

# Compact Horizontal Limit Switches

**SL1 Series**

Mechanical life of 20 million operations. Robust long-life and maintenance-free compact horizontal-type limit switches with IP67 seal.



- Mechanical life exceeds 20 million operations, owing to a 2-piece spring mechanism
- High sensitivity (M.D. = 0.1 mm)
- Superior seal: oil-resistant/immersion-proof type (JIS) and IP67 (IEC). O-ring and integral diaphragm seal are built in
- Small, space-saving body can be tightly gang-mounted
- UL/CSA/CE/GB (CCC marking) -certified models are available (excluding some models)

## PERFORMANCE

	Item	Details
Standards	Compliance	NECA C 4508/JIS C 8201-5-1/IEC 60947-5-1
	Certification	UL 508/CSA C22.2 No.14/EN 60947-5-1/GB14048.5 (except high oil- and heat-resistance types)
Structure	Contact form	Single-Pole Double-Throw (SPDT; refer to contact diagram below)
	Contact type	Standard load type: pure silver rivet Low current load type: gold-plated rivet
	Terminal type	M3 screw
	Protective structure	IP67 (IEC 60529, JIS C 0920)
	Pollution level	3 (EN 60947-5-1)
Electrical performance	Electrical rating	See Table 1.
	Rated frequency	45 to 65 Hz and D.C.
	Insulation resistance	Between non-continuous terminals: 100 MΩ Between each terminal and non-live metal parts: 100 MΩ
	Rated insulation resistance (Ui)	250V Dielectric strength between each terminal and non-conducting metal parts: 2,000 Vac (45 to 65 Hz, 5 s, leak current 1 mA)
	Dielectric strength between contacts	1,000 Vac (50 to 60 Hz, 1 minutes, leak current 1 mA)
	Rated impulse dielectric strength (Uimp)	2,500V
	Switching overcurrent	Category II (60204-1)
	Initial contact resistance	Silver contacts: 50 mΩ max. (6 to 8 Vdc 1A, voltage drop method) Gold-plated contacts: 100 mΩ max. (6 to 8 Vdc 0.1A, voltage drop method)
	Contact minimum allowable load	Silver contacts: 5 mA 24 Vdc, 10 mA 12 Vdc Gold-plated contacts: 5 mA 5 Vdc
	Rated thermal current (Ith)	Silver contacts: 5A Gold-plated contacts: 1A (Temperature increase: 65°C max.)
	Short-circuit protection	M10A(IEC 60127) (TUV) Instant blowing fuse, 10A (silver contacts) or 3A (gold contacts) (CQC)
	Conditional rated short-circuit current	1,000A (power factor 0.5 to 0.7)
Mechanical performance	Actuator strength	Withstands load 5 times O.F. (operating direction for 1 minute)
	Terminal strength	Withstands tightening torque of 0.6 N·m for 1 minute
	Impact resistance (malfunction)	300 m/s <sup>2</sup> , contact opening for 1 ms max. in free position and total travel position (NECA C 4508)
	Vibration resistance (malfunction)	1.5 mm peak-to-peak amplitude for 2 continuous hours Contact opening for 1 ms max. in free position and total travel position (NECA C 4508)
	Allowable operating speed	0.02 mm/s to 0.5 m/s. 0.02 mm/s to 0.25 m/s on the SL1-B Series
	Operating frequency	120 operations/minute. (60 operations/min for cold- and weather-resistant / high oil and heat resistance type).

Life	Mechanical	Min. 20 million operations. Min. 2 million operations for the <b>SL1-B</b> Series. Min. 1 million operations for cold- and weather-resistant type. Min. 2 million operations for high oil and heat resistance type. (All values assume overtravel (O.T.) of 1/3 to 2/3 the rated amount.)
	Electrical	Standard load type: Min. 2 million operations (125 Vac 1A) Min. 300,000 operations (250 Vac 5A, 48 Vdc 2A, 30 Vdc 5A) Low current load type: Min. 5 million operations (125 Vac-0.1A, 48 Vdc-0.1A)
Ambient operating conditions	Temperature	Standard type: -10 to +70°C Cold and weather resistant type: -50 to +70°C -30 to +70°C for <b>SL1-B</b> , -40 to 70°C for <b>SL1-P</b> High oil and heat resistance type: 0 to 120°C
	Humidity	Max. 98% RH
Recommended tightening torque	Body	1.3 to 1.7 N·m (M4 hexagon socket head bolt)
	Terminal screw	0.4 to 0.6 N·m (M3 binding head machine screw)
	Panel mounting nut	4 to 6 N·m (M14 hexagonal nut)

● Table 1. Electrical rating

Item	Contact material	JIS/IEC/EN/GB	UL/CSA
Standard load type	Silver	AC-15:3A-250V AC-12:5A-250V DC-12:2A-48V	5A-250 Vac General Use Load 5A-30 Vdc
Low current load type	Gold-plated	AC-12:0.1A-125V DC-12:0.1A-48V	0.1A-125 Vac General Use Load 0.1A-30 Vdc

● Reference ratings (Since values can vary due to operating environment and type of load, verify them on an operating unit.)

Standard load model with silver contacts

AC rating	125 Vac				250 Vac			
	Resistance	Induction	Electric motor		Resistance	Induction	Electric motor	
			N.C.	N.O.			N.C.	N.O.
Current (A)	5	3	1	2	5	3	0.5	1

Low current load type with gold-plated contacts

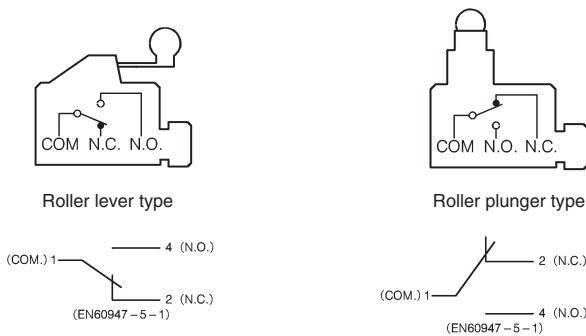
AC rating	115 Vac	
	Resistance	Induction
Current (A)	0.1	—

DC rating	8 Vdc		14 Vdc		30 Vdc		115 Vdc		230 Vdc	
	Resistance	Induction	Resistance	Induction	Resistance	Induction	Resistance	Induction	Resistance	Induction
Current (A)	5	3	5	3	5	3	0.5	0.1	0.25	0.05

DC rating	8 Vdc		14 Vdc		30 Vdc	
	Resistance	Induction	Resistance	Induction	Resistance	Induction
Current (A)	0.1	—	0.1	—	0.1	—

Note: "Induction" refers to a load having a power factor of 0.4 and time constant of 7 ms (DC). "Electric motor" refers to a load having a value of six times the inrush current.

CONTACT FORM









STANDARDS

	Approving body	Standard	File No.
Certification	UL	UL 508 CSA C22.2 No.14	E 96090
	TÜV	EN 60947-5-1	R2-50006349
	CQC	GB 14048.5	2003010305083850

## ORDER GUIDE







### ●Without code

Actuator		Basic catalog listing*2	Options			
Name	Shape		Low current load K *2	Cold- and weather-resistant L *2	Cold- and weather-resistant + low current load KL *2	High temperature and high oil resistance V
Roller plunger		SL1-A	SL1-AK	SL1-AL	SL1-AKL	SL1-AV
Boot seal roller plunger		SL1-B	SL1-BK	SL1-BL	—	SL1-BV
Cross roller plunger		SL1-D	SL1-DK	SL1-DL	SL1-DKL	SL1-DV
Long roller plunger		SL1-E	SL1-EK	SL1-EL	—	SL1-EV
Plunger		SL1-H	SL1-HK	SL1-HL	SL1-HKL	SL1-HV
Short roller lever		SL1-P	SL1-PK	SL1-PL	SL1-PKL	SL1-PV

\*1: Use with SL1-PA12.

\*2: UL/C-UL/CE/CCC-certified model.

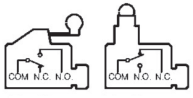
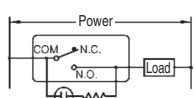
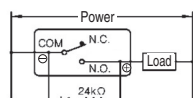
### ●With code

Actuator		Options			
Name	Shape	No resin filling A:Cable exits on right B:Cable exits on left	With resin filling X:Cable exits on right Y:Cable exits on left	No resin filling+low current load A:Cable exits on right B:Cable exits on left	Resin filling+low current load X:Cable exits on right Y:Cable exits on left
		Roller plunger		SL1-A□G*	SL1-A□G*
Boot seal roller plunger		SL1-B□G*	SL1-B□G*	SL1-BK□G*	SL1-BK□G*
Cross roller plunger		SL1-D□G*	SL1-D□G*	SL1-DK□G*	SL1-DK□G*
Long roller plunger		SL1-E□G*	SL1-E□G*	SL1-EK□G*	SL1-EK□G*
Plunger		SL1-H□G*	SL1-H□G*	SL1-HK□G*	SL1-HK□G*
Short roller lever		SL1-P□G*	SL1-P□G*	SL1-PK□G*	SL1-PK□G*

\*Asterisk ( \* ) after G indicates selectable cable length (1/2/3/5 m).

\*Model with indicator is available for SL1 switches with cable, except for those without resin filling.

### ●Attached Table 2. Electrical rating and circuit configuration


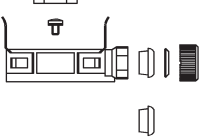

Item	Contact material	Electrical rating		
		Without indicator	With indicator	
			Code: E (Lit when not operating.) 100/200 VAC Neon lamp.	Code: F (Lit when not operating.) 24 VDC LED lamp.
Standard load type	Silver rivet	See Attached Table 1.	AC-12: 5A-200V	DC-12: 2A-24V
Low current load type	Gold plated rivet	See Attached Table 1.	AC-12: 0.1A-125V	DC-12: 0.1A-24V
Circuit configuration	—	 Roller lever type      Roller plunger type	 Power COM N.C. N.O. Load Neon lamp 100kΩ	 Power COM N.C. N.O. Load 24kΩ LED

Note: The model with an LED lamp has polarity. Pay attention to the polarity when wiring.

Options		
High temperature and high oil resistance + low current load KV	Without cover N *1,2	Without cover + low current load KN *1,2
SL1-AKV	SL1-AN	SL1-AKN
—	—	SL1-BKN
—	SL1-DN	SL1-DKN
—	SL1-EN	—
—	SL1-HN	SL1-HKN
SL1-PKV	SL1-PN	—

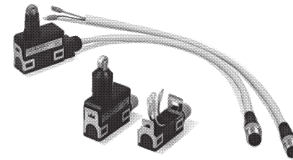
Options			
Resin filling+AC indicator X:Cable exits on right Y:Cable exits on left	Resin filling+DC indicator X:Cable exits on right Y:Cable exits on left	Resin filling+low current load +AC indicator X:Cable exits on right Y:Cable exits on left	Resin filling+low current load +DC indicator X:Cable exits on right Y:Cable exits on left
SL1-AE□G*	SL1-AF□G*	SL1-AKE□G*	SL1-AKF□G*
SL1-BE□G*	SL1-BF□G*	SL1-BKE□G*	SL1-BKF□G*
SL1-DE□G*	SL1-DF□G*	SL1-DKE□G*	SL1-DKF□G*
SL1-EE□G*	SL1-EF□G*	SL1-EKE□G*	SL1-EKF□G*
SL1-HE□G*	SL1-HF□G*	SL1-HKE□G*	SL1-HKF□G*
SL1-PE□G*	SL1-PF□G*	SL1-PKE□G*	SL1-PKF□G*

## AUXILIARY PARTS

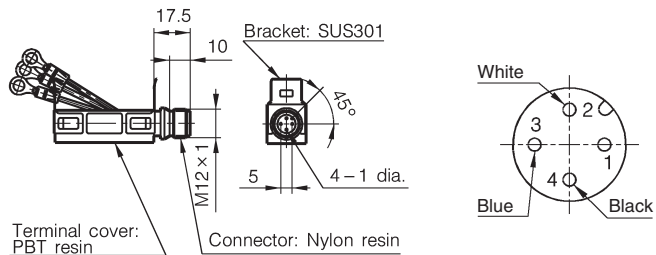
Name	Appearance	Specifications	Catalog listing
PA5 Series connector cover		For DC type, 3 leads	SL1-PA5I3
Terminal cover set		Cover, panel mounting nuts (2), cap nut, washer and seals (for 5.8 to 7.8 mm dia. cable and for 7.9 to 9.6 mm dia. cable)	SL1-PA12
Seal		for 7.9 to 9.6 mm dia. cable (set of 10): Standard type: NBR containing PVC.	SL1-PA22
		for 7.9 to 9.6 mm dia. cable (set of 10): Cold- and weather-resistant type: fluorosilicone rubber.	SL1-PA23
		for 7.9 to 9.6 mm dia. cable (set of 10): High temperature and high oil resistance type: fluorocarbon rubber.	SL1-PA24

### Connector for SL1 Series

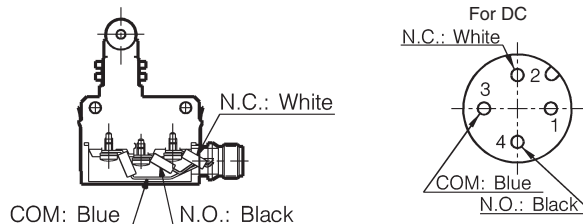
Switches in the SL1 Series can be modified into the connector type by attaching the SL1-PA5I3 onto the SL1 switch body, as shown below. Either replace the terminal cover of the SL1 standard type switch with a sealed connector with cable, or use the switch without a terminal cover.



### External dimensions



### Wiring diagrams



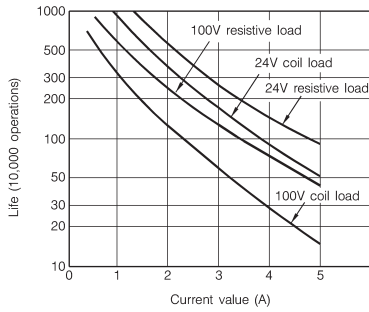
### Assembly method



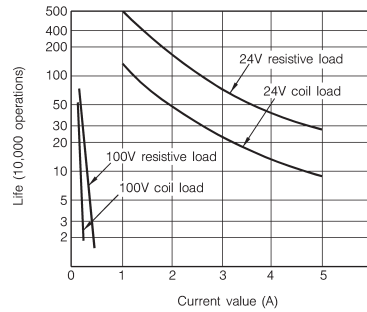
## ELECTRICAL LIFE

### ● Normal load type

#### Contacts used for AC

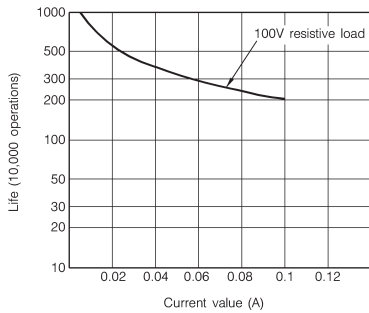


#### Contacts used for DC

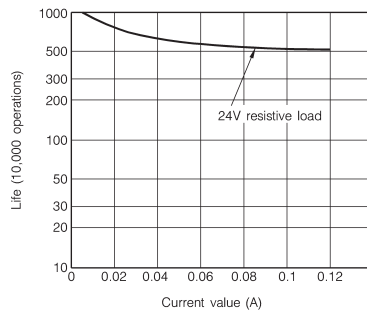


### ● Low current load type

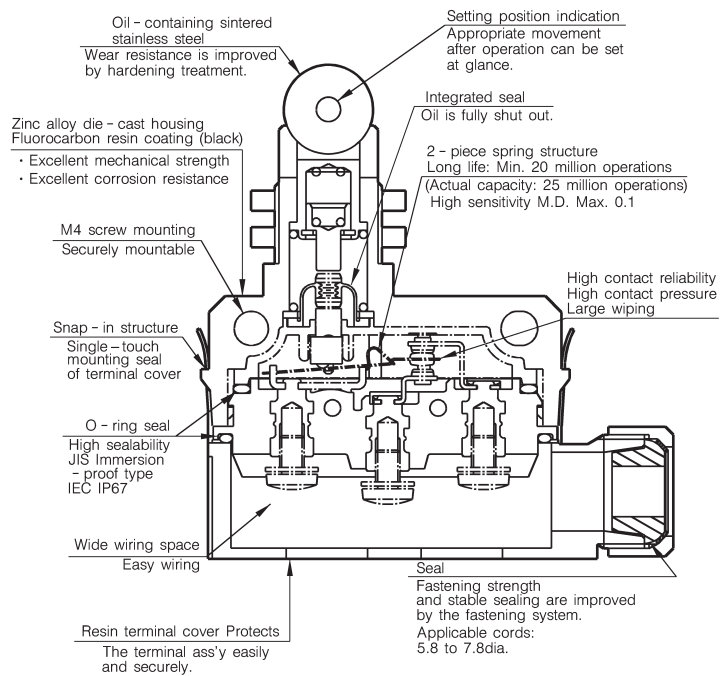
#### Contacts used for AC



#### Contacts used for DC



## STRUCTURAL DIAGRAM



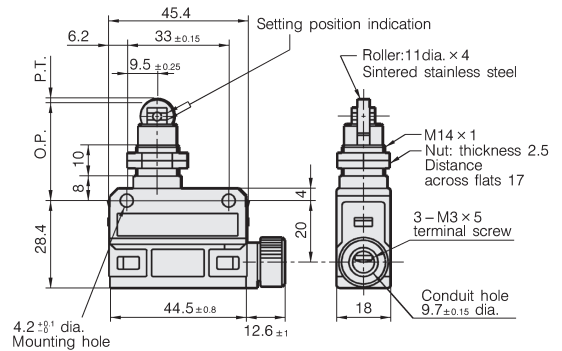
## APPEARANCE, OPERATING CHARACTERISTICS AND EXTERNAL DIMENSIONS

(unit: mm)

### Roller plunger type



Catalog listing	SL1-A□□
Operating force O.F. (max. N)	11.8
Release force R.F. (min. N)	4.9
Pretravel P.T. (max. mm)	1.5
Overtravel O.T. (min. mm)	3
Movement differential M.D. (max. mm)	0.1
Operating position O.P.(mm)	31.4±0.8

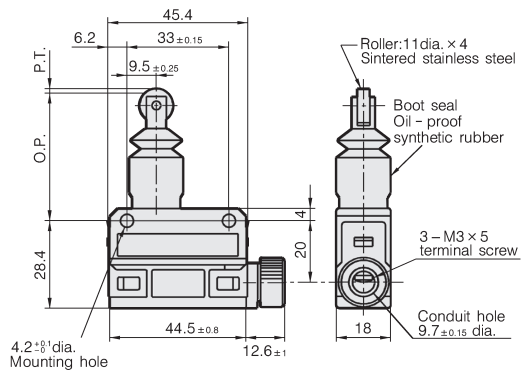


\*Dimensional tolerance is ±0.4 unless otherwise specified.

### Boot seal roller plunger type



Catalog listing	SL1-B□□
Operating force O.F. (max. N)	11.8
Release force R.F. (min. N)	4.9
Pretravel P.T. (max. mm)	1.5
Overtravel O.T. (min. mm)	3
Movement differential M.D. (max. mm)	0.1
Operating position O.P.(mm)	41.4±0.8

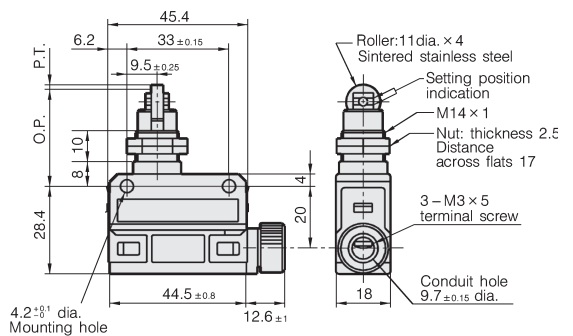


\*Dimensional tolerance is ±0.4 unless otherwise specified.

### Cross roller plunger type



Catalog listing	SL1-D□□
Operating force O.F. (max. N)	11.8
Release force R.F. (min. N)	4.9
Pretravel P.T. (max. mm)	1.5
Overtravel O.T. (min. mm)	3
Movement differential M.D. (max. mm)	0.1
Operating position O.P.(mm)	31.4±0.8

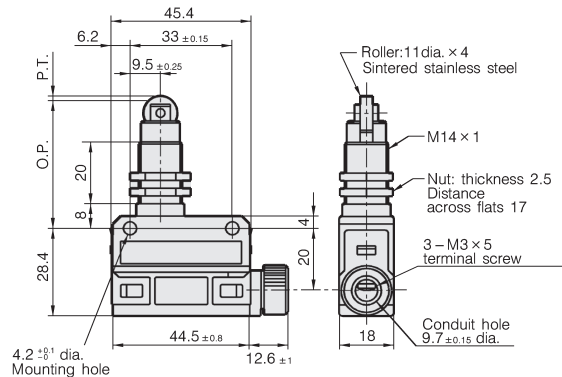


\*Dimensional tolerance is ±0.4 unless otherwise specified.

## Long roller plunger type



Catalog listing	SL1-E□□
Operating force O.F. (max. N)	11.8
Release force R.F. (min. N)	4.9
Pretravel P.T. (max. mm)	1.5
Overtravel O.T. (min. mm)	3
Movement differential M.D. (max. mm)	0.1
Operating position O.P.(mm)	41.4±0.8

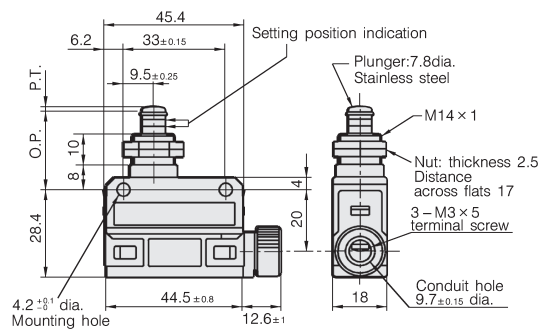


\*Dimensional tolerance is ±0.4 unless otherwise specified.

## Plunger type



Catalog listing	SL1-H□□
Operating force O.F. (max. N)	11.8
Release force R.F. (min. N)	4.9
Pretravel P.T. (max. mm)	1.5
Overtravel O.T. (min. mm)	3
Movement differential M.D. (max. mm)	0.1
Operating position O.P.(mm)	25.4±0.8

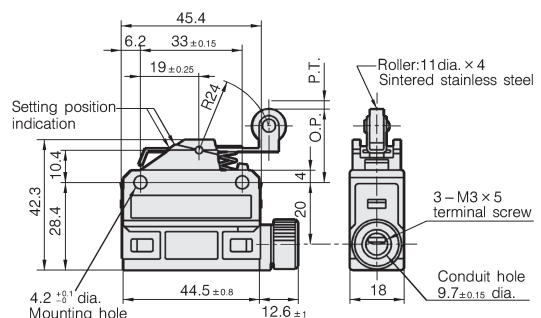


\*Dimensional tolerance is ±0.4 unless otherwise specified.

## Short roller lever type



Catalog listing	SL1-P□□
Operating force O.F. (max. N)	4.0
Release force R.F. (min. N)	0.78
Pretravel P.T. (max. mm)	2
Overtravel O.T. (min. mm)	4
Movement differential M.D. (max. mm)	0.3
Operating position O.P.(mm)	23.1±0.8



\*Dimensional tolerance is ±0.4 unless otherwise specified.



# PRECAUTIONS FOR USE

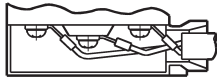
## 1. Preparing lead wire tips

Cut and strip the lead wire tip as illustrated below, and use a round crimp-type terminal lug having an M3 insulating sleeve. A bare crimp-type terminal lug will cause a short-circuit. If a bare crimp-type terminal lug must be used, insulate it with a sleeve or the like, or point the terminal lugs in opposite directions to prevent a short-circuit.

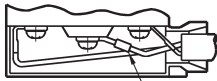
Lead wire connection direction and recommended cutting sizes (unit: mm)

### 1.1 For 3-core wires

- An example of standard connections using crimp-type terminal lug, having an insulation sleeve



- An example of insulating a bare crimp-type terminal lug with a mark tube or the like

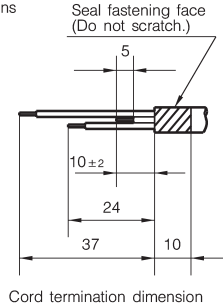


Mark tube or the like

- ✗ A wrong example of using a bare crimp-type terminal lug

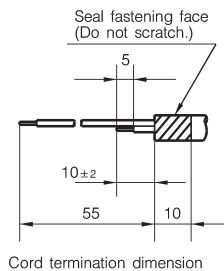
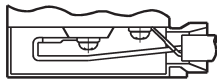


Short circuit

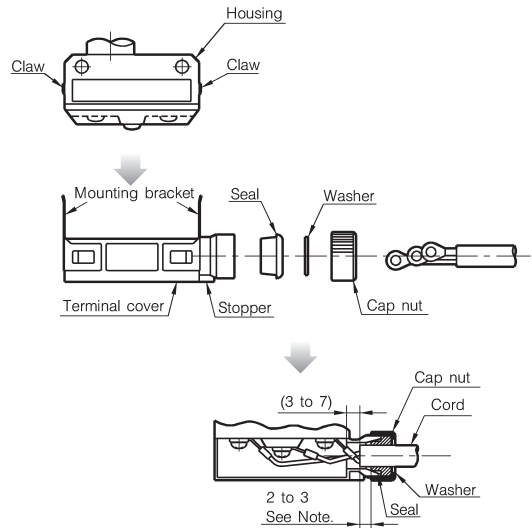


### 1.2 For 2-core wires

- An example of reversing the direction of a bare crimp-type terminal lug



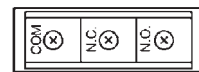
## 2. Wiring



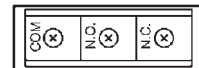
Note: Assemble these components so that the cable sheath protrudes 2 to 3 mm from the end of the seal.

- Add components to the cable in the order: cap nut, washer, seal and terminal cover.
- Make sure that the mounting bracket on the terminal cover is held by the catches of the housing in this snap-in structure. Then tighten with the cap nut.
- To remove the terminal cover, release the snap-in structure with a screwdriver by expanding the mounting bracket on one side.
- The cable can be drawn out rightward or leftward by changing the mounting direction of the terminal cover.
- Be careful since the terminal layout differs for the (roller) lever type and (roller) plunger type, as illustrated below.

(roller) lever type



(roller) plunger type



- A seal suitable for a cable diameter of 5.8 to 7.8 mm is attached to the terminal cover at the factory. If a cable of a different diameter is used, use replacement seal **SL1-PA22**, **SL1-PA23** or **SL1-PA24** (sold separately). To ensure a good seal, be sure to use a seal matching the diameter of the cable. If a question arises, please contact your nearest Azbil sales agent.
- Do not wire while the power is ON. There is a danger of injury by electrical shock or unexpected movement of the mechanism.
- Make sure that crimp terminals attached to wires do not come into contact with the cover or housing. If they do, the cover may not close properly or a ground fault may occur.
- Securely tighten the cap nut.  
Insufficient tightening impairs sealing performance, leading to insulation failure and eventually preventing the switch from performing satisfactorily.

### 3. Installing the switch

- Tighten each part of the limit switch to the appropriate tightening torque as described in the product specification. Overtightening will damage the threads or other parts. Insufficient tightening degrades the seal and other characteristics.
- Do not leave or use the switch with the terminal cover open. The entry of water or dust into the switch can lead to malfunction.
- Do not let the actuating object strike the lever arm or the switch head. If they do, the actuator may bend and the switch may not be able to return properly.
- Do not use leads with silicone rubber insulation, or silicone filler, or grease or oil containing silicone. They can cause contacts to fail to conduct electricity.

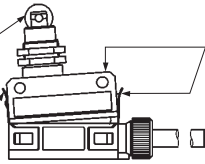
### 4. Adjusting the switch

- Do not apply excessive force (5 times the O.F. or more) to the actuator beyond the travel limit position. Doing so may damage the switch.
- Keep the overtravel between 1/3 and 2/3 of the rated value. With a small overtravel, vibration or shock may cause the contacts to rattle or to make poor contact.

### 5. Assembly of auxiliary parts

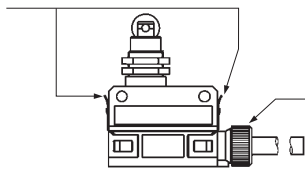
Actuator section (Do not apply a force that is 5 times the O.F. or more.)

1. Insert one of the tabs on the side of the housing into the mounting bracket on the terminal cover.



2. Push the housing straight down from above so that the other tab is completely inserted into the terminal cover mounting bracket. With the roller lever type (SL1-P\*\*), since the actuator is large there is little space to hold on the housing. If it is too difficult to insert by pushing the housing down, it can be relatively easily installed by pushing the terminal cover side.

3. Check that the housing is completely inserted into the terminal cover. If not, switch performance requirements may not be satisfied.



4. When tightening the cap nut, do not hold the housing, but rather the terminal cover. If stress is applied to the housing and the compression of the O-ring becomes uneven, sealing performance requirements may not be satisfied.

### 6. Environment

- Do not use the switch in an environment where strong acid or alkali is directly splashed onto it.

Before use, thoroughly read the "Precautions for use" and "Precautions for handling" in the Technical Guide on pages D-111 to D-122 as well as the instruction manual and product specification for this switch.