# Small Safety Limit Switch
# D4F

CSM_D4F_DS_E_4_1

## Smallest Class of Safety Limit Switches in the World

- The world's smallest limit switch with a direct opening mechanism (four-contact construction model).
- High-sensitivity safety limit switch.
- Built-in switches with two- or four-contact construction are available.
- Degree of protection: IP67
- Conforms to EN115-1, EN81-1 and EN81-2. (slow-action models only)
- Certified standards: UL, EN (TÜV), and CCC

⚠ Be sure to read the *"Safety Precautions"* on page 6 and the *"Precautions for All Safety Limit Switches"* .

**Note:** Contact your sales representative for details on models with safety standard certification.

For the most recent information on models that have been certified for safety standards, refer to your OMRON website.

## Model Number Structure

### Model Number Legend

**D4F-□□-□□**
**1 2 3 4**

1. **Built-in Switch**
   1: 1NC/1NO (slow-action)
   2: 2NC (slow-action)
   3: 2NC/2NO (slow-action)
   4: 4NC (slow-action)
2. **Actuator**
   02: Roller plunger (Metal roller)
   20: Roller lever (Metal lever, resin roller)
3. **Cable Length**
   1: 1 m
   3: 3 m
   5: 5 m
4. **Pull-outing direction of cable**
   R: Horizontal
   D: Vertical

## Ordering Information

### List of Models

#### Safety Limit Switches (with Direct Opening Mechanism)

Consult with your OMRON representative when ordering any models that are not listed in this table.

| Actuator | Cable length | Pull-outing direction of cable | Built-in switch | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | 1NC/1NO (slow-action) | | 2NC (slow-action) | | 2NC/2NO (slow-action) | | 4NC (slow-action) | |
| | | | Model | Direct opening | Model | Direct opening | Model | Direct opening | Model | Direct opening |
| Roller lever (Metal lever, resin roller) | 1 m | Horizontal | D4F-120-1R | ⊖ | D4F-220-1R | ⊖ | D4F-320-1R | ⊖ | D4F-420-1R | ⊖ |
| | | Vertical | D4F-120-1D | | D4F-220-1D | | D4F-320-1D | | D4F-420-1D | |
| | 3 m | Horizontal | D4F-120-3R | ⊖ | D4F-220-3R | ⊖ | D4F-320-3R | ⊖ | D4F-420-3R | ⊖ |
| | | Vertical | D4F-120-3D | | D4F-220-3D | | D4F-320-3D | | D4F-420-3D | |
| | 5 m | Horizontal | D4F-120-5R | ⊖ | D4F-220-5R | ⊖ | D4F-320-5R | ⊖ | D4F-420-5R | ⊖ |
| | | Vertical | D4F-120-5D | | D4F-220-5D | | D4F-320-5D | | D4F-420-5D | |
| Roller plunger (Metal roller) | 1 m | Horizontal | D4F-102-1R | ⊖ | D4F-202-1R | ⊖ | D4F-302-1R | ⊖ | D4F-402-1R | ⊖ |
| | | Vertical | D4F-102-1D | | D4F-202-1D | | D4F-302-1D | | D4F-402-1D | |
| | 3 m | Horizontal | D4F-102-3R | ⊖ | D4F-202-3R | ⊖ | D4F-302-3R | ⊖ | D4F-402-3R | ⊖ |
| | | Vertical | D4F-102-3D | | D4F-202-3D | | D4F-302-3D | | D4F-402-3D | |
| | 5 m | Horizontal | D4F-102-5R | ⊖ | D4F-202-5R | ⊖ | D4F-302-5R | ⊖ | D4F-402-5R | ⊖ |
| | | Vertical | D4F-102-5D | | D4F-202-5D | | D4F-302-5D | | D4F-402-5D | |

# Specifications

## Standards and EC Directives

### Conforms to the following EC Directives:

- Machinery Directive
- Low Voltage Directive
- EN50047
- EN60204-1
- EN1088
- GS-ET-15

### Certified Standards

| Certification body | Standards | File No. |
|---|---|---|
| TÜV SÜD | EN60947-5-1<br>(certified direct opening) | ✻1 |
| UL ✻2 | UL508<br>CSA C22.2 No.14 | E76675 |
| CQC (CCC) ✻3 | GB14048.5 | 20030103050<br>64266 |

✻1. Contact your OMRON sales representative.
✻2. Certification has been obtained for CSA C22.2 No. 14 under UL.
✻3. Ask your OMRON representative for information on certified models.

## Certified Standard Ratings

### TÜV (EN60947-5-1), CCC (GB14048.5)

| Item / Utilization category | AC-15 | DC-13 |
|---|---|---|
| Rated operating current ($I_e$) | 0.75 A | 0.27 A |
| Rated operating voltage ($U_e$) | 240 V | 250 V |

**Note:** Use a 10 A fuse type gI or gG that conforms to IEC60269 as a short-circuit protection device.

### UL/CSA (UL508, CSA C22.2 No. 14)

**C300**

| Rated voltage | Carry current | Current (A) | | Volt-amperes (VA) | |
|---|---|---|---|---|---|
| | | Make | Break | Make | Break |
| 120 VAC<br>240 VAC | 2.5 A | 15<br>7.5 | 1.5<br>0.75 | 1,800 | 180 |

**Q300**

| Rated voltage | Carry current | Current (A) | | Volt-amperes (VA) | |
|---|---|---|---|---|---|
| | | Make | Break | Make | Break |
| 125 VDC<br>250 VDC | 2.5 A | 0.55<br>0.27 | 0.55<br>0.27 | 69 | 69 |

## Characteristics

| | | |
|---|---|---|
| **Degree of protection ✻1** | | IP67 (EN60947-5-1) |
| **Durability ✻2** | **Mechanical** | 10,000,000 times min. |
| | **Electrical** | 1,000,000 times min. (4 mA resistive load at 24 VDC, 4 circuits)<br>150,000 times min. (1 A resistive load at 125 VAC, 2 circuits/4 mA resistive load at 24 VDC, 2 circuits) ✻3 |
| **Operating speed** | | 1 mm/s to 0.5 m/s |
| **Operating frequency** | **Mechanical** | 120 operations/minute |
| | **Electrical** | 30 operations/minute |
| **Contact resistance ✻5** | | 300 mΩ max. (with 1 m cable), 500 mΩ max. (with 3 m cable), 700 mΩ max. (with 5 m cable) |
| **Minimum applicable load ✻4** | | 4 mA resistive load at 24 VDC, 4 circuits (N-level reference value) |
| **Rated insulation voltage ($U_i$)** | | 250 V |
| **Rated frequency** | | 50/60 Hz |
| **Protection against electric shock** | | Class I (with a ground wire) |
| **Pollution degree (operating environment)** | | 3 (EN60947-5-1) |
| **Impulse withstand voltage (EN60947-5-1)** | **Between terminals of same polarity** | 2.5 kV |
| | **Between terminals of different polarity** | 4 kV |
| | **Between each terminal and ground** | 4 kV |
| **Insulation resistance** | | 100 MΩ min. (at 500 VDC) between terminals of the same polarities, between terminals of different polarities, between current-carrying metal parts and grounds, and between each terminal and non-current carrying metal parts |
| **Contact gap** | | 2 × 2 mm min. |
| **Vibration resistance** | **Malfunction** | 10 to 55 Hz, 0.75 mm single amplitude |
| **Shock resistance** | **Destruction** | 1,000 $m/s^2$ min. |
| | **Malfunction** | 300 $m/s^2$ min. |
| **Conditional short-circuit current** | | 100 A (EN60947-5-1) |
| **Conventional free air thermal current (Ith)** | | 2.5 A (EN60947-5-1) |
| **Ambient operating temperature** | | –30 to 70°C (with no icing) |
| **Ambient operating humidity** | | 95% max. |
| **Cable** | | UL2464 No. 22 AWG, finishing O.D.: 8.3 mm |
| **Weight** | | Approx. 190 g (D4F-102-1R, with 1 m cable)<br>Approx. 220 g (D4F-120-1R, with 1 m cable) |

**Note: 1.** The above values are initial values.
**2.** Once the contact is opened or closed with an ordinary load, it cannot be used for a load smaller than that. The contact surface may be rough, which impairs the reliability of contacting.

**✻1.** The degree of protection shown above is based on the test method specified in EN60947-5-1. Be sure to confirm in advance the sealing performance under the actual operating environment and conditions.

**✻2.** Durability values are calculated at an operating temperature of 5 to 35°C, and an operating humidity of 40% to 70%. Contact your OMRON sales representative for more detailed information on other operating environments.

**✻3.** Do not apply 1 A at 125 VAC to more than two circuits.

**✻4.** The value will vary depending on factors such as the switching frequency, the ambient environment, and the reliability level. Be sure to confirm correct operation with the actual load before application.

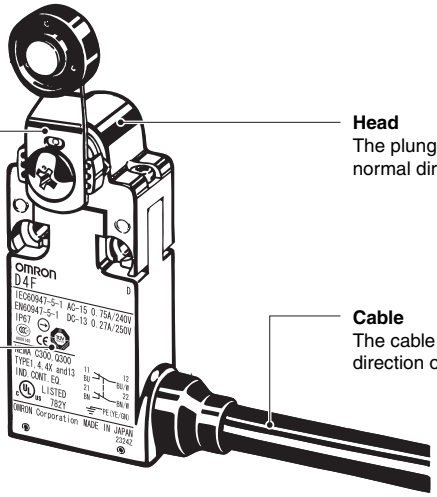
**✻5.** The contact resistance was measured with 0.1 A at 5 to 8 VDC with a fall-of-potential method.

# Structure and Nomenclature

## Structure

**Lever**
Improved safety of the lever-setting (Form lock configuration). Many grooves are incised on the lever and the rotating shaft that mesh with each other to prevent a slip between the lever and the rotating shaft.
The lever can be set for positioning in steps of 9 degrees.

**Built-in Switch**
Has a direct opening mechanism separating the contacts when the NC contacts are welded.

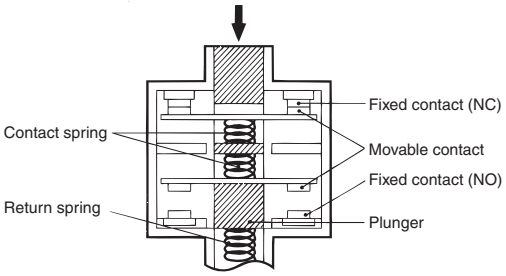



**Head**
The plunger type of actuator can be used in a normal direction and reverse direction.

**Cable**
The cable can be pulled out in a horizontal direction or in a vertical direction.

## Direct Opening Mechanism

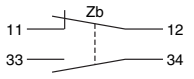
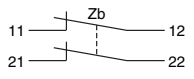
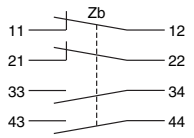
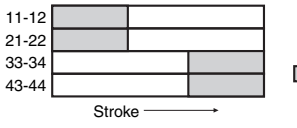
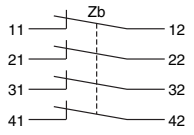
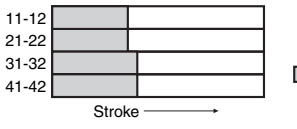
### 1NC/1NO Contact (slow-action)




Conforms to EN60947-5-1 Direct Opening ⊖.

(Only the NC contacts have a direct opening function.)
When contact welding occurs, the NC contacts are separated from each other by pushing in the plunger.

## Contact Form

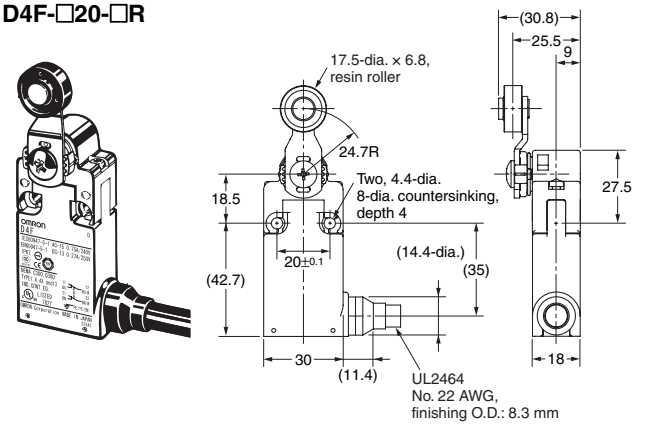
| Model | Contact | Contact form | Operating pattern | Remarks |
|---|---|---|---|---|
| **D4F-1□-□□** | 1NC/1NO (slow-action) |   | | Only NC contact 11-12 has a certified direct opening mechanism. ⊖<br>The terminals 11-12 and 33-34 can be used as unlike poles. |
| **D4F-2□-□□** | 2NC (slow-action) |   | | NC contacts 11-12 and 21-22 have a certified direct opening mechanism. ⊖<br>The terminals 11-12 and 21-22 can be used as unlike poles. |
| **D4F-3□-□□** | 2NC/2NO (slow-action) |   |   | NC contacts 11-12 and 21-22 have a certified direct opening mechanism. ⊖<br>The terminals 11-12, 21-22, 33-34 and 43-44 can be used as unlike poles. |
| **D4F-4□-□□** | 4NC (slow-action) |   |   | NC contacts 11-12, 21-22, 31-32 and 41-42 have a certified direct opening mechanism. ⊖<br>The terminals 11-12, 21-22, 31-32 and 41-42 can be used as unlike poles. |

**Note:** The terminal numbers are according to EN 50013 and the contact symbols are according to EN 60947-5-1.

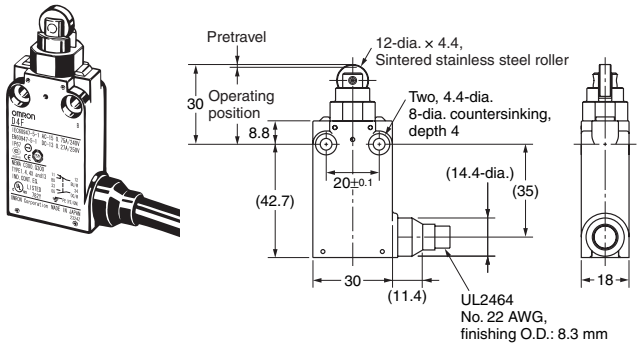
# Dimensions and Operating Characteristics

(Unit: mm)

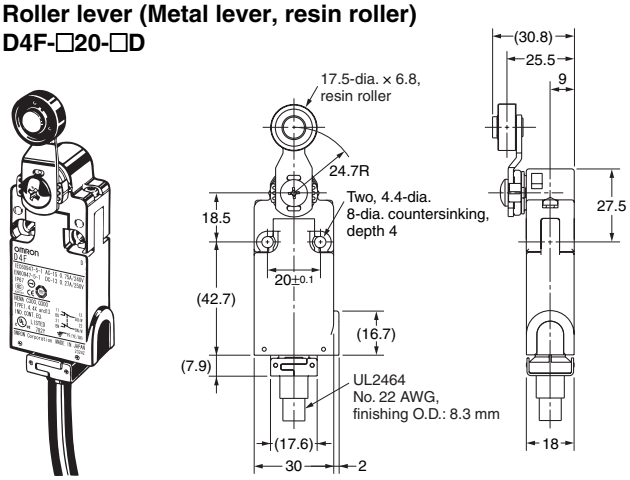
**Roller lever (Metal lever, resin roller)**
**D4F-□20-□R**



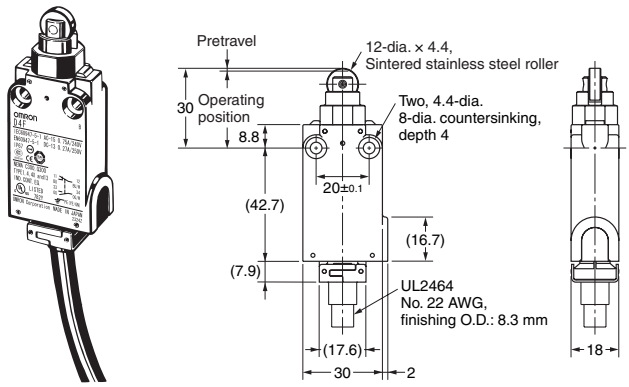

**Roller plunger (Metal roller)**
**D4F-□02-□R**




**Roller lever (Metal lever, resin roller)**
**D4F-□20-□D**




**Roller plunger (Metal roller)**
**D4F-□02-□D**




**Note:** Each dimension has a tolerance of 0.4 mm unless otherwise specified.

## Slow-action (1NC/1NO), (2NC), (2NC/2NO), and (4NC)

| Operating Characteristics | Model | D4F-□20-□R<br>D4F-□20-□D | D4F-□02-□R<br>D4F-□02-□D |
|---|---|---|---|
| **Operating force** | **OF max. ✻1** | 5 N | 12 N |
| **Release force** | **RF min. ✻2** | 0.5 N | 1.5 N |
| **Pretravel** | **PT1 (11-12 and 21-22)**<br>**PT1 (31-32 and 41-42)**<br>**PT2 ✻3** | 6±3° (NC)<br>9±3° (NC)<br>(12°) (NO) | 1 mm max. (NC)<br>1.3 mm max. (NC)<br>(1.2 mm) (NO) |
| **Overtravel** | **OT min.** | 40° | 3.2 mm |
| **Operating position** | **OP (11-12 and 21-22)**<br>**OP (31-32 and 41-42)** | ---<br>--- | 29.4±1 mm<br>29±1 mm |
| **Total travel** | **TT ✻3** | (55°) | (4.5 mm) |
| **Direct opening travel** | **DOT min. ✻4** | 18° | 1.8 mm |
| **Direct opening force** | **DOF min.** | 20 N | 20 N |

**Note:** Variation occurs in the simultaneity of contact opening/closing operations of 2NC, 2NC/2NO, and 4NC contacts. Check contact operation.

**✻1.** The OF value is the maximum load that opens an NC contact (11-12, 21-22, 31-32, 41-42).

**✻2.** The RF value is the minimum load that closes an NC contact (11-12, 21-22, 31-32, 41-42).

**✻3.** The PT2 and TT values are reference values.

**✻4.** The D4F is used in accordance with EN81 and EN115 at a minimum DOT of 30° and 2.8 mm.

# Safety Precautions

Be sure to read the precautions **for All Safety Limit Switches** in the website at:http://www.ia.omron.com/.

**Indication and Meaning for Safe Use**

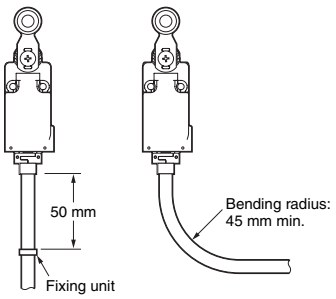
| | |
|---|---|
| **Precautions for Safe Use** | **Supplementary comments on what to do or avoid doing, to use the product safely.** |
| **Precautions for Correct Use** | **Supplementary comments on what to do or avoid doing, to prevent failure to operate, or undesirable effect on product performance.** |

## Precautions for Safe Use

- Do not use more than one D4F side-by-side.
- Do not switch circuits for two or more standard loads (250 VAC, 3 A). Doing so may adversely affect insulation performance.

### Handling of Cables

- Cables cannot be flexed repeatedly.
- The cable is fixed with sealing materials on the bottom of the switch. When excessive force may be imposed on the cable, fasten the cable with a fixing unit at a distance of 50 mm from the bottom of the switch as shown.
- Do not pull or press the cable at an excessive force (50 N max.).
- When bending the cable, secure the cable with more than 45 mm bending radius so as not to cause damage to the insulator or sheath of the cable. Doing so may result in current leakage or burning.




- When wiring, be sure to prevent penetration of a liquid such as water or oil through the cable end.

### Operating Environment

- Do not use the Switch submersed in oil or water or in locations continuously subject to splashes of oil or water. Doing so may result in oil or water entering the Switch. (The IP67 degree of protection of the Switch specifies the amount of water penetration after the Switch is submerged in water for a certain period of time.)

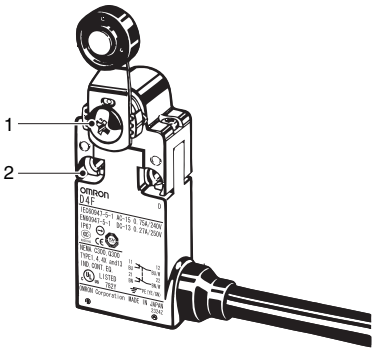
## Precautions for Correct Use

The Switch contacts can be used with either standard loads or microloads. Once the contacts have been used to switch a load, however, they cannot be used to switch smaller loads. The contact surfaces will become rough once they have been used and contact reliability for smaller loads may be reduced.

### Appropriate Tightening Torque

Be sure to tighten each screw of the D4F properly, otherwise the D4F may soon malfunction

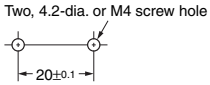
| No. | Type | Appropriate tightening torque |
|---|---|---|
| 1 | Lever mounting screw (M5) | 2.4 to 2.8 N·m |
| 2 | Body mounting screw (M4) | 1.18 to 1.37 N·m |




### Mounting

Use two M4 screws and washers to mount the D4F securely. The D4F can be mounted more securely with proper tightening torque.

**Mounting Holes (Unit: mm)**




### Changing the Lever Angle

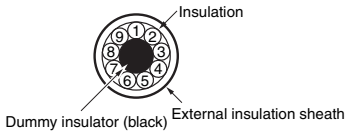
- Unfasten the screw that holds the lever to set the position of the lever at any angle through 360° (in steps of 9°).
- After unfastening the screws that hold the lever, mount the lever the other way (normal side or reverse side). Set an angle of the lever to complete adjustment within a range in which the lever does not touch the switch body.

## Wiring

### Identifying Wires

Identify wires according to the color (with or without white lines) of the insulation on the wire.

**Cross section**




**Core Insulator Colors**

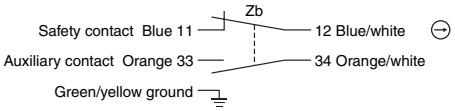
Blue/white, Orange/white, Pink/white, Brown/white, Green/yellow, Brown, Pink, Orange, and Blue

Example: Blue/white is a blue insulator with a white line.

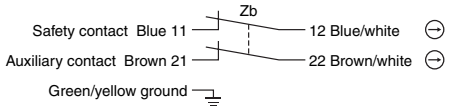
### Terminal Numbers

- Identify terminal numbers based on the color (with or without white lines) of the insulation on the wire.
- The safety and auxiliary contacts of D4F models of four-terminal contact construction and those of two-terminal contact construction are described below.
- The safety contacts are direct-opening NC contacts (11-12 and 21-22); they are used for safety circuits, and each of them is indicated with the appropriate mark ⊖.
- Auxiliary contacts are used to check (to monitor) the operating state of the switch, which are equivalent to NO contacts (33-34 and 43-44) or NC contacts (31-32 and 41-42).
- The NC contacts 31-32 and 41-42 of auxiliary contacts (orange or pink) can be used as safety contacts.

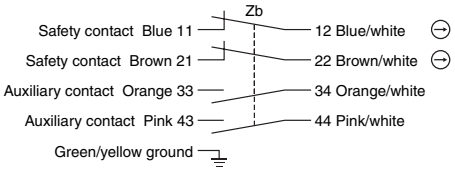
**<1NC/1NO>**



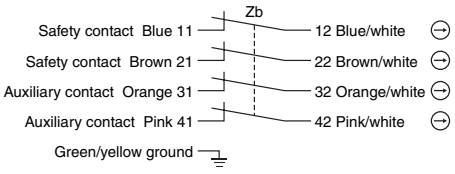

**<2NC>**




**<2NC/2NO>**




**<4NC>**

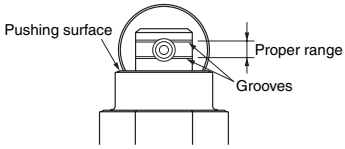



**Note: Safety Contacts:**
The safety contacts are direct opening contacts certified by EN and each of them is indicated with the mark ⊖.

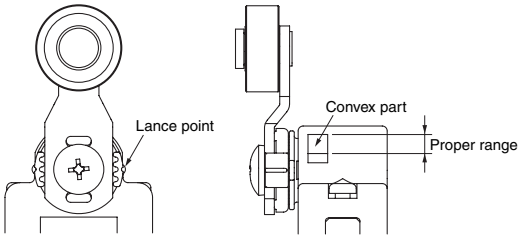
- Cut the dummy core insulator and all unused wires at the end of the external insulation sheath when wiring the cable.

## Operating

- To set the plunger stroke correctly, press-fit the plunger until the top of the pushing surface comes between two grooves on the plunger.

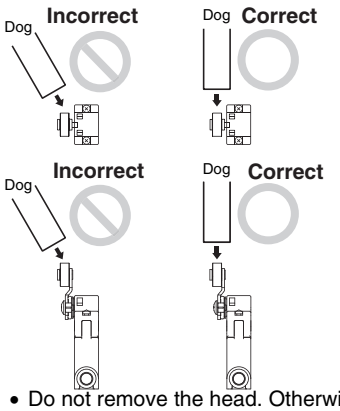



- To set the roller lever stroke correctly, push the dog and cam until the lance point comes within the range of the convex part that is the correct setting position.




## Others

- Actuating the switch from an angle other than 90 degrees to the switch face may deform or damage the actuator, or deform or damage the rotary spindle, so make sure that the dog is straight.




- Do not remove the head. Otherwise, a failure may occur.
- To avoid telegraphing, take the following precautions.

1. Modify the rear end of the dog to an angle of 15° to 30° as shown below or to a secondary-degree curve.

2. Modify the circuit so as not to detect the wrong operating signals.

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