65A
Power consumption	2.2VA
Contact output	1C contact 250V AC 0.1A (resistance load)
Detection torque (*1)	About 10.0 N·cm
Slip torque (*2)	About 30.0 N·cm
Rotation speed	2 rpm
Material	Main body case, flange: aluminum casting Main shaft, blade: SUS304 Seal: nitrile rubber
Operating temperature	Inside the tank: -10°C to 70°C (no freezing is allowed) Outside the tank: -10°C to 50°C (no freezing is allowed)
Operating pressure	Inside the tank: 0 - 196 kPa
Paint color	Munsell 10YR7.5/14 (yellow)

Please contact us for specifications of other models.

(\*1) The detection torque means the torque value required to stop rotation of the motor.

(\*2) The slip torque means the torque value to make the motor protection mechanism start functioning in a case of overload or impact applied to the blade.

[3] Models

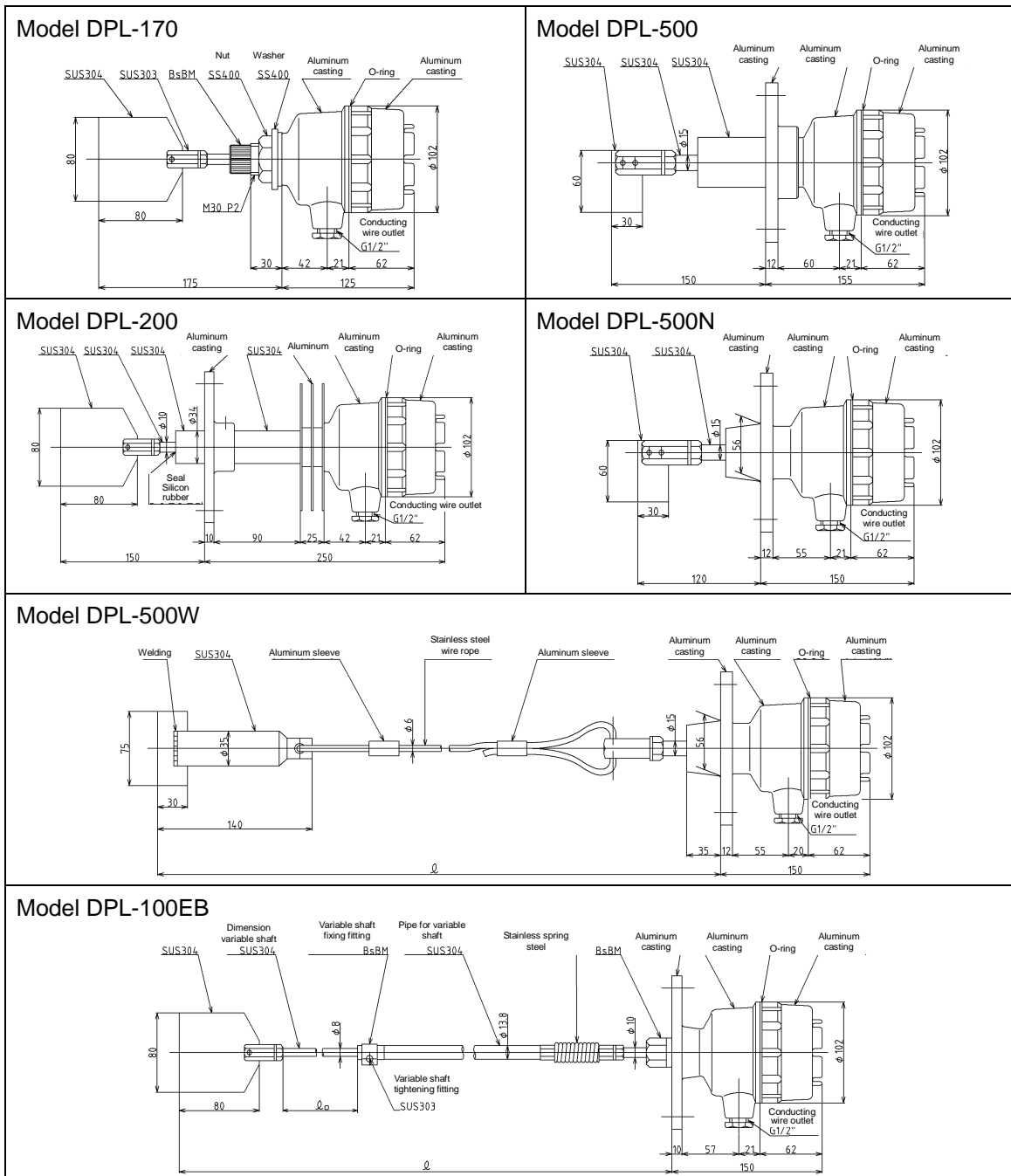
DPL —



Type of level switch	
1	Standard type
2	High temperature type
5	Strong type

Material of flange	
0	With aluminum alloy coating
2	SUS304 pasted (on the powder contact surface)
3	SUS316 pasted (on the powder contact surface)
4	Made of SUS304
5	Made of SUS316
7	Screw-in type
8	Titanium pasted (on the powder contact surface)

Existence of protective tube, material	
0	None
1	SUS304
2	SUS316
4	Titanium





#### [4] Cautions for Handling

##### a. Determination of installation site

Install it at a position where the powder particle level actually changes.

##### b. Impact of powder particles

When installed directly below dropping at the feeding port, etc., of powder particles, or due to impact of collapse in the bridge phenomenon inside the hopper, etc., it may be broken. Change the installation site, or provide a protective plate.

##### c. Vibration of hopper

Avoid a place where mechanical vibration of the hopper itself or vibration from a vibrator, etc., are applied for long hours. It may affect the detection action, and life of the level meter itself.

##### d. Relationship with transport equipment (Examples for reference of conveyor transportation)

###### ◎ Level meter for “full” signal

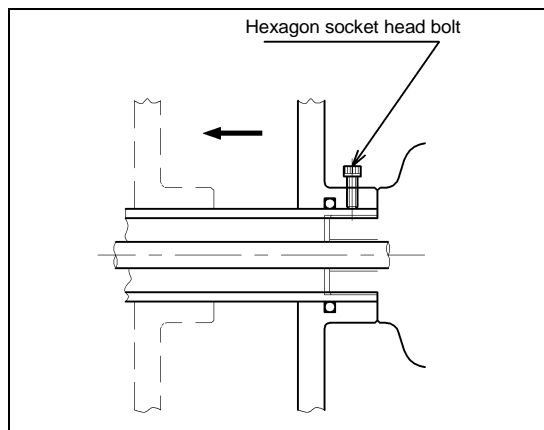
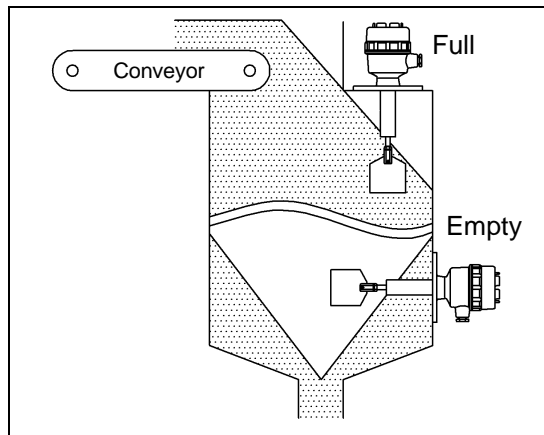
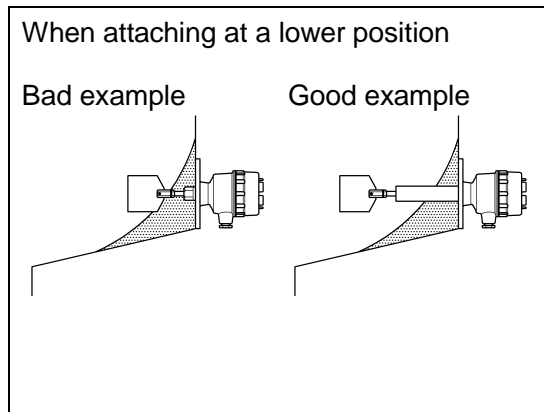
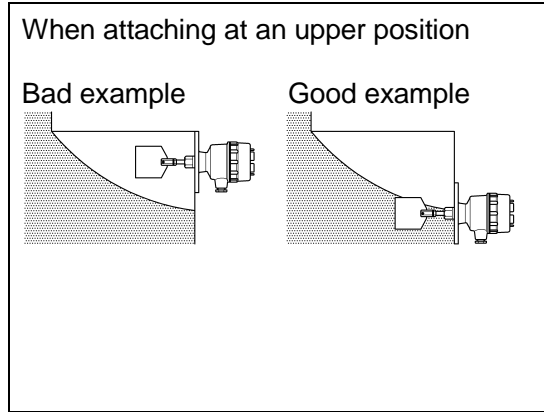
Attach it to a position where it does not go over even if all the remaining measured objects on the conveyor enter the hopper.

###### ◎ Level meter for “empty” signal

Attach it to a position anticipating the time when the conveyor starts moving and the raw material is fed after the hopper “empty” signal is issued.

##### e. Slide flange type

The flange part slides toward the blade by loosening the hexagon socket head bolt. Attach it to a position under good condition. After determining the position of the flange, firmly tighten the hexagon socket head bolt.





### [5] Cautions for Connection

#### a. External terminals

##### a-1. Power Supply

24V DC +/- 10%, red/black

DC power supply has polarity (0V, 24V).

Pay careful attention so as not to make a mistake in wiring.

**Inverter control board**

It converts DC power supply to AC power supply to drive the motor. When DC power supply is turned on, the LED lights up.

The power voltage is pasted on the main body. As the voltage is displayed on the nameplate, make sure not to make a mistake.



##### a-2. Signal

L: "b" contact

C: (common)

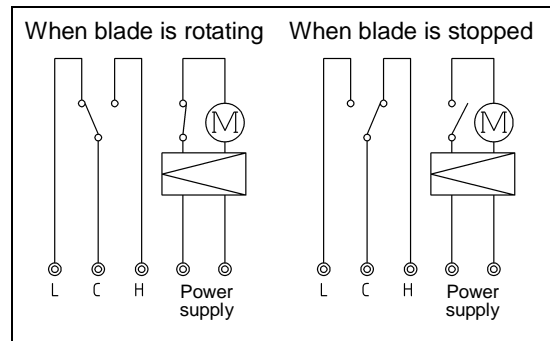
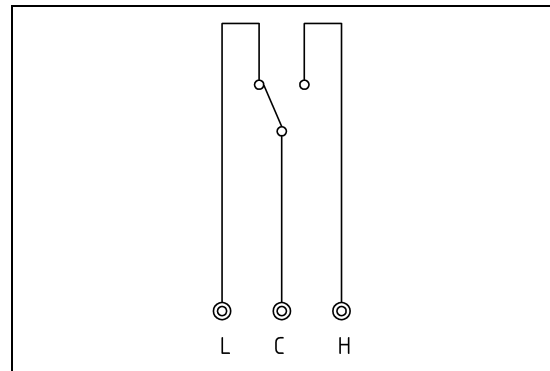
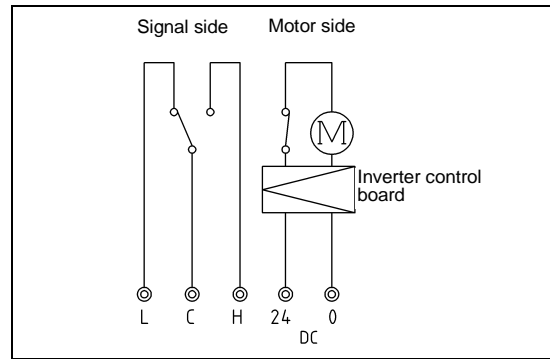
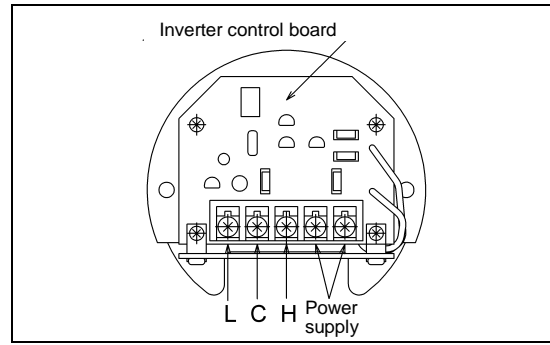
H: "a" contact

Between C and L: current carrying when the blade is rotating.

Between C and H: current carrying when the blade stops in the power-on state.

Wire the signal appropriate for your use from the terminals.

**Contact capacity**  
250V AC 0.1A (resistance load)  
30V DC 0.1A (resistance load)



a-3. Check change of detection signal  
(micro switch for signal)

Checking method of signal change

Lightly turn the blade counterclockwise for about 20°.

When the blade is turned counterclockwise for about 20°,

Between C and H: current carrying state

Between C and L: no current carrying state

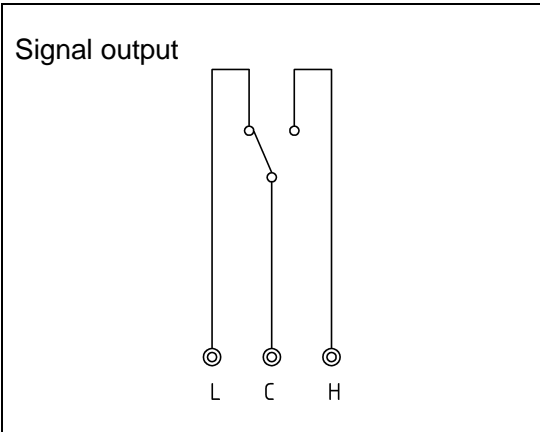
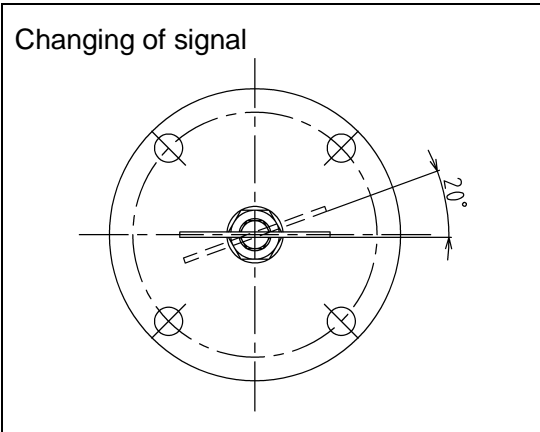
When the blade is returned,

Between C and H: no current carrying state

Between C and L: current carrying state

If the blade is turned strongly more than that, a light clicking metallic sound is made and the position of the blade is slipped turning by 90°.

This is a result of the slip mechanism and not a failure.



b. Wiring used and piping

b-1.

For wiring used, twist wires to crimp with a crimp type terminal and then connect to the external terminal. Avoid a single wire whenever possible.



b-2.

When using a cable, use a cable with a finished outside diameter  $\phi 10$  to  $\phi 11$ .

If the cable size is not appropriate, rainwater or dust, etc., will enter resulting in a failure.

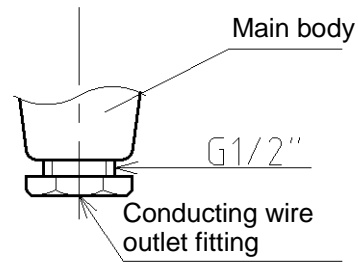


b-3.

After wiring, strongly tighten the conducting wire outlet fitting. It has bushing rubber inside to tighten the cable and avoid rain or moisture.

If it is loose, rainwater or dust will enter resulting in a failure. If a wrong cable size is used, it may also result in a failure.

Conducting wire outlet



Examples of cables that can be used

CVV (vinyl cable for control)

1.25 mm 4-core, finished outside diameter:  $\phi 11$

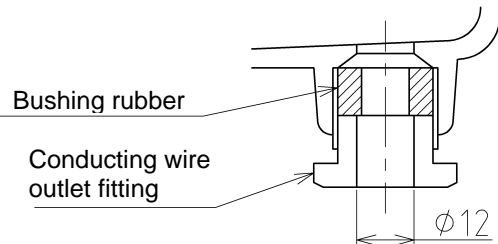
2.00 mm 3-core, finished outside diameter:  $\phi 11$

VCT (vinyl cabtire cable)

0.75mm 5-core, finished outside diameter:  $\phi 10.5$

1.25mm 4-core, finished outside diameter:  $\phi 10.5$

Conducting wire outlet  
(cross sectional drawing)



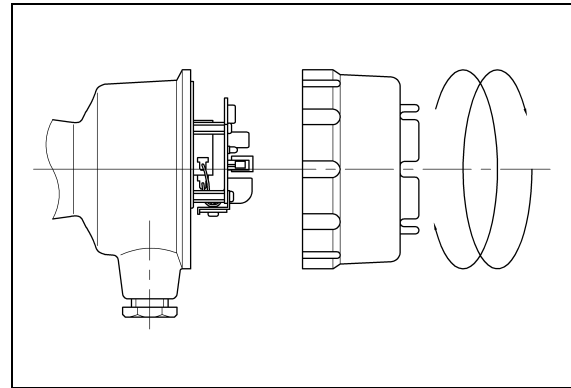


### c. Attachment and detachment of cover

If the cover is not tightened firmly, rainwater, moisture, dust, etc., will enter resulting in a failure.

Observe this especially when it is used outdoors.

1. Attachment of this cover is a screw-in type.
2. When removing the cover, pay attention to the O-ring and loosen the screw to remove it toward you. When attaching it, sufficiently tighten the O-ring and securely screw it in.



Firmly and securely tighten the cover by screwing in.

### [6] Key Point Inspection

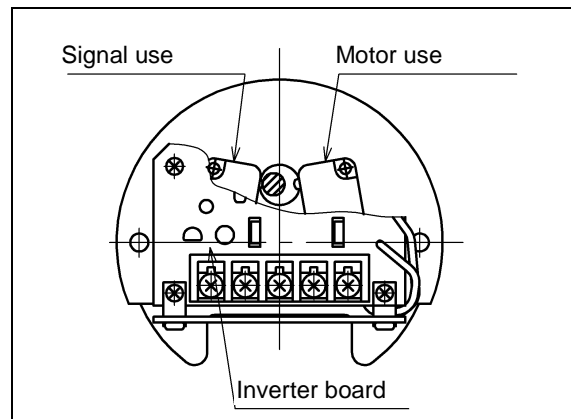
#### <Inspection of internal mechanism>

By removing the rear cover in the procedures specified in item c of [5], the internal mechanism can be seen. Refer to item a of [5], and inspect it.

The button on the observer's left is for the detection signal and the right is for the motor power supply.

There are a lot of small parts mounted on the board, pay careful attention not to damage them.

Also, pay attention to the lead wire. Start work after turning off the power supply, since there is a danger of electric shock. Turn on the power after completing the work.



## [7] Torque Adjustment

Adjustment of the detection torque is equipped on the mechanism mounting plate of the rear face (bottom) of the internal mechanism. By changing the setting position of the spring, it can be adjusted.

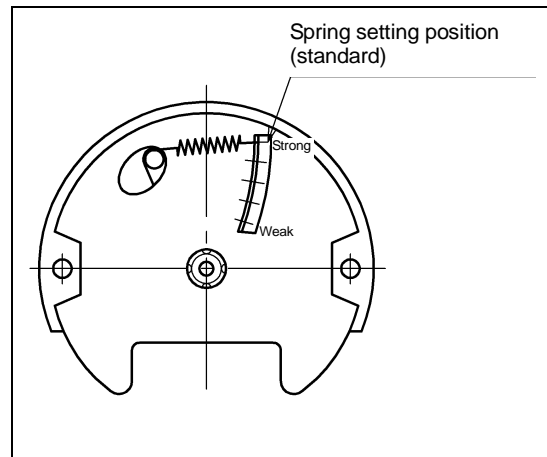
Avoid adjustment in an unreasonable state like deforming the spring when adjusting the detection torque. It negates the effect of the spring disabling detection.

Also, avoid using the “weakest” setting position whenever possible. It is recommended to consider a solution by changing the blade shape.

\* Stable action can be obtained by changing the blade shape.

Please consult us for details.

Change of detection torque (reference)	
Strongest	Weakest
About 10.0N·cm to about 6.0N·cm	



## [8] Power Supply Fuse

A fuse is used in the power supply part of this product. If the circuit of the board should be broken, the internal electric current increases, therefore the fuse works to protect the circuit of the board.

The fuse can be released by turning on the power again. When the fuse works, remove the cause.

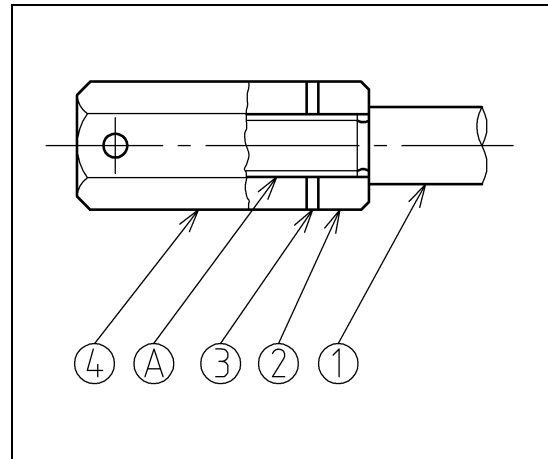
The fuse does not stop the power supply, therefore do not touch the parts on the board, etc.

In an abnormal state, it may be very hot and you may get burned. Please pay careful attention.

## [9] Repair and Replacement Method

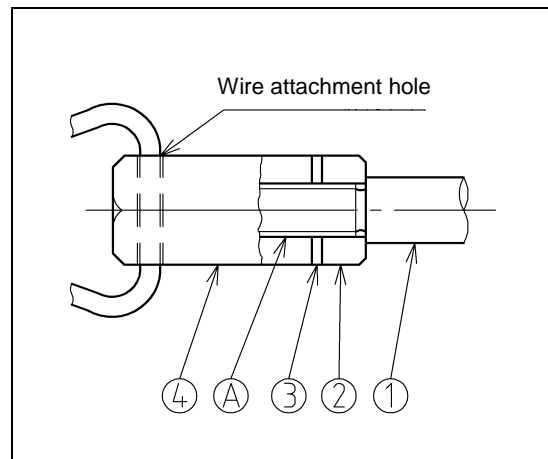
### a-1. Attachment of blade

The relationship between the main shaft and the blade boss is as follows. The screw A is a left-hand thread. Screw the nut ② into the main shaft ①, place the S washer ③, and then screw in the blade boss ④. As a screw locking agent is used for the thread part, please work carefully.



### a-2. Attachment of wire

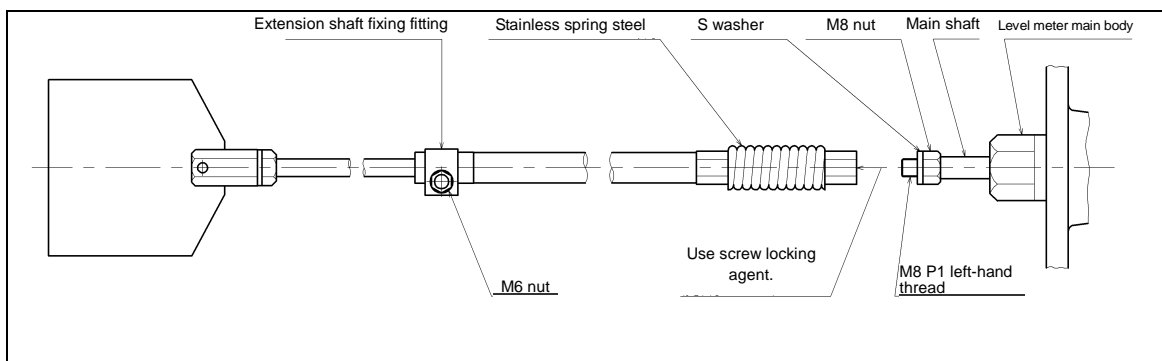
The relationship between the main shaft and the wire (wire boss) is as follows. The screw A is a left-hand thread. Screw the nut ② into the main shaft ①, place the S washer ③, and then screw in the wire boss ④. As a screw locking agent is used for the thread part, please work carefully.



### a-3. Attachment of extension shaft

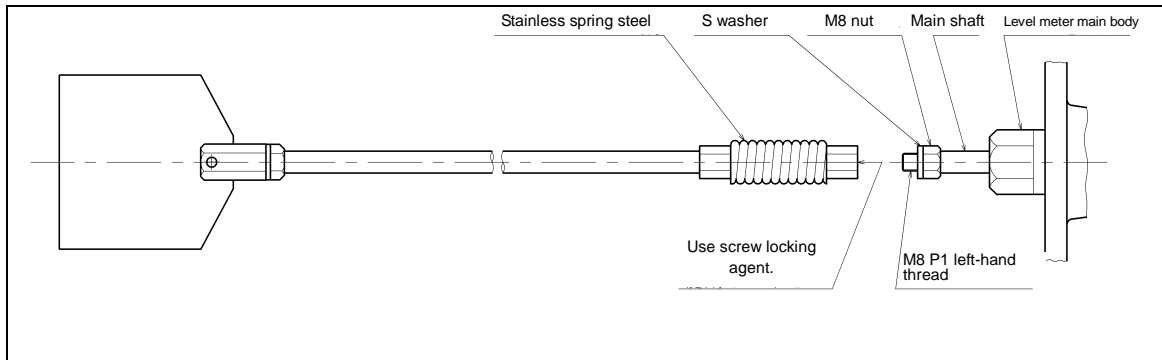
#### Mounting EB/ED model extension shaft

1. Apply a screw locking agent on the screw of the extension shaft spring part.
2. Screw the extension shaft into the main shaft of the level meter. The screw is a left-hand thread.
3. Tighten it completely to the end with the tightening tool.
4. Loosen the M6 nut of the extension shaft fixing fitting, set to the L dimension in your operating environment, and then tighten the M6 nut. (From the flange end face to the tip of the blade is the L dimension.)



## Mounting EA/EC model extension shaft

1. Apply a screw locking agent on the screw of the extension shaft spring part.
2. Screw the extension shaft into the main shaft of the level meter. The screw is a left-hand thread.
3. Tighten it completely to the end with the tightening tool.



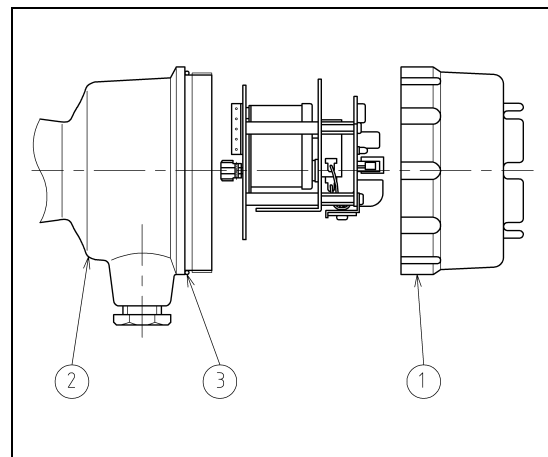
## b. Replacement of internal mechanism

### b-1. Detachment of cover



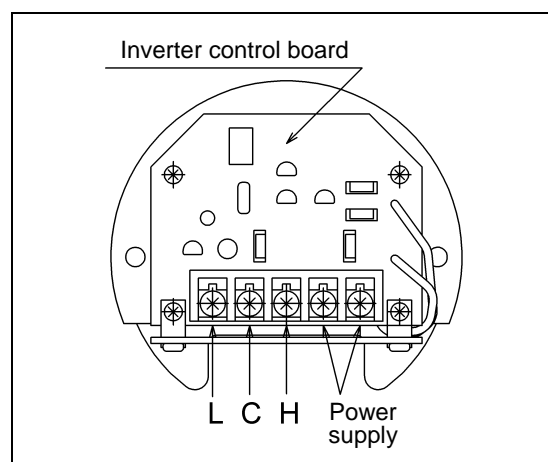
Work in the state that the power is shut off. It may result in an electric shock.

As the cover ① is fixed to the main body case ② by screwing in, loosen the screw to remove it toward you while paying attention to the O-ring ③.



### b-2. Detachment of internal mechanism

Remove the connected external wirings from their terminals. The internal mechanism is fixed to the main body case with 2 screws. Remove them with a Phillips screwdriver and remove the internal mechanism by pulling toward you.



### b-3. Assembly after replacement

When the external wirings are connected to the terminals as they were, attach the cover ①.



Turn on the power after completing the work.

[10] Assembly Inspection Method

1. Check that the wirings are connected correctly with a tester.
2. Check the insulation resistance between each terminal and ground with a megger.

Never fail to check the above items 1 and 2 before starting the next inspection.

- a. Turn on the power supply.
- b. Check that the blade and the main shaft are smoothly rotating.
- c. Touch the blade by hand or place the paddle main body into powder to check that the signal is changed over.  
(2 - 3 positions for 1 turn)
- d. Turn the blade by 90° by hand and check that the rotation of the shaft slips.  
(2 - 3 positions for 1 turn)

[11] Trouble Prevention

1. Do not give impact on the main body.
2. Check that the blade, main shaft, and protective tube are not bending.
3. Pay attention to the attachment of the cover so that no rainwater, dust, etc., enter.
4. Check that no material adheres to the blade or the main shaft.
5. When adjusting the detection torque, do not stretch the spring. It disables detection.
6. Avoid using the weakest torque whenever possible. It is recommended to consider a solution by changing the blade shape.
7. Do not make a mistake in the power supply voltage when wiring.
8. Do not mistake the power supply terminal for the alarm terminal when wiring.
9. Do not flow overcurrent or short circuit the alarm contact.
10. Use an appropriate crimp terminal and adopt a wiring method that is not easily disconnected when wiring to the terminal.
11. Do not tighten the attachment screw to the terminal with more than the necessary force.  
The screw may break off.
12. Prevent rainwater intrusion from the conducting wire outlet.

Examples when abnormality of detection action occurs (outline)

Abnormal state	Material inside tank	This product failure state	
		Main shaft rotation	Signal changing
There is material, however, the signal does not change over to that side.	Bridge is caused by the material, etc., and there is a hollow space around the blade resulting in idling of the blade.	<ol style="list-style-type: none"> <li>1. Power supply, voltage</li> <li>2. Motor failure</li> <li>3. Internal fuse is acting.</li> </ol>	<ol style="list-style-type: none"> <li>1. Contact failure of the contact of the signal output unit.</li> <li>2. Contact burning of the due to overcurrent, etc.</li> </ol>
There is no material, however, the signal does not change over to that side.	The material is adhered and accumulated from the tank wall to the blade.	<ol style="list-style-type: none"> <li>1. Return action failure due to clogging of the seal part.</li> <li>2. Failure of the return spring</li> <li>3. Bending of the main shaft</li> <li>4. Deformation of the main body</li> <li>5. Internal fuse is acting.</li> </ol>	<ol style="list-style-type: none"> <li>1. Contact failure of the contact</li> <li>2. Contact burning of the signal output unit due to overcurrent, etc.</li> </ol>

## [12] Examples of Defects

### 1. Defective due to short-circuit accident

When wiring to the internal mechanism, the alarm side (L, C, H) and the power supply side are mistaken.

◎ Only supply power after making sure.

### 2. Tightening failure of the cover

Especially when using it outdoors, rainwater enters, and corrosion, contact failure, etc., occur.

◎ Securely tighten the cover without fail.

### 3. Defective due to damage of the screws of the cover and the terminal block.

◎ Tighten them with appropriate screwdriver.

### 4. Defective due to intrusion of rainwater, etc., from the conducting wire outlet.

◎ Securely tighten the conducting wire and fittings.



Pay careful attention so as not to touch the terminal block by finger tip, etc. (Watch out for electric shocks)

### 5. When the power supply fuse acts.

◎ Malfunction of the internal mechanism board. Defective due to dew condensation or adhesion of foreign matter on the board.

Or defective due to the above 2 or 4.

\* Turn off the power supply once and turn it on again for recovery.

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