



## INSTRUCTION MANUAL

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### PADDLE TYPE LEVEL SWITCH

MODEL: PRL

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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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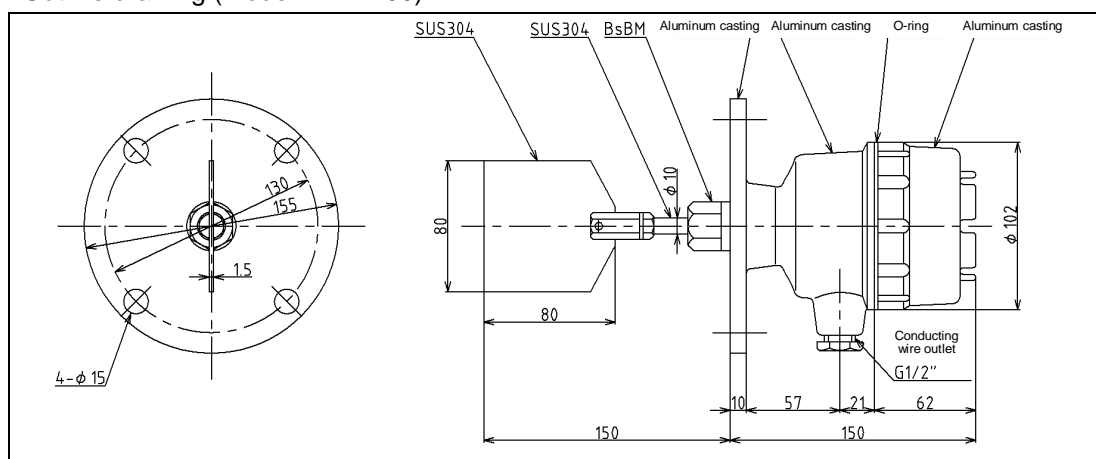
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Outline drawing (Model: PRL-100)



### [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 stopped and the contact output is issued. It is structured so that the motor power is cut off at this point to protect the motor.

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

### [2] Standard Specifications

|                       |   |
|-----------------------|---|
| Power voltage         | 100/110V AC 50/60Hz, or 200/220V AC 50/60Hz   |
| Attaching method      | Flange attachment JIS 5K65A   |
| Power consumption     | 2.5W  |
| Contact output        | 1C contact 250V AC 5A (resistance load)   |
| Detection torque (*1) | About 10.0 N·cm   |
| Slip torque (*2)      | About 30.0 N·cm   |
| Rotation speed        | 1 rpm   |
| Material              | Main body case, flange: aluminum casting<br>Main shaft, blade: SUS304<br>Seal: nitrile rubber |
| Operating temperature | Inside the tank: 70°C max.<br>Outside the tank: 55°C max.                                     |
| Operating pressure    | Inside the tank: 0 - 196 kPa  |
| Paint color           | Munsell 10YR7.5/14  |

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 slip mechanism start functioning in a case of overload or impact applied to the blade.

[3] Models

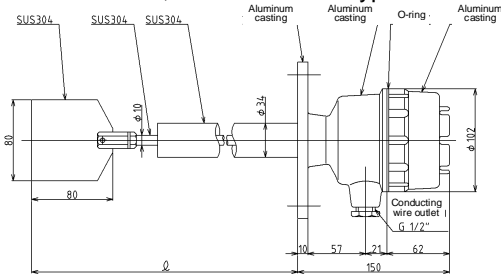
PRL — ☐ ☐ ☐ ☐

| 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  |
| Other specifications                   |   |
| EA, EC                                 | Fixed type with extension shaft                             |
| EB, ED                                 | Extension and contraction type with extension shaft         |
| F                                      | 2 flanges   |
| S                                      | Special specification of seal part                          |
| J                                      | Specifications considering earthquake resistance            |
| G                                      | Double protective tube air purge, air cooling specification |
| N                                      | Withstand load low cost (only applicable for 500N)          |
| W                                      | Wire type (only applicable for 500W)                        |
| P                                      | With pulse output   |
| Z                                      | Very small load specification                               |
| KC                                     | With indoor specification connector                         |
| KW                                     | With outdoor use connector                                  |

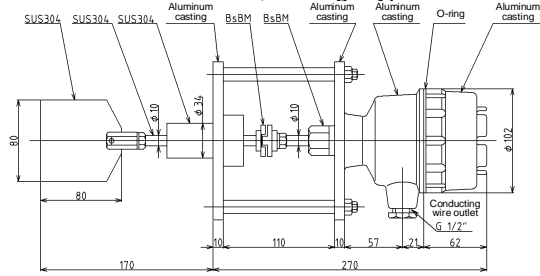
\* The other specifications can overlap depending on the combination.

## Outline drawings (other standard models)

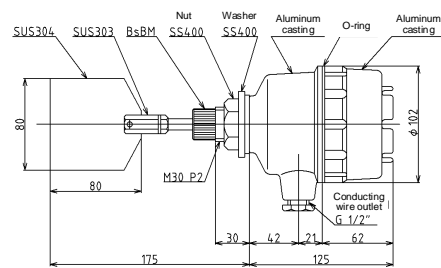
**Model PRL-101, Protective tube type**



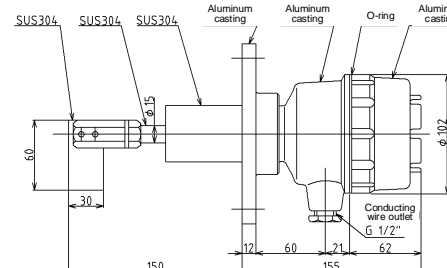
**Model PRL-100F/200F, 2 flange type**



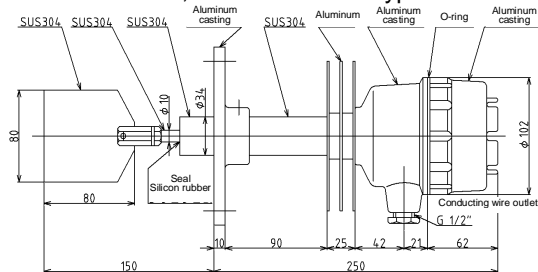
**Model PRL-170, Screw-in type**



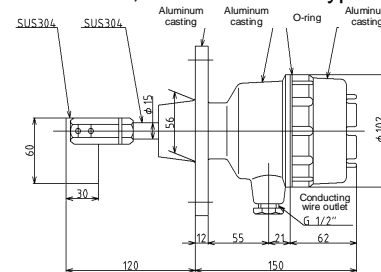
**Model PRL-500, Withstand load type**



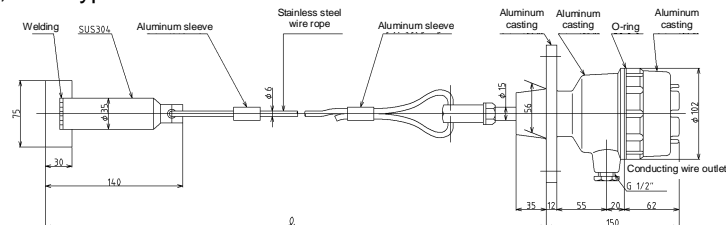
**Model PRL-200, Heat resistance type**



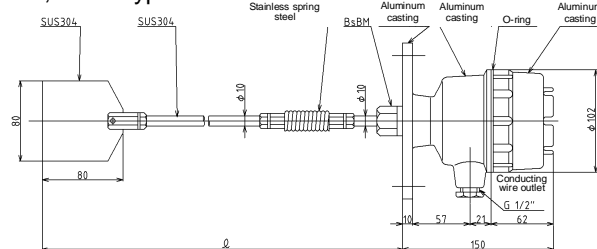
**Model PRL-500N, Withstand load type**



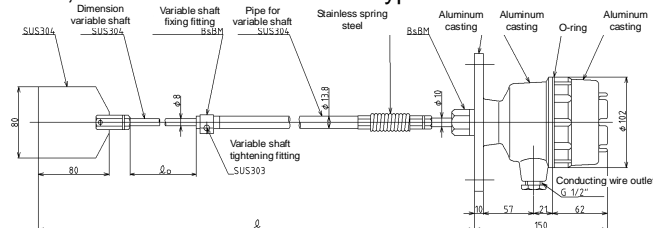
**Model PRL-500W, Wire type**



**Model PRL-100EA/100EC, Fixed type with extension shaft**



**Model PRL-100EB/100ED, Extension and contraction type with extension shaft**





#### [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

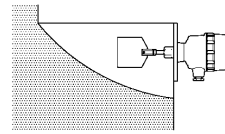
Attach it to a position anticipating the time when the conveyor starts moving and the raw material is fed after the hopper “empty” signal is issued.

##### e. Slide flange type

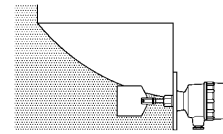
The flange part slides toward the blade by loosening the hexagon socket head bolt. Attach it to a position under good condition. After determining the position of the flange, firmly tighten the hexagon socket head bolt.

#### When attaching at an upper position

##### Bad example

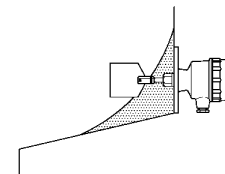


##### Good example

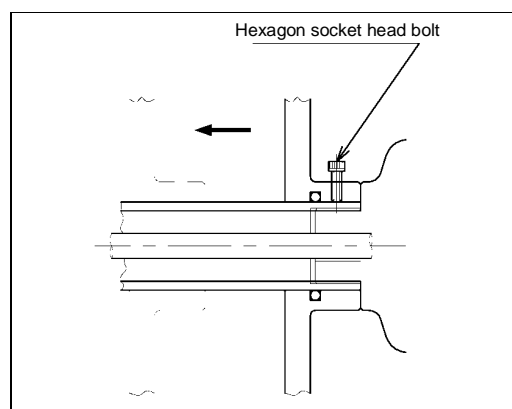
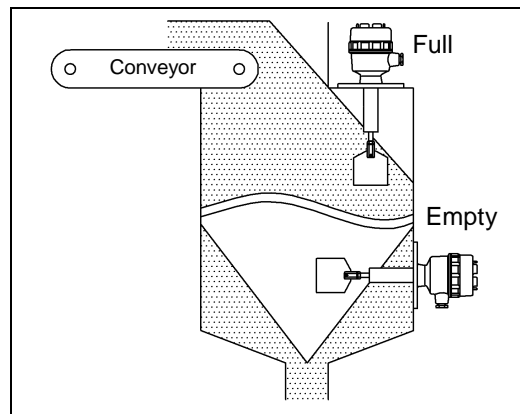
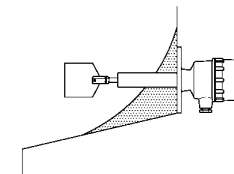


#### When attaching at a lower position

##### Bad example



##### Good example





## [5] Cautions for Connection

### a. External terminals

The color coding of the external terminals are as shown below.

#### a-1. Power Supply (wire color of motor)

White and white in the case of 100V AC (110V AC), and black and black in the case of 200V AC (220V AC).

Regardless of the voltage, white and black in the case of shipment from our company with lead wire.



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 (1C contact)

L ("b" contact): green

C (common): yellow

H ("a" contact): red

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.

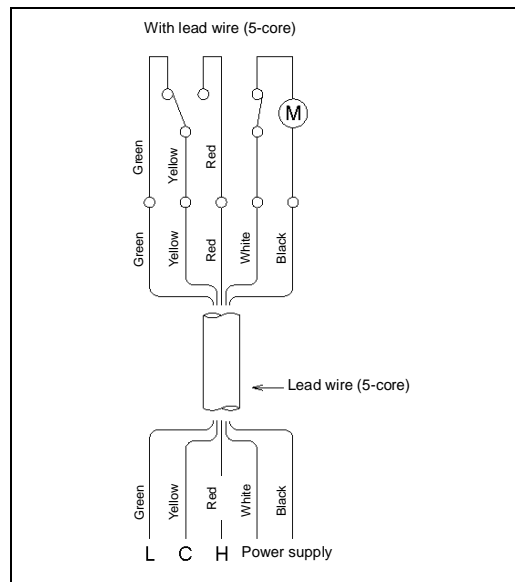
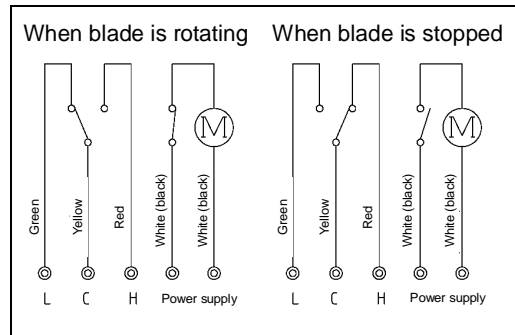
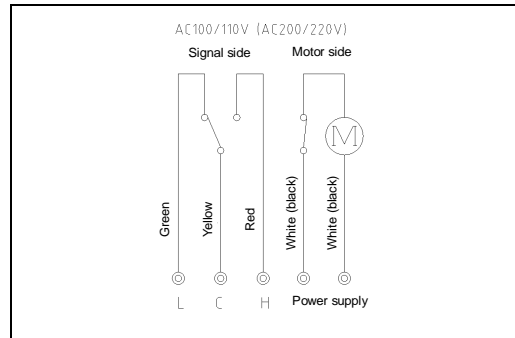
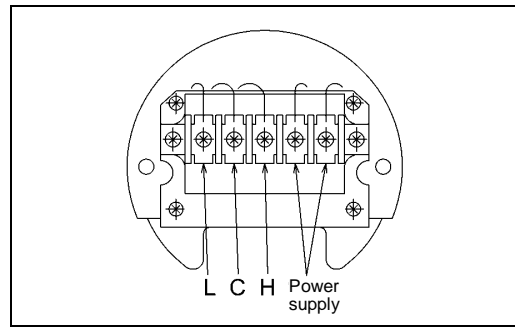
The colors are provided in the same manner for one with a lead wire (5-core), so wire the signal appropriate for your use from the terminals.



Contact capacity

Standard: 250V AC 5A

Z type (very small load): 250V AC 0.1A



### a-3. Circuit with lamp/with pulse contact

#### <With lamp>

- Blade rotation lamp lighting specification  
When the blade is rotating, the lamp lights up.
- Blade stop lamp lighting specification  
When the blade is at a stop, the lamp lights up.

#### <Pulse lamp>

6 pulses for the blade 1 rotation / 1 minute

#### <With pulse contact>

6 pulses are output for the blade 1 rotation / 1 minute.

Wire from the 2P terminal of the internal mechanism

#### Rating

Maximum contact capacity: 25W

Maximum switching voltage: 1000V DC

Maximum switching current: 1A

#### <With connector>

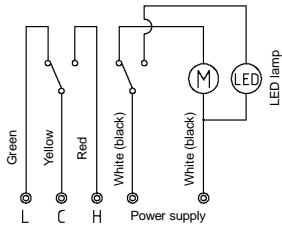
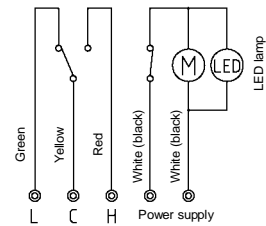
For indoors (Model PRL-100KC)

For outdoors (Model PRL-100KW)

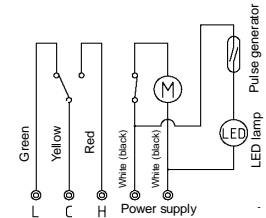
“a” contact and “b” contact are prepared for contact.

Please designate contact and connector appropriate for your specifications. The connector for outdoors is a waterproof type.

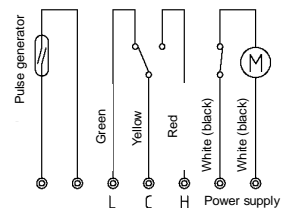
#### <With lamp>



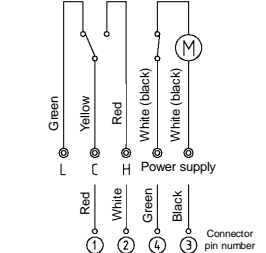
#### <Pulse lamp>



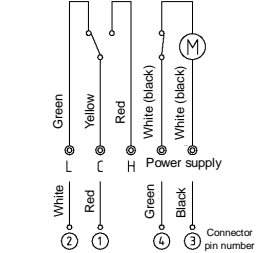
#### <With pulse contact >



#### KC/KW model (“a” contact) circuit diagram



#### KC/KW model (“b” contact) circuit diagram





#### a-4. Check change of detection signal

##### Checking method of signal change

Lightly turn the blade counterclockwise for about  $20^\circ$ .

When the blade is turned counterclockwise for about  $20^\circ$ ,

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

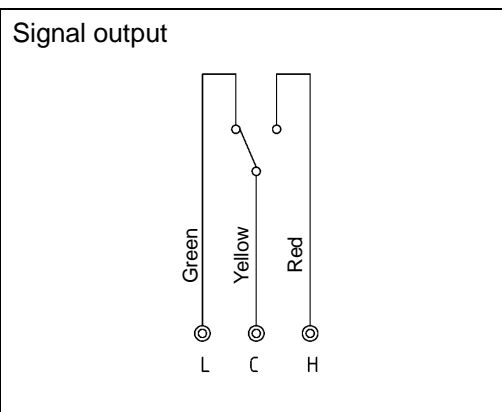
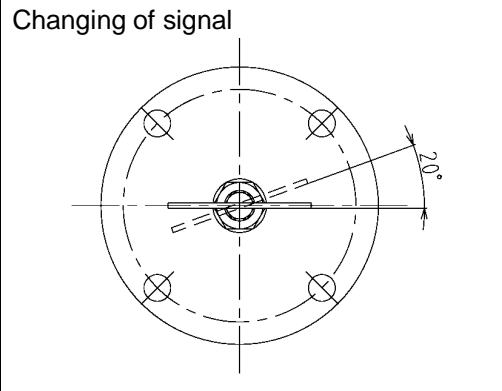
Between C and L: current carrying state

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  $90^\circ$ .

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

##### Slip torque value

About 30.0 N·cm



b. Wiring used and piping, air purge specifications

b-1.

For wiring used, twist wires to crimp with a crimp type terminal (R-3) and then connect to the external terminal. Avoid a single wire whenever possible.



CAUTION

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.



CAUTION

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.

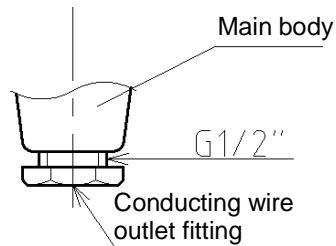
b-4.

Use seal tape, etc., to the piping of air purge so as not to cause air leakage. If there is an intrusion of foreign matter, moisture, etc., into the piping, it may cause a defective, so pay attention.

Do not loosen the fixing parts such as flange bolts in a state that pressure is applied to the paddle type level switch. It may cause a failure or defective. When removing the paddle type level switch, previously close the main valve.

The recommended pressure of the air purge nozzle R1/4" is within the range of 20Kpa to 50Kpa for use. When it is set slightly higher than the tank inner pressure within the air purge recommended pressure, it is more effective for seal clogging prevention.

Conducting wire outlet



Examples of cables that can be used

CVV (vinyl cable for control)

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

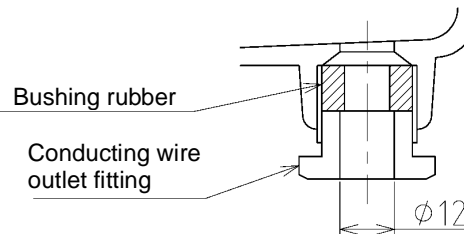
2.00 mm 3-core, finished outside diameter:  $\phi 11$

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.

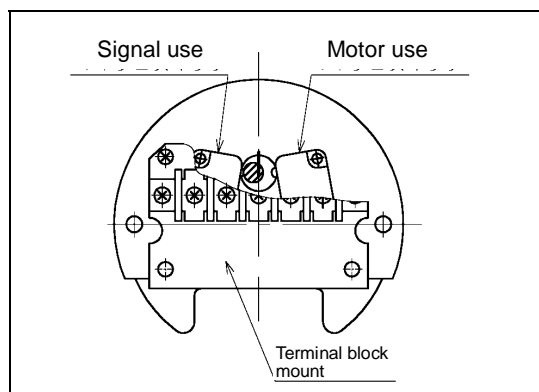
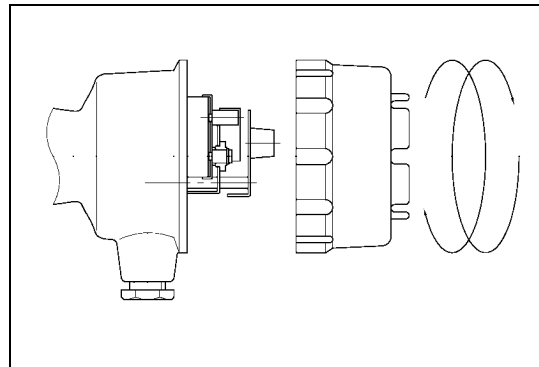


Firmly and securely tighten the cover by screwing in.

### [6] Key Point Inspection

#### <Inspection of internal mechanism>

If the rear cover is removed in the procedures of item c of [5], the operation state of the internal mechanism can be checked. Inspect after referring to item a of [5].



## [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. As for the removing method of the internal mechanism, refer to b-2 detachment of internal mechanism on page 12.

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” spring setting position whenever possible. It is recommended to consider a solution by changing the blade shape.

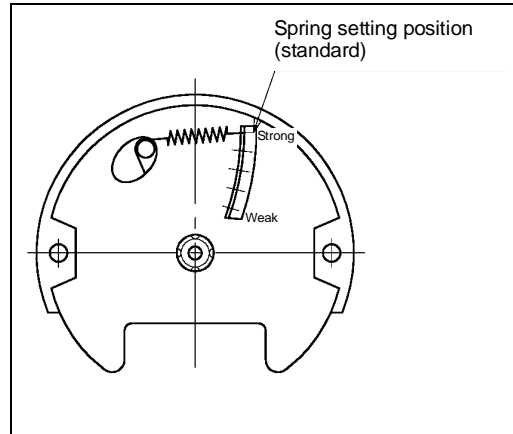
\* Stable action can be obtained by changing the blade shape.

Please consult us for details.

## [8] Repair and Replacement Method

### a-1. Attachment of blade

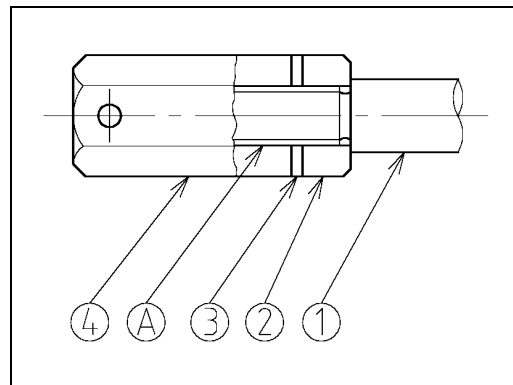
The relationship between the main shaft and the blade boss is as follows. The screw A is a left-hand thread. Screw the nut ② into the main shaft ①, place the S washer ③, and then screw in the blade boss ④. When replacing the blade, fix the nut ② with a spanner, etc., and turn the blade boss ④ clockwise to remove it. As a screw locking agent is used for the thread part, please work carefully.



### Change of deflection torque (reference)

|   |                 |
|---|-----------------|
| Strongest (position of strong)            | About 10.0 N·cm |
| Weak 4 (4 <sup>th</sup> from the weakest) | About 9.0 N·cm  |
| Weak 3 (3 <sup>rd</sup> from the weakest) | About 8.0 N·cm  |
| Weak 2 (2 <sup>nd</sup> from the weakest) | About 7.0 N·cm  |
| Weakest (position of weak)                | About 6.0 N·cm  |

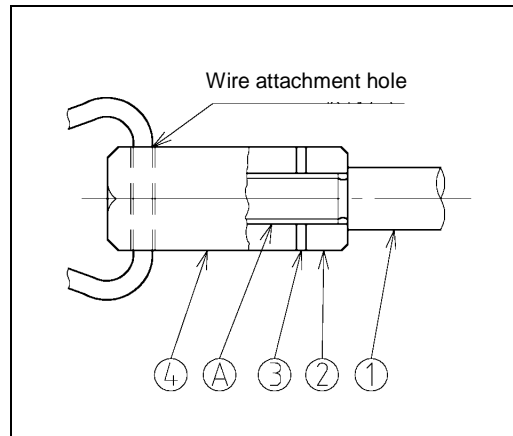
\* Do not use at the weakest whenever possible.



### 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.

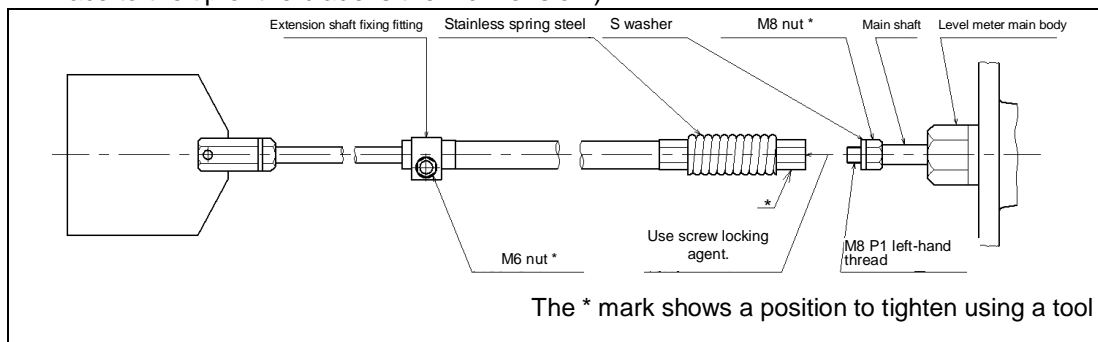
When replacing the wire boss, fix the nut ② with a spanner, etc., and turn the wire boss ④ clockwise to remove it. As a screw locking agent is used for the thread part, please work carefully.



### a-3. Attachment of extension shaft

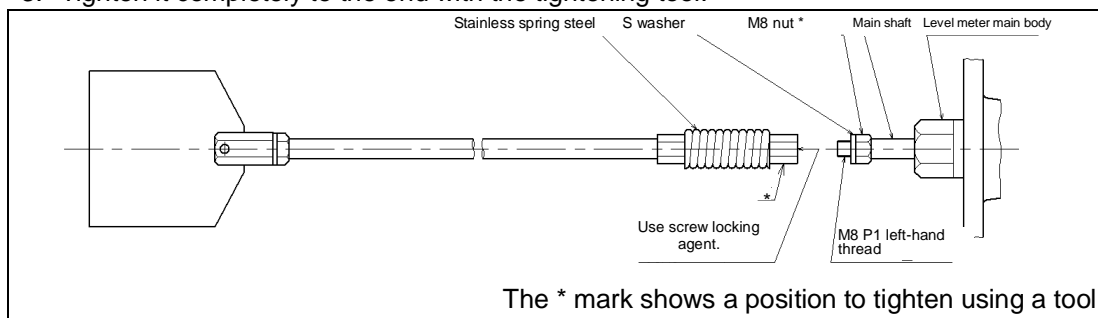
Mounting EB/ED model extension shaft

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 securely 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 and attachment of internal mechanism

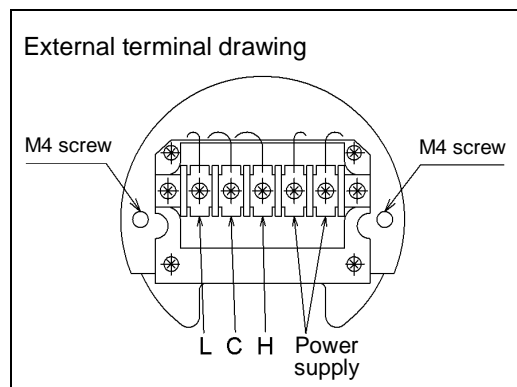
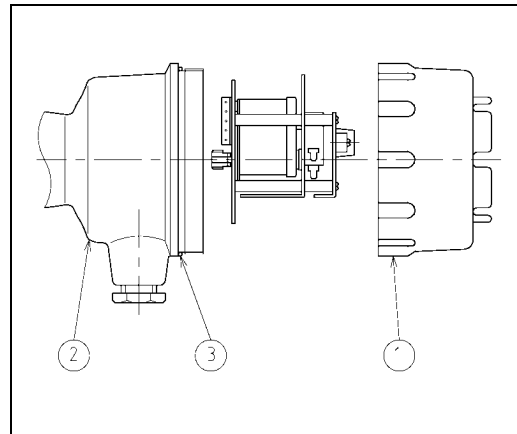
Remove the connected external wirings from their terminals. The internal mechanism is fixed to the main body case with 2 M4 screws. Remove them with a Phillips screwdriver and remove the internal mechanism by pulling toward you. When attaching the internal mechanism, insert it until a clicking sound is made.

### b-3. Assembly after replacement

When the external wirings are connected to the terminals as they were, attach the cover ①. When attaching the cover, pay attention not to press the connected external wirings or not to slacken them unnecessarily.



Turn on the power after completing the work.



[9] Operation Checking Method

1. Check that the wirings are connected correctly with a tester.
2. Check the insulation resistance between each terminal and ground.
3. Turn on the power supply.
4. Check that the blade and the main shaft are smoothly rotating.
5. Touch the blade by hand or place the entire blade into powder to check that the signal is changed over.  
(2 - 3 positions for 1 turn)
6. Turn the blade by 90° by hand and check that the rotation of the shaft slips.  
(2 - 3 positions for 1 turn)

[10] 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” spring setting position 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. Securely construct the conducting wire outlet to prevent intrusion of rainwater.

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. | 1. Power supply, voltage<br>2. Motor failure   | 1. Contact failure of the contact of the signal output unit.<br>2. Contact burning of the due to overcurrent, etc. |
| 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.   | 1. Return action failure due to clogging of the seal part.<br>2. Failure of the return spring<br>3. Bending of the main shaft<br>4. Deformation of the main body | 1. Contact failure of the contact<br>2. Contact burning of the signal output unit due to overcurrent, etc.         |

## [11] Examples of Defects (Typical Examples)

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

When wiring to the internal mechanism, the signal 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 outlet fitting. And when carrying out piping, also construct securely.



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