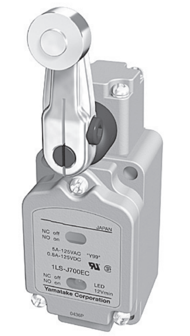
PHOTOELECTRIC SENSORS & SWITCHES
MEASUREMENT SENSORS
PROXIMITY SWITCHES
LIMIT SWITCHES
SAFETY KEY SWITCHES
LIMIT SWITCHES WITH POSITIVE OPENING MECHANISM
GENERAL PURPOSE LIMIT SWITCHES
TECHNICAL GUIDE FOR LIMIT SWITCHES
EXPLOSION-PROOF SWITCHES
TECHNICAL GUIDE FOR EXPLOSION-PROOF SWITCHES
STANDARD □LS□
SPATTER-GUARDED □LS□□
1LS-J7□□
1LS-J8□□
1LS□-J401
VCL-□□
SL1-□□
SL1-□C

With on-site mechanical life 3 times that of conventional models, improved reliability drastically reduces minor line interruptions.

- Mechanical life: at least 30 million operations.
- Improved sliding action and corrosion resistance prevents the actuator return failure.
- Wiring to the switch is by connector, to ensure a tight seal. (Conventional G1/2 conduit / switch terminal wiring type is also available.)
- At-a-glance fluorescent setting indication prevents faulty initial setup.
- UL/CSA/GB(CCC marking)-certified models available.



APPLICATIONS
- Automobile production facilities and related equipment Special-purpose machine tools Conveyors Automatic assembly machines
- General industrial machinery

ORDER GUIDE

Actuator		Operating characteristics			Basic catalog listing	Options			
Name	Shape	Max. O.F. (operating force)	Max. P.T. (pretravel)	Min. T.T. (total travel)		LED lamp With 12 to125 Vac-dc EC	Double seal +LED SEC	Connector +LED EC-PD	Preleaded connector +LED EC-PD03
Roller lever type		13.4 N	Standard type 20°	Standard travel 50°	1LS-J700	1LS-J700EC	1LS-J700SEC	1LS-J700EC-PD	1LS-J700EC-PD03
			High sensitivity 5°	Standard travel 50°	1LS-J710	1LS-J710EC	1LS-J710SEC	1LS-J710EC-PD	1LS-J710EC-PD03
		8.9 N	Standard type 20°	High overtravel 80°	1LS-J720	1LS-J720EC	1LS-J720SEC	1LS-J720EC-PD	—
			High sensitivity 10°	High overtravel 80°	1LS-J730	1LS-J730EC	1LS-J730SEC	1LS-J730EC-PD	1LS-J730EC-PD03

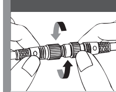
UL/CSA/GB (CCC marking) approved products   UL/CSA(C-UL)approved products

Quick Lock type

Actuator		Operating characteristics			catalog listing
Name	Shape	Max. O.F. (operating force)	Max. P.T. (pretravel)	Min. T.T. (total travel)	With LED Lamp
Roller lever type		13.4 N	Standard type 20°	Standard travel 50°	1LS-J700EC-SD03
			High sensitivity 5°		1LS-J710EC-SD03
		8.9 N	Standard type 20°	High overtravel 80°	1LS-J720EC-SD03
			High sensitivity 10°		1LS-J730EC-SD03

Compatible with OMRON Smartclick connectors.
Smartclick Smartclick is a registered trademark of OMRON Corporation.

Connector with cable



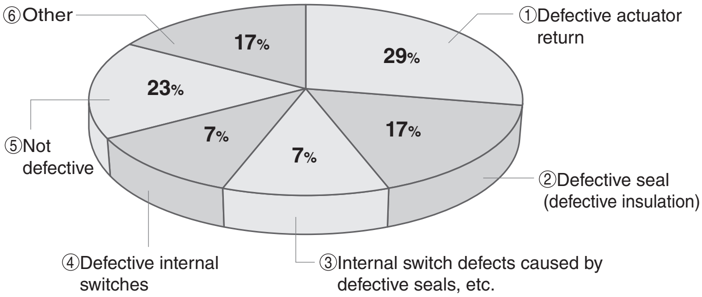
See page F-001

ULTRA LONG LIFE LIMIT SWITCHES

Here is what's different about the Model 1LS-J7□□

1. Breakdown of trouble in conventional limit switches

The following shows the results of investigation and analysis of the causes of trouble in products returned for repair to Azbil from the field.



The ultra long life limit switch Model 1LS-J7□□ adopts countermeasures for the following five of these causes:

①Defective actuator return
②Defective seal (defective insulation)
③Internal switch defects caused by defective seals, etc.
④Defective internal switches
⑤Not defective (but setup was faulty, due often to low visibility of O.T. indicator)

These modifications have resulted in an ultra long life that could not be achieved with conventional limit switches.

2. Countermeasures

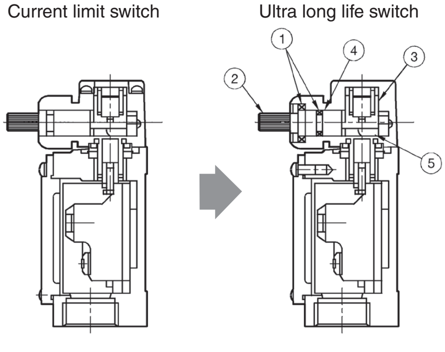
The following table summarizes the requirements related to the above causes, and outlines the countermeasures that have been adopted.

Cause of trouble	Requirements	Implemented countermeasures
①Defective actuator return	Improvement of sliding action of operating head components,improvement of corrosion resistance, improvement of lubricant quality and quantity.	Moving parts on the operating head were SUS-nitrided and treated with special coating. Specially coated O-ring was used. Lubricant was changed.
②•③Defective seals	Improvement of seal around the shaft. Improvement of switch body cover and conduit seal.	Shaft seal was double-sealed (V-ring + O-ring). Terminal connections with open covers were eliminated, and an internal loaded connector was used.*2
④Defective internal switches	Improvement of internal switch life.	Two internal moving springs were used.
⑤Low visibility of O.T. indicator	Modification of setting indication function*1	The root of the shaft was capped with a rubber cap with indication slit, and fluorescent marking is visible through the slit.

Notes:
*1. Conventional limit switches are equipped with an operation pointer for indicating the appropriate O.T. (overtravel). However, as this pointer is difficult to see when actually setting operation, generally setting is performed by an operation indicator lamp. For this reason, a phenomenon occurs where there is little margin in the initial setup during mounting with respect to O.P. (operating position), and the switch does not turn ON even though the dog arrives at the switch operation position and presses the lever. As a result of investigating, we found that a large number of normal limit switches were returned for repair for this reason. As a countermeasure, the O.T. indication was changed to an easy-to-view fluorescent type.
*2. Conventional terminal connection type and G1/2 conduit types where the cover is opened for wiring to the switch terminal are also available.

3. Structure of Ultra Long Life Limit Switches

Overall switch

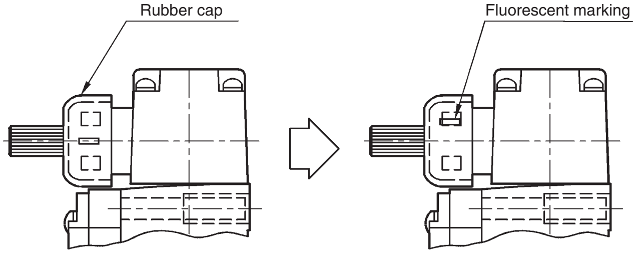


The slide-action and corrosion resistance of moving parts inside the operating head were improved.

①The seal of the moving head was improved by double-sealing the shaft with both V-ring and O-ring.
②③Slide-action was improved and corrosion when immersed in water was prevented by treating the operating shaft and other moving parts with SUS nitriding and special coating.
④Friction was reduced by a special coating on the shaft O-ring.
⑤Lubricant with higher fluidity and better resistance to extreme pressure was used.

The life of the moving parts was lengthened by the above modifications.

●Setting indicator pointer



During standly **During appropriate operation**

In this design, the shaft root is capped with a slitted black rubber cap. When the lever is flipped down and reaches the appropriate O.T. (overtravel), the fluorescent marking can be seen through the slit. This modification enables easy confirmation from a distance and facilitates initial setup.

4. Evaluation Results

Mechanical life was improved considerably, as seen below.

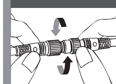
Estimated life under actual operating conditions		Results of proprietary accelerated mechanical life test	
		Minimum life	**Lifespan at 3,000 operations/day**
Current **LS** Example: **1LS1-J**	Approx. 3 million operations	2 million operations	2 to 3 years
Ultra long life **LS** Example: **1LS-J700**	Approx. 13 million operations	Min. 6 million operations	8 to 9 years

PERFORMANCE

Catalog listing			1LS-J70□	1LS-J71□	1LS-J72□	1LS-J73□
External standards	Compliance		NECA C 4508, JIS C 8201-5-1			
	Certification		UL/CSA*1/GB			
Structure	Contact form		2-circuit double break			
	Terminal type		M4 screw (switch terminal screw)			
	Contact type		Silver rivet			
	Protective structure		IP67(IEC60529, JIS C 0920)			
Electrical performance	Electrical rating		See Table 1.			
	Dielectric strength		Between non-continuous terminals (same polarity): 1,000V, 50/60 Hz for 1 minute Between each terminal and non-live metal part: 2,000V, 50/60 Hz for 1 minute *4			
	Insulation resistance		Max. 100 MΩ (by 500 Vdc megger)			
	Initial contact resistance	Contact	Max. 50 mΩ (6 to 8 Vdc, thermal current 1A, voltage drop method)			
		Connector	Max. 40 mΩ (excluding fixed resistance of cable, etc.)			
	Recommended min. contact operating voltage/current		24 Vdc 10 mA			
Mechanical performance	Actuator strength		Withstands load 5 times O.F. (operating direction for 1 minute)			
	Impact resistance		300 m/s^2	200 m/s^2	300 m/s^2	
			Contact opening for 1 ms max. in free position and total travel position (NECA C 4508)			
	Vibration resistance		1.5 mm peak-to-peak amplitude, frequency 10 to 55 Hz, for 2 continuous hours Contacts open for 1 ms max. in free position and total travel position. (NECA C 4508)			
	Allowable operating speed		1LS-J70□,1LS-J72□,1LS-J73□:1.7 mm/s to 0.5 m/s 1LS-J71□:0.4 mm/s to 0.5 m/s (At min. speed, instability of contacts lasts 0.1 s or less. At max. speed, there is no actuator damage.)			
	Operating frequency		Max. 120 operations/minute			
	Cable pullout strength		Min. 100 N			
Life	Mechanical life		Min. 30 million operations (at 1/3 to 2/3 of the rated overtravel)			
	Electrical life		See Table 2.			
Ambient operating conditions	Temperature		–10 to +70˚C(freezing not allowed*2)			
	Humidity		Max. 98% RH*3			
Recommended tightening torque	Body		5 to 6 N·m (M5 hexagon socket head bolt)			
	Cover		1.3 to 1.7 N·m (M4 screw)			
	Head		0.8 to 1.2 N·m (M3.5 screw)			
	Lever		4 to 5.2 N·m (M5 screw)			
	Terminal screw		1.3 to 1.7 N·m (M4 binding head machine screw with toothed washer)			

Notes:
*1. Some models do not fall under this category.
*2. With the double seal type (S type), 0 to +70˚C for **1LS-J71□**, and -5 to +70˚C for other models
*3. Max. 95% RH for connector and preleaded connector types
*4. For models with indicators, these are the values with the indicator removed.

Connector with cable



See page F-001

●Table 1. Electrical rating

Type of indicator lamp	None		12 to 125 Vac/dc LED	
Switch type	**Catalog listing**	**Electrical rating**	**Catalog listing**	**Electrical rating**
Standard	1LS-J700 1LS-J720	125, 250, 480 Vac 10A 125 Vac 1/2HP 250 Vac 1HP 125 Vdc 0.8A 250 Vdc 0.4A	1LS-J700EC 1LS-J720EC	125 Vac 5A 125 Vdc 0.8A
Standard with double seal	—	—	1LS-J700SEC 1LS-J720SEC	125 Vac 5A 125 Vdc 0.8A
High sensitivity	1LS-J710 1LS-J730	125, 250, 480 Vac 10A 125 Vac 1/2HP 250 Vac 1HP 125 Vdc 0.8A 250 Vdc 0.4A	1LS-J710EC 1LS-J730EC	125 Vac 5A
High sensitivity with double seal	—	—	1LS-J710SEC 1LS-J730SEC	125 Vac 5A
DC connector and preleaded connector types	—	—	1LS-J7□0EC-PD 1LS-J7□0EC-PD03	30 Vdc 3A

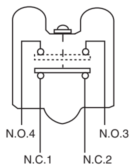
●Table 2. Electrical rating of products conforming to GB standards

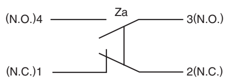
	Application category	Rating			Rated operational current (Ith)
		Without indicator	With LED lamp	With neon lamp	
Standard load type	AC-15	3.0A-240V AC	3.0A-125V AC	3.0A-240V AC	10A
	DC-12	0.4A-30V DC	0.4A-30V DC	–	10A

●Table 3. Electrical life

Internal switch	Load	Life		Life
Standard load type	Rated load	Min. 500,000 operations	125 Vac 10 mA, 30 Vdc 10 mA	Min. 30 million operations
Low current load type	Rated load	Min. 2 million operations		
Standard load, double seal	Rated load	Min. 200,000 operations		

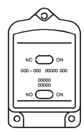
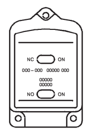
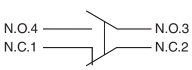
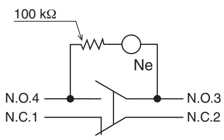
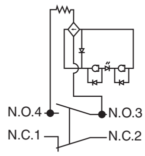
●Circuit diagram





EN60947-5-1

INDICATOR LAMP SPECIFICATIONS

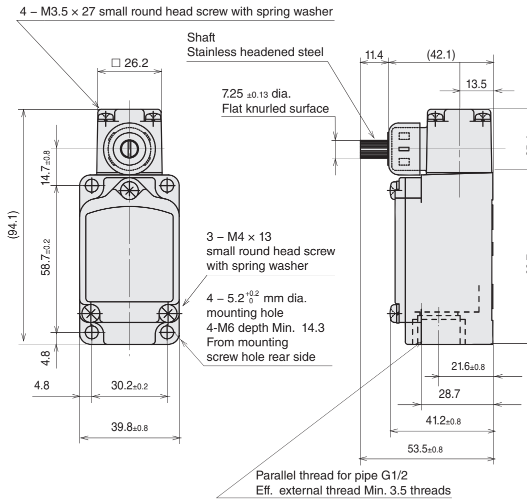
Option		No indicator lamp	Neon lamp, 100/200 Vac		AC-DC LED, 12 to 125V
Catalog listing		1LS-J7□□□	1LS-J7□□□E		1LS-J7□□□EC
Lamp cover front side		—			
Circuit diagrams					
Notes		—	To ensure lighting of the neon lamp, use 75 Vac min.		The voltage indicator lamp (red LED) is 12 to 125V. The indicator lamp operates on either AC or DC power.
Lamp cover catalog listing (replacement part)			LS-29PA1		LS-29PAEC
Specifications	Operating voltage		100 to 200 Vac		12 to 125V, AC or DC
			100 Vac	200 Vac	12 to 125V
	Thermal current		Approx. 0.5 mA	Approx. 1.5 mA	0.6 mA max.
	Resistance		100 kΩ		33 kΩ

EXTERNAL DIMENSIONS

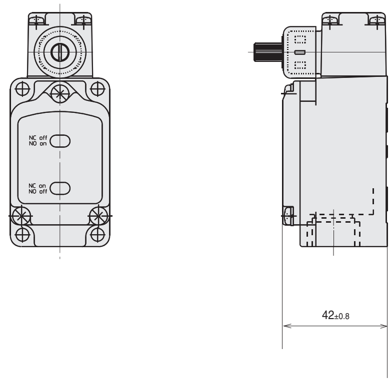
(unit: mm)

●Basic dimensions

Without indicator lamp 1LS-J7□□□

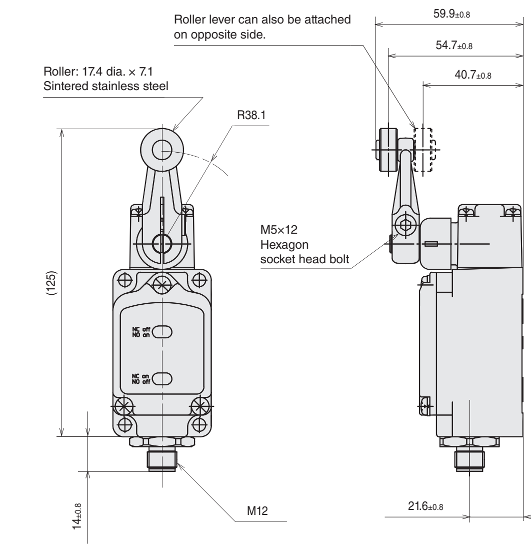


With indicator lamp 1LS-J7□□□EC

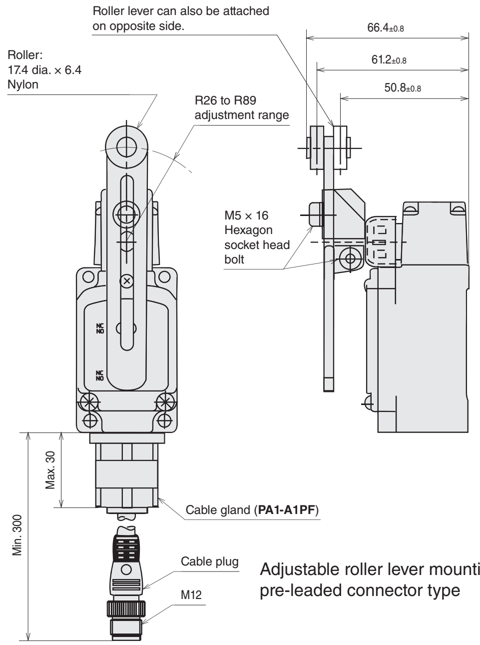


●Actuator mounting dimensions and connector dimensions

Standard roller lever mounting connector (quick removal) type

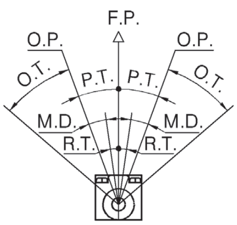


Adjustable roller lever mounting preleaded connector type



Adjustable roller lever mounting pre-leaded connector type

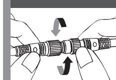
OPERATING CHARACTERISTICS



Characteristics		Catalog listing	1LS-J70□□□□ standard travel general characteristics	1LS-J71□□□□ standard travel high sensitivity characteristics	1LS-J72□□□□ high overtravel general characteristics	1LS-J73□□□□ high overtravel high sensitivity characteristics
Operating characteristics *	O.F. (operating force)	max.	13.4 N	13.4 N	8.9 N	8.9 N
	R.F. (release force)	min.	2.2 N	2.2 N	0.98 N	0.98 N
	P.T. (pretravel)		Max. 20°	$5°^{+2}_{0}$	Max. 20°	$10°^{+3}_{0}$
	M.D. (movement differential)	max.	12°	3°	12°	5°
	O.T. (overtravel)	min.	30°	30°	55°	62°
	R.T. (return operation)		Min. 5°	—	Min. 5°	—
Pointer position angle			25° to 45°	16° to 36°	25° to 45°	16° to 36°

*Operating characteristics, O.F. and R.F. values were obtained at a standard roller lever length of 38.1 mm.

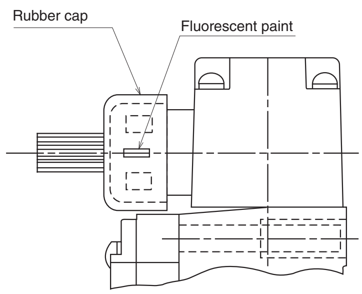
Connector with cable



See page F-001

ABOUT OPERATION SETTINGS

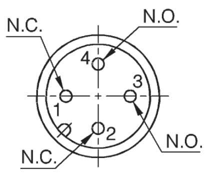
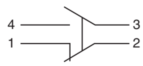
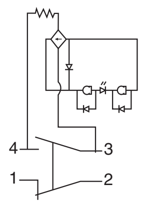
There is a slit window in the rubber cap mounted on the operation shaft. When the shaft rotates and reaches the appropriate operation range, a fluorescent marking appears in this window to indicate that the switch is in a stable operating position.



During appropriate operation

CONNECTOR PIN LAYOUT

1LS-J7□□□□-P□□

Catalog listing codes	Pin layout	Circuit diagrams		Note (applies only to models with indicator lamp)
		Without indicator lamp	With indicator lamp	
		—	EC	
PD **PD03**				The switch is assembled so that lamps light when the actuator is in the FREE position. The lamps can be made to light in the PUSH position by attaching the bracket on the rear side of the cover in the opposite direction.

●4-lead type

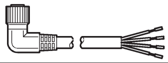
Connector		Internal switch
Contact No.	Lead color	Terminal No.
1	Red	N.C. 1
2	Green	N.C. 2
3	Black	N.O. 3
4	White	N.O. 4

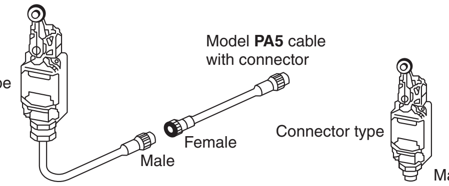
The contact assignments of limit switches comply with Nippon Electric Control Equipment Industries Association standards (NECA 4202).

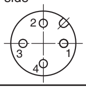
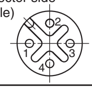
CONNECTOR WITH CABLE

Be sure to use a Model **PA5** connector with cable when connecting a preleaded connector or connector-type switch.

● Model PA5 connector with cable

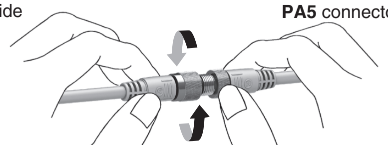
Shape	Power supply	Cord properties	Cord length	Catalog listing	Lead colors
	DC	Vinyl-insulated cord with high resistance to oil and vibration (UL/NFPA79 CM, CL3)	2 m	**PA5-4ISX2SK**	1: brown, 2: white, 3: blue, 4: black
			5 m	**PA5-4ISX5SK**	1: brown, 2: white, 3: blue, 4: black
			2 m	**PA5-4JSX2SK**	1: brown, 2: white, 3: blue, 4: black
			5 m	**PA5-4JSX5SK**	1: brown, 2: white, 3: blue, 4: black



For AC		For DC	
Switch side (male)	Connector side (female)	Switch side (male)	Connector side (female)
			

● Tightening the connector

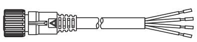
Align the grooves and rotate the fastening nut on the **PA5** connector by hand until it fits tightly with the connector on the switches side.

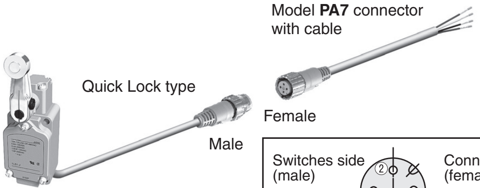


Note: The shape of the connector plugs and sockets is different for AC and DC cables, which are not mutually compatible.

Be sure to use a Model **PA7** connector with cable when connecting Quick Lock type switch.

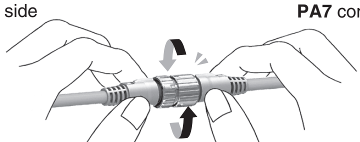
● Model PA7 connector with cable

Shape	Power supply	Cord properties	Cord length	Catalog listing	Lead colors
	DC	Vinyl-insulated cord with high resistance to oil and vibration (UL/NFPA79 CM)	2 m	**PA7-4ISX2SK**	1: brown, 2: white, 3: blue, 4: black
			5 m	**PA7-4ISX5SK**	1: brown, 2: white, 3: blue, 4: black



● Tightening the connector

Align the triangle mark and mate the male and female connector then rotate 45 degree to match the keys on the rings by hand.

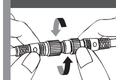


Compatible with OMRON Smartclick connectors.
Smartclick Smartclick is a registered trademark of OMRON Corporation.

CONNECTOR SPECIFICATIONS[*1]

Item		Preleaded connector type	Quick Lock connector type
Operating voltage/current		For AC: min. 5V 5 mA, max. 250V 3A For DC: min. 5V 5 mA, max. 125V 3A	
Insulation resistance		Max. 100 MΩ(by 500 Vdc megger)	Max. 50 MΩ(by 500 Vdc megger)
Dielectric strength		1,500 Vac for 1 minute (between contacts, and between contact and connector housing)	
Initial contact resistance		Max. 40 mΩ(with 3A current to connected male and female connectors. Semiconductor lead-specific resistance not included.)	
Mating/unmating force		0.4 to 4.0 N per contact	
Mating cycles		50	
Connector nut tightening torque		Min. 0.8 N·m*1	
Cable pullout strength		Min. 100 N	
Vibration resistance		10 to 55 Hz, 1.5 mm peak-to-peak amplitude, for 2 hours each in X, Y and Z directions	
Impact resistance		300 m/s^2, 3 times each in X, Y and Z directions	980 m/s^2, 10 times each in X, Y and Z directions
Protective structure		IP67	
Ambient operating temperature		–10 to +70˚C	
Ambient storage temperature		–20 to +80˚C	
Ambient operating humidity		Max. 95% RH	
Material	Contacts	Gold-plated brass	
	Contact holder	Glass-lined polyester resin	
	Housing	Polyester elastomer	
	Coupling	Brass (DC type: Ni-plated. AC type: orange-colored)	
	O-ring	NBR	

*1. The recommended tightening torque is 0.4 to 0.6 N·m. If the connector is not tightened firmly, IP67 protection may be lost, or the connector may come loose. Tighten firmly by hand.

Connector with cable

See page F-001

PRECAUTIONS FOR USE

1. Connecting switches that have indicator lamps

1.1 Series connection

Up to six switches can be connected in series when the power is 100V. The brightness of the LED lamp is fixed regardless of the power, since light is generated by a built-in fixed-current diode.

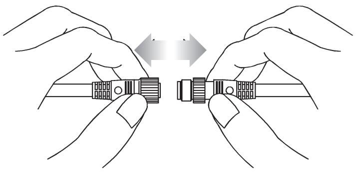
1.2 PC connection possible

The leakage current when the limit switch is not operating is a maximum of 0.6 mA. The PC will not malfunction due to dim lighting of the LED. Moreover, a fixed-current diode is built in to ensure a fixed LED brightness regardless of the power voltage.

2. Handling of connector and preleaded connector switches

2.1 Tightening the fixing cap ring and outside screw lock ring

If the screw of the mating part is made of resin, the threads can easily be damaged when the connector is first tightened. When assembling the connector, align the center of the cores, push in as far as possible, and then turn to tighten.
Be sure to tighten fully by hand. The recommended tightening torque is 0.4 to 0.6 N·m. Use of a tightening tool may damage the connector. If the connector is not tightened firmly, IP67 protection may be lost, or the connector may come loose.

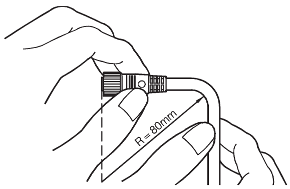


2.2 Inserting and removing connectors

Before inserting or removing connectors, be sure to the turn the power OFF. When removing, hold the connector itself--do not pull by the cable.

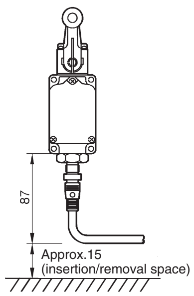
2.3 Cautions when bending cables

The minimum bend radius (R) of the cable is 80 mm. Allow sufficient cable for bends.



2.4 Installation of connector type switches

(unit: mm)



2.5 Cautions when replacing connectors

When removing connectors to replace the switch or cable, wipe the connector and the surrounding area thoroughly to remove any water.
After removing the connector, do not allow it to be immersed in chemicals or powder, or to be dropped. If the connector is immersed in a fluid, allow it to fully dry before connecting again. If the connector is dropped in powder, wipe it off completely beforeconnecting again. Failure to observe these precautions may result in a short circuit or a failed connection.

3. Other

3.1 Protective structure

- IP67 protection does not assure complete waterproofing. Switch should not be in constant contact with water.
- Avoid use where external force is applied at all times on the connecting section of the connector.
- Do not use the body as a step or place heavy objects on top of it.

3.2 Ensuring a good seal

- When general-purpose limit switches are used in locations subject to splashing by water, oil, dirt and dust, or chips, water or oil sometimes enters the switch from the conduit due to capillary action. For this reason, be sure to use a sealed connector compatible with the cable.
- When the screws in the head or covers are loosened to change the operating direction of the switch, or the relationship between switch operation and the indicator lamp (lamp ON during switch standby / during switch operation), tighten the screws to the recommended tightening torque to ensure a good seal.

＜Recommended tightening torque＞
Cover: 1.3 to 1.7 N·m (M4 screw)
Head: 0.8 to 1.2 N·m (M3.5 screw)

3.3 Attaching switches

- Tighten each of the parts on the limit switch according to the appropriate tightening torques listed in the performance tables. Overtightening damages screws and other parts. On the other hand, insufficient tightening of screws lowers the effectiveness of the seal and reduces various performance characteristics.
- Do not leave or use covers and conduit parts open. Water, dirt, or dust may enter, which causing malfunction.
- Prevent impact to the lever body and head. Failure to do so might deform the actuator or cause defective switch return.
- Do not use silicone rubber electrical lead insulation, silicone adhesive or grease containing silicone. Doing so might result in defective electrical conductivity.

3.4 Wiring

- Do not perform wiring with the power ON. Doing so might cause electric shock, or the machine may start unexpectedly, causing an accident.
- Use crimp-type terminal lugs with covered insulation for electrical leads to prevent contact with covers and housings. If a crimp-type terminal lug contacts a cover, the cover may no longer shut or a ground fault may occur.
- Use sealed connectors (**PA1** Series, etc. sold separately) or flexible tubing (**PA3** Series) with IP67 or equivalent seal for conduits.
- Firmly tighten covers and conduits. If covers and conduits are not sufficiently tightened, the seal will be impaired and switch performance will no longer be assured.

3.5 Adjusting switches

- Do not apply excessive force (5 times O.F.) to the actuator beyond the total travel position. Doing so might damage the switch.
- Keep overtravel between 1/3 to 2/3 of the rated value. Small overtravel might cause the contacts to rattle due to vibration and impact, or may result in defective contact.

4. Environment

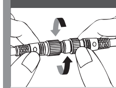
- Do not use the product in an environment where the cover may directly come into contact with any strong volatile solvent.
- Do not use the switch in an environment where strong acid or alkali is directly splashed onto it.

6. Other cautions

- Do not apply a lubricant to the sliding part of the actuator or any other component. Application of an inappropriate lubricant may degrade sliding performance or impair the protective structure.
- Remove any foreign substances adhering to the sliding part. Dust or any other foreign substance attached to the sliding part may cause a malfunction.
- Check the actual load.
  To increase reliability, confirm that the switch has no problems in actual use before using the switch.

Before use, thoroughly read the “Precautions for use” and “Precautions for handling” in the Technical Guide on pages **D-101** to **D-112** as well as the instruction manual and product specification for this switch.

Connector with cable



See page F-001

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