

### ■ Direct-sliding ball bearing is equipped to the plunger

Suitable for sliding, angled, offset objects.

### ■ No movement differential

This type can detect even subtle bump and small height difference such as thickness of a sheet on a sliding conveyer.

### ■ The built-in switch is cartridge type

Free from worries about failure caused by twisting the cable when installing. Makes the replacement process simple and reduces the maintenance cost.



## ■ Representative specification

unit:mm

| Product name     | Output mode        | with LED          | Cartridge |
|------------------|--------------------|-------------------|-----------|
| <b>CSH121A-A</b> | A : Normally open  | <b>CSH121A-AL</b> | KS51A     |
| <b>CSH121B-A</b> | B : Normally close | <b>CSH121B-AL</b> | KS51B     |

-A: S  $\phi$  10 hemisphere SUS,  
Hardened HRC 45-50

L: LED indicator (120mm from the switch)  
Add "-L" after cartridge name for LED type

## ■ Common specification

unit:mm

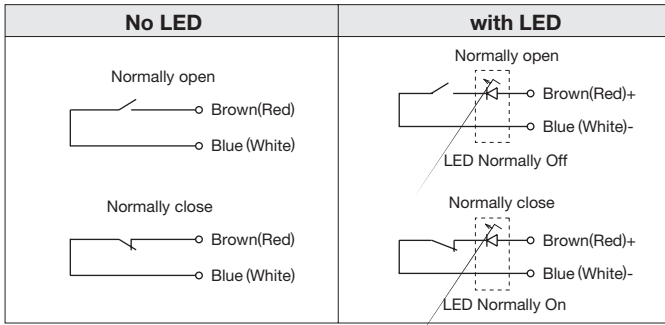
|                       |   |
|-----------------------|---|
| Switch structure      | Dry contact   |
| Output mode           | A : Normally open / B : Normally close  |
| Pretravel             | 0.3   |
| Stroke                | 2.8 (Vertical direction)  |
| Repeatability         | Both On→Off, Off→On/ 0.005 (Vertical direction)<br>(At operating speed 50~200mm/min)*1              |
| Movement differential | 0   |
| Contact life time     | 10million (If no specified bungle caused by vibration<br>and used under voltage and current rating) |
| Protective structure  | IP65  |
| Contact force         | 1.5N (Vertical direction)   |
| Plunger shaft         | Non   |
| Case material         | SUS 303   |

|                             |  |
|-----------------------------|--|
| Cable<br>(Refer to P2-4)    | Standard length 2m Oil resistant $\phi$ 4 / 2 cores,<br>Tensile strength 30N, minimum bending R7 |
| Operating temperature range | 0°C~80°C (Ice-free)  |
| Temperature drift           | 0  |
| Oscillation                 | 10~55Hz total amplitude 1.5 for X,Y,Z each direction   |
| Impact                      | 300m/s <sup>2</sup> for X,Y,Z each direction   |
| Contact rating              | DC5V~DC24V 10mA (MAX20mA) Resistance load  |
| Standard accessory          | Two fixing nuts  |

\*1 Operating speed slower than 10mm/min is not recommended.

## ■ Circuit diagram

(Old wire color)

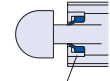


Electrical specification / circuit diagram. (Refer to P2-1)  
CL type interface unit cannot be used with LED.

**When using the switches with LED option, limit the current below 10mA.**

## ■ Protective structure

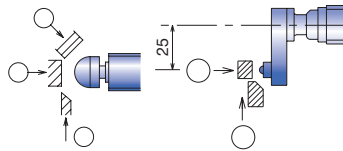
Rubber scraper is applied to the plunger. When the lip of the scraper is damaged by cuttings, the water resistance becomes impaired.



Rubber scraper

## ■ How to use

Suitable for sliding, angled, offset (25mm) objects.  
Do not press the plunger to the stroke end.  
It may cause malfunction due to the impact.

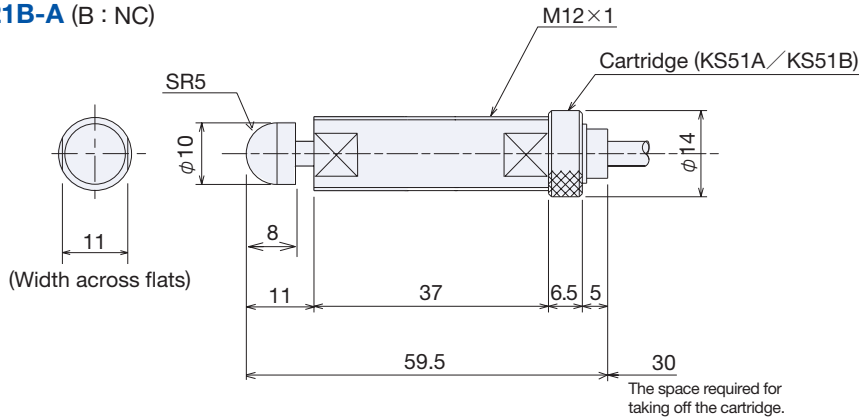


## ■ Outer dimension

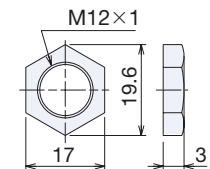
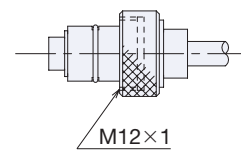
(-A: S  $\phi$  10 hemisphere SUS, Hardened HRc 45-50)

CSH121A-A (A : NO)

CSH121B-A (B : NC)

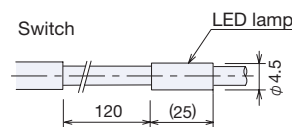


Drawing of cartridge  
KS51A / KS51B



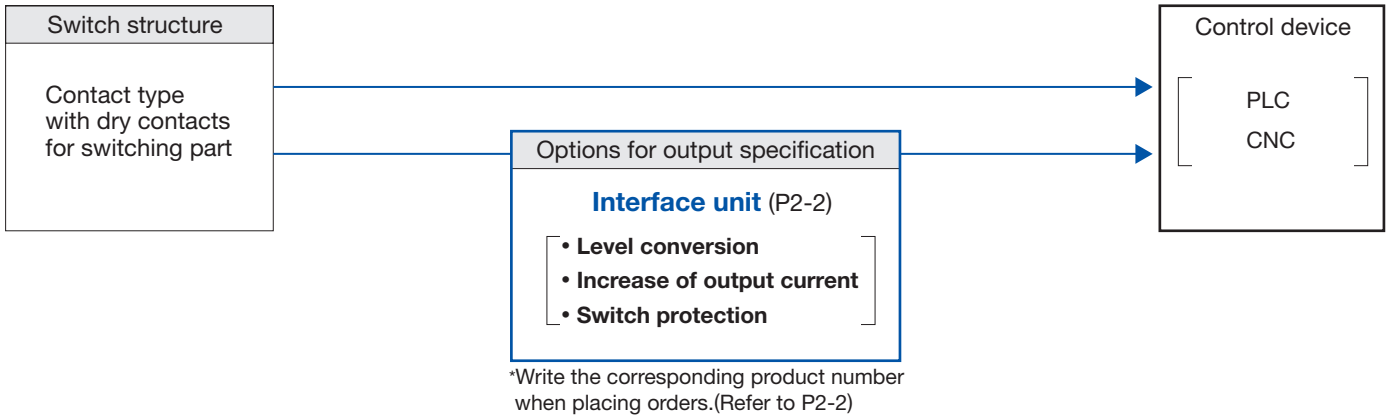
Material: BsBM  
Treatment: Ni plating  
Product name: S645

(-L: LED indicator)



## Contact type with dry contacts for switching part

### Block diagram



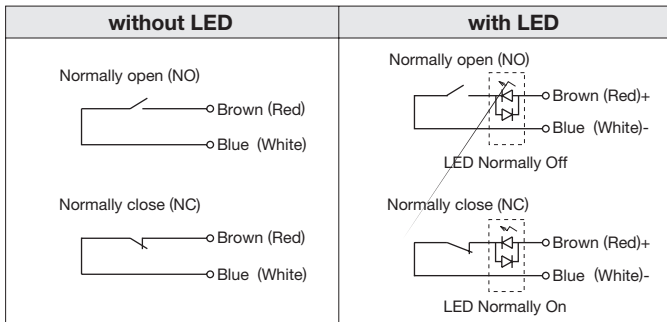
### Specification

|                       |   |
|-----------------------|---|
| Contact rating        | DC+5V~DC+24V 10mA (MAX20mA) Resistance load<br>(Switch without LED,DC1V-24V possible) |
| Insulation resistance | More than 100MΩ with DC250V Megger  |
| Output mode           | A : Normally open or B : Normally close   |

Refer to P6-3 about how to use switches under the condition of AC100V-200V.

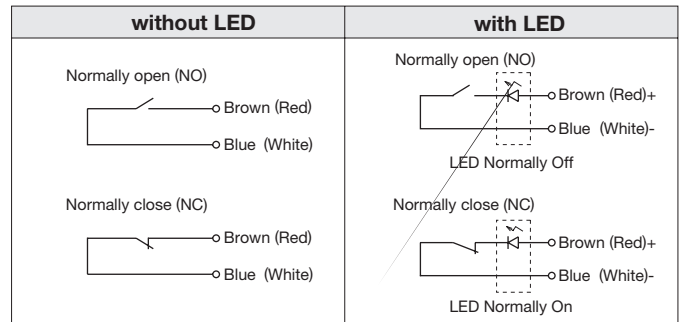
### Circuit diagram

High-accuracy MT-Touch Switch 1-signal type (Old wire color)

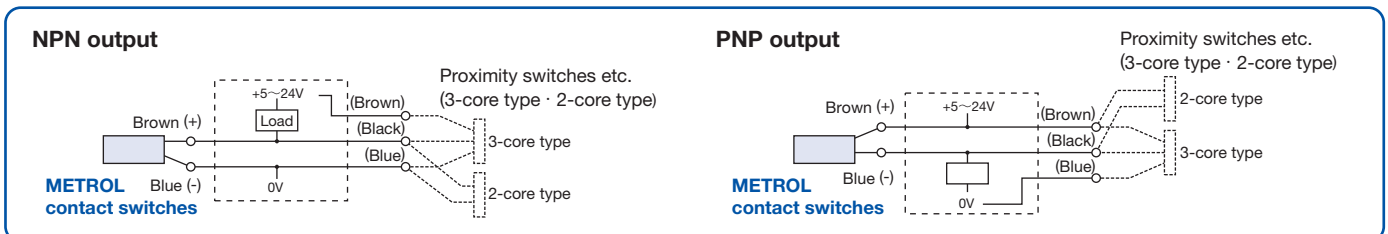


When using the switches with LED option, limit the current below 10mA.

CS-Touch Switch and others  
(Other sensors 1-signal types)



## How to replace currently using proximity switches (3-core and 2-core type) with METROL (2-core type)



## Interface unit

### Electrical specification

|                             |  |
|-----------------------------|--|
| Power supply voltage        | DC24V ±10%<br>(Full-wave rectification with ripple 5% or less) |
| Power consumption           | 30mA   |
| Input                       | One contact signal   |
| Output                      | Transfer output (in-phase or inverted output)                  |
| Operating temperature range | 0°C~50°C   |

- When using the switches (except MT-Touch Switch) with the interface unit, the option for the LED attached on the switch is not available.
- The diode is attached in parallel to the LED for MT-Touch Switch for the cases where the switch is used with the interface unit.
- No diode is attached to the switches except for MT-Touch Switch.

### Characteristics

#### 1) Protection for the dry contacts from inrush current

- The interface unit is not needed, when using the switches under the contact rating. The switch side of the interface unit has high-frequency alternating current control and it reduces the influence of sparks and chattering caused by vibration.
- Being separated from I/O circuit, the dry contacts of the switches remain intact from sudden inrush current.

#### 2) Increase the output current (except photo coupler type)

- Enable to drive a relay or similar devices directly.
- When driving a relay by this unit, the repetitive accuracy would be lowered due to delay of the relay.

#### 3) Level conversion unit

- Level conversion (normally close to normally open, normally open to normally close)

### Output specification

| Product name    |        | CL-1N                        | CL-1P                   | CL-1FT                     | CL-1F                       | CL-1FH                      |
|-----------------|--------|------------------------------|-------------------------|----------------------------|-----------------------------|-----------------------------|
| Output method   |        | NPN-TR                       | PNP-TR                  | Photo coupler              | Photo Mos relay             |                             |
| Diagram         |        |                              |                         |                            |                             |                             |
| Output level    |        | 0V sink                      | 24V source              | No-voltage floating output |                             |                             |
| Output capacity |        |                              | DC24V<br>100mA<br>350mW | DC30V<br>20mA<br>120mW     | AC/DC60V<br>100mA<br>240mW  | AC/DC200V<br>100mA<br>240mW |
| Operating time  | Delay  | 100µsec (Representing value) |                         |                            | 500µsec(Representing value) |                             |
|                 | Spread | 20~100µsec                   |                         |                            | 10~20µsec                   |                             |

### Outer dimension

**Terminal layout**

In-phase output: 1, 4, 5, 8, 9, 12, 13, 14

Inverted output: 2, 3, 6, 7, 10, 11

DC24V: (-) 13, (+) 14

Switch input: (-) 1, (+) 2

**No terminal block is provided. Refer to the following.**

Panasonic: HC2-SFD-S  
Omron: PYF-08A

**Connection diagram (Plural switches)**

When connecting plural switches to one plug-in type interface unit, refer to the diagram below.

Within 100mm

It is available only for the switches without LED.

Within 20m

- Make sure no noise and inductive source.
- Overall length of the sensor side cables should be in 100mm.

**Connecting diagram with electrical load**

**CL-1N**

**CL-1P**

**CL-1FT**

**CL-1F/CL-1FH**

### Precautions

- 1) Do not connect the load exceeding the output rating specified for each model. Since the switching parts and interface elements may be damaged due to the flow of current in excess of the rating caused by noise or surge induction, place the switch at an adequate distance from any power lines or other sources of noise.
- 2) As a rule of thumb, connect one switch to one unit.
- 3) Select the installation location of I/F unit so that the cable length between the switch and the I/F unit should not exceed 20m .
- 4) Since the I/F unit is not water-proof, protect it from moisture such as water and oil.
- 5) In case of using Normally-open type switch with a LED indicator, I/F unit can be used only when the LED is normally OFF and turns ON in operation. Similarly, for Normally-Close type switch, the unit can be used only when the LED is normally ON and turns OFF in operation.
- 6) This I/F unit is especially designed for the METROL switches, do not use this I/F unit with the switch from other manufacturers.

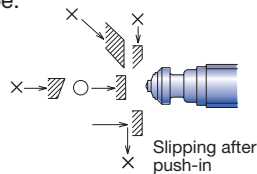
# Common warnings and precautions

## Electrical

- Use under the specified contact rating.
- Chattering may occur when opening and closing the circuit with dry contacts regardless of whether the switch has a snap action mechanism. Take the first signal as a judgment signal.
- In adverse condition such as using a magnet coil for inductive load and over current may occur, regardless of whether the switch has dry contacts or is contact-less using interface unit with built-in surge protection unit is recommended(Refer to P2-2).
- When using the switch with LED, keep the current below 10mA.

## How to use

- When using the plunger type with plain bearing, make contact with the detected object at right angle (with deflection angle  $\pm 3^\circ$ ). For sliding, rotating, angled, offset objects, use ball bearing type or contacting ball type.



- When the plunger is pushed straight by the detected object, do not allow the object to abruptly slide away, as it will cause the plunger to snap back. Note that this may cause failure of the bearing and built-in switching part.
- Because offset distance (misalignment with axis of the plunger) should be shorter than 5mm, the maximum diameter for detecting surface is 10mm for the plunger type with plain bearing.
- In case the detected surface is angled or ragged, note that the switch may fail to operate properly or cause malfunction.
- If the contacting part is worn away depending on conditions, the signal point becomes different. When designing the detected objects, give consideration to its angle, chamfer and roughness so that the contacting part holds up longer. (Mainly for sliding touch type)

## Operating environment

- Use in the environment in where cuttings and dust don't prevent switch movement.
- Choose protective cover option in case cutting may damage the rubber boot.
- An extra cover is recommended to avoid direct hit by high-pressure coolant or heavy cuttings.

## Contacting part material

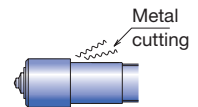
- Even though hardened stainless steel is used as the material of the contacting part or stopper surface (for Stopper Bolt with a Built-in Switch series), they are oxidized and may gather rust under certain conditions.

## Rubber for protective structure (boot, seal, O-ring)

- Rubbers for some products are intended for water-soluble cutting oil (Alkaline). For oily, chlorine-base, coolants and other chemicals, consult METROL for assistance.
- The rubber material for High-accuracy MT-Touch Switch and CS-Touch Switch is for both oily and water-soluble coolants.

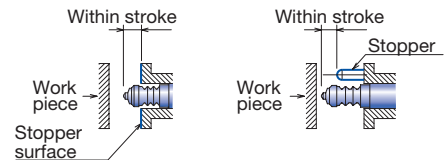
## Installation

- Ensure that the threaded part of the switch is not bent during installation.
- When using fixing screws, do not tighten the screws with excessive force. That may distort the switch shape or restrict the movement of the plunger. If the fixing screws are damaged, the switch can be stuck and difficult to be detached.
- When the switch with a protective cover is installed horizontally, an extra cover is needed separately to prevent coolant or cuttings from entering inside and getting piled up on the switch.



### For the switches without stopper

- Do not excessively press the plunger to the stroke end. It may cause malfunction due to impact.
- If there is possibility to press the plunger to the stroke end, install a separate stopper to prevent malfunction.



### For cartridge type switches

- Tighten the cartridge firmly by fingers. Do not use pliers to fix it. That may cause malfunction.
- The cartridge is thin. Handle it carefully.
- When installing the cartridge type switches, give consideration to enough space to replace the cartridge.

## Screw / nut tightening torque Screw / Nut

|   | Screw / Nut | Tightening torque | Applicable models                   |
|---|-------------|-------------------|-------------------------------------|
| PT-Touch Switch                           | M5×0.5      | 1N·m              | <b>PT</b>                           |
| MT-Touch Switch                           | M8×0.5      | 4N·m              | <b>P085DB</b>                       |
|   | M10×0.5     | 8N·m              | <b>P10</b>                          |
|   | M14×0.5     | 10N·m             | <b>P10DH</b>                        |
| CS-Touch Switch                           | M5×0.5      | 2N·m              | <b>CSJ055</b>                       |
|   | M6×0.75     | 4N·m              | <b>CS067</b>                        |
|   | M8×0.75     | 7N·m              | <b>CSP087</b>                       |
|   | M10×0.5     | 8N·m              | <b>CSM</b>                          |
|   | M21×1       | 12N·m             | <b>CSH</b>                          |
| Machine Components with a Built-in Switch | M6×0.5      | 2N·m              | <b>ST</b><br><b>BP</b><br><b>SP</b> |
|   | M6×1        | 8N·m              |                                     |
|   | M8×1.25     | 20N·m             |                                     |
|   | M10×1.5     | 35N·m             |                                     |
| Stopper-Mini                              | M10×0.75    | 10N·m             | <b>STM</b>                          |

# Cables and cable protection

## Type of cable

### Cabtyre cable

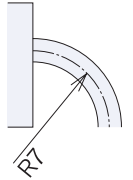
Cabtyre cables are used as robot cables without any safety compromise since the working voltage and current are low, though cabtyre cables are not applicable to UL, CSA, EN or other safety standards.

#### Specification

|                        |  |
|------------------------|--|
| Conductor material     | Copper-tin alloy, tight winding  |
| Conductor resistance   | 1Ω/m (per 1 core)  |
| Sheath material        | PVC (Non-migrating styrene, oil-resistant, alkaline-resistant)   |
| Minimum bending radius | 7mm  |
| Outer diameter         | $\phi 3$ (2-core)<br>$\phi 3.5$ (3-core)<br>$\phi 4$ (2-core for dry contact type, 3-core for contact-less type and 5-core for dry contact type)<br>$\phi 5$ (s-core, 3-core)<br>$\phi 5.5$ (5-core) |
| Sheath color           | Black : 2 cores, 3 cores for normally close<br>Gray : 2 cores, 3 cores for normally open<br>(Excludes MT-Touch Switch Series)  |

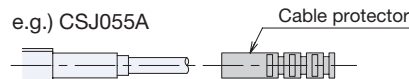
#### Handling instruction

- 1) Do not pull or twist the cable with excessive force. Max.30N (3kgf)
- 2) Water-resistance →P6-7
- 3) When extending cable length, use cabtyre cable having a cross-section area of at least 0.02mm<sup>2</sup>.
- 4) The minimum bending radius is 7mm.



Cable protector (Depending on products)

e.g.) CSJ055A



### Core-wire cable

For CS-Touch Switch CSM short type (P4-7) and stopper-mini type (P5-16)

**Specification:**  $\phi 0.6$  AWG 30 (0.05mm<sup>2</sup>) Tensile strength 15N

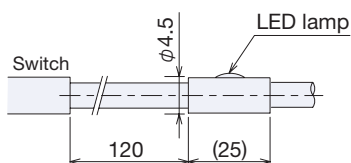
#### Cross-section area / weight(Including sheath / 1m)

| Outer diameter | Cores  | AWG    | Cross-section area (mm <sup>2</sup> ) | Weight (g) |
|----------------|--------|--------|---------------------------------------|------------|
| $\phi 2.8$     | 2-core | AWG 26 | (0.151mm <sup>2</sup> )               | 10g        |
| $\phi 3.5$     | 3-core | AWG 28 | (0.096mm <sup>2</sup> )               | 15g        |
| $\phi 4$       | 2-core | AWG 30 | (0.063mm <sup>2</sup> )               | 16g        |
| $\phi 4$       | 3-core | AWG 28 | (0.096mm <sup>2</sup> )               | 19g        |
| $\phi 4$       | 5-core | AWG 28 | (0.096mm <sup>2</sup> )               | 21g        |
| $\phi 5$       | 2-core | AWG 30 | (0.063mm <sup>2</sup> )               | 26g        |
| $\phi 5$       | 4-core | AWG 30 | (0.063mm <sup>2</sup> )               | 32g        |
| $\phi 5$       | 3-core | AWG 30 | (0.063mm <sup>2</sup> )               | 26g        |
| $\phi 5.5$     | 5-core | AWG 30 | (0.063mm <sup>2</sup> )               | 33g        |

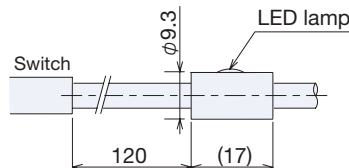
## Outer dimension

L : Tubular type

#### Cable $\phi 3$ or smaller



#### Cable $\phi 4$



#### Cable $\phi 5$

