

# Instruction Manual

# High-vacuum resistance Switch GN Series

## Standard specification

| How to use                    | Product name | Output mode | Repeatability* <sup>1</sup> (μm) | Stroke(mm) | Pretravel(mm)          | Contact force     | Contact material |
|-------------------------------|--------------|-------------|----------------------------------|------------|------------------------|-------------------|------------------|
| Straight touch type           | GN-PT5M1A    | A : NO      | 1                                | 1.5        | about 0.3              | 0.5N              | SUS420           |
|                               | GN-PT5M3A    |             | 3                                |            |                        |                   | PEEK             |
|                               | GN-PT6M3A    |             | 5                                | 2.8        |                        |                   | SUS420           |
|                               | GN-CS067A    | B : NC      | 1                                | 1.5        | 0 <sup>2</sup>         | 0.8N              | SUS440C          |
|                               | GN-PT5M1B    |             | 3                                |            |                        |                   |                  |
|                               | GN-PT5M3B    |             | 5                                | 2.8        | about 0.3              |                   | SUS420           |
|                               | GN-PT6M3B    |             | 10                               | 5.0        | 0 <sup>2</sup>         |                   | SUS440C          |
|                               | GN-CS067B    |             |                                  |            |                        |                   |                  |
|                               | GN-CSK141B   |             |                                  |            |                        |                   |                  |
| Sliding and angled touch type | GN-BP5MA     | A : NO      | 10                               | 1.0        | about 0.3              | 1.0N              | SUS440C          |
|                               | GN-BP6MA     |             |                                  | 3.0        | about 0.2 <sup>3</sup> | 1.5N <sup>3</sup> | ZrO2             |
|                               | GN-BP161A    |             |                                  | 1.0        | about 0.3              | 1.0N              | SUS440C          |
|                               | GN-BP6MB     | B : NC      |                                  | 3.0        | about 0.2              | 1.5N              | ZrO2             |
|                               | GN-BP161B    |             |                                  |            |                        |                   |                  |

\*1 Both On→Off, Off→On/ 0.003 (range)(At operating speed 50-200mm/min) \*2 Adjust the installed location of the switch by the signal switching point.

\*3 Specifications are subject to change without notice due to ongoing development.

## Common specification

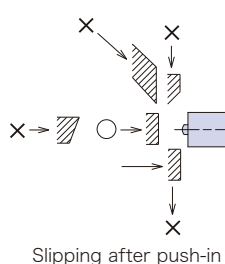
|                              |                                                                     |
|------------------------------|---------------------------------------------------------------------|
| Switch structure             | Dry contact                                                         |
| Compatible vacuum            | 10 <sup>-5</sup> Pa                                                 |
| Allowable baking temperature | 120°C                                                               |
| Movement differential        | 0                                                                   |
| Protective structure         | IP40                                                                |
| Wire                         | PTFE Core-wire cable0.5m AWG 27<br>〈AT01B030〉 made by Junkosha Inc. |

|                         |                                                                        |
|-------------------------|------------------------------------------------------------------------|
| Potting compound        | Torr Seal                                                              |
| Solder                  | Lead-free solder                                                       |
| Oscillation             | 10 - 55Hz total amplitude 1.5 for X, Y, Z each direction               |
| Impact                  | 300m/s <sup>2</sup> X,Y,Z each direction                               |
| Contact rating Standard | DC5V-DC24V Steady current : 10 mA or less(rush current: 20 mA or less) |
| accessory               | Two fixing nuts                                                        |

## How to use

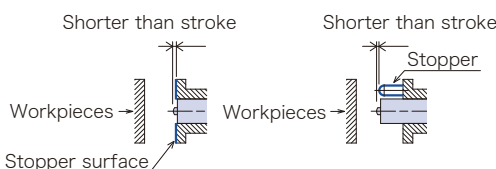
### Straight touch type

**GN-PT / GN-CS / GN-CSK**



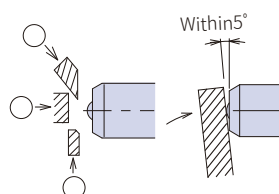
### Make contact with detected objects at right angle(within deflection angle $\pm 3^\circ$ )

If there is a possibility to press the plunger to the stroke end, install a stopper separately to prevent the malfunction.



### Sliding and angled touch type

**GN-BP**

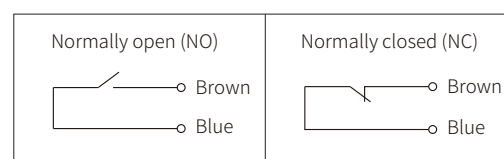


### Suitable for angled touch

The degree required to turn on the switch when the detected object doesn't meet the switch end fully.

When using for rotation indexing, adjust the position in consideration of eccentricity and core blurring accuracy of rotating objects.

## Circuit diagram



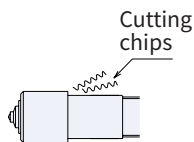
## Tightening torque for case screws and nuts

| Product name      | Screw / Nut | Tightening torque |
|-------------------|-------------|-------------------|
| <b>GN-PT5M1A</b>  | M5×0.5      | 1N・m              |
| <b>GN-PT5M3A</b>  | M5×0.5      | 1N・m              |
| <b>GN-PT6M3A</b>  | M6×0.75     | 4N・m              |
| <b>GN-CS067A</b>  | M6×0.75     | 4N・m              |
| <b>GN-PT5M1B</b>  | M5×0.5      | 1N・m              |
| <b>GN-PT5M3B</b>  | M5×0.5      | 1N・m              |
| <b>GN-PT6M3B</b>  | M6×0.75     | 4N・m              |
| <b>GN-CS067B</b>  | M6×0.75     | 4N・m              |
| <b>GN-CSK141B</b> | M14×1       | 10N・m             |
| <b>GN-BP5MA</b>   | M5×0.5      | 1N・m              |
| <b>GN-BP6MA</b>   | M6×0.75     | 4N・m              |
| <b>GN-BP161A</b>  | M16×1       | 12N・m             |
| <b>GN-BP6MB</b>   | M6×0.75     | 4N・m              |
| <b>GN-BP161B</b>  | M16×1       | 12N・m             |

## Common warnings and precautions for all-purpose high-precision switch series

### ■ Mounting

- Ensure that the threaded part of the switch is not bent during installation. When tilted, it may result in poor signal.
- 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 using the protective cover in a horizontal position, be sure to provide a cover or the like so that the chips do not accumulate on the switch body. Especially for gapless boot protection, the effect of boot protection will be impaired.



- Do not subject cabtyre cable or core wire cable to excessive pulling or twisting of 30 N or more. The bending radius should be at least R7. (Except for heat resistance cable)
- Do not swing the switch by grabbing the cable or its attaching portion when installing. (Especially when the cable is perpendicular to the switch)
- When installing it with several cables, hold the switch to avoid the cables from being pulled by weight.

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

- Rubbers for some products are intended for water-soluble cutting oil (alkaline).
- The rubber material for High-precision MT-Touch Switch is for both oily and water-soluble coolants.
- Rubber might be hardened when the ambient temperature is low. When the contacting part is depressed for a long period of time, it might take longer time for the contacting part to return to the original position.

### ■ How to use

- Objects shall be aligned straight ahead for the metal bearing plunger type. (The angle must be within  $\pm 3$  degrees when high precision is required such as when using a high precision switch, or when judging existence detection or ON/OFF.)
- For the metal bearing, pressing while offsetting (deviated from the axis) will cause the movement of the axis to be unsmooth and wear fast.
- For sliding, angled, or offset touch, select bearing or ball contacting part or lever type.
- Note that straightly pressing the detector, rapidly sliding and relieving it to the side and rapidly returning it by recoil may damage the bearings and internal contacts (when contacts are normally closed).
- Note that pushing it in with a fingertip and returning at once (snap) may also damage the internal contacts.
- 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 operating 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)

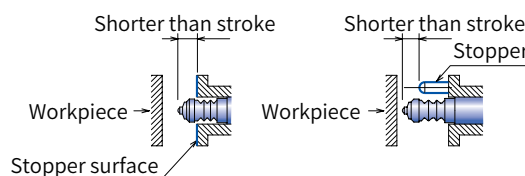
### ■ Contacting part material

- Even though hardened stainless steel is used as the material of the contacting part or stopper surface, it is oxidized and may gather rust under certain conditions.

- NC (Normally closed) type structure might cause chattering depending on the roughness of workpiece surface and environment used (i.e. vibration and contacting speed). In such case, please select NO (Normally open) type structure.
- Use it with the operating speed of 50 to 200 mm/min when precision is required.

#### ● 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 a possibility to press the plunger to the stroke end, install a stopper separately to prevent the malfunction.



### ■ Electrical

- Use under the specified contact rating.
- I/F units with a built-in contact point protection circuit are effective for adverse condition environments where overcurrent may flow. Such environments may involve, regardless of the presence of contact points, inductive loads with coils (such inductive loads mainly mean relay coils, motors, solenoids, many of which require a current of 30mA or more when driven and generate counter-electromotive force when switched OFF).
- Since operating errors may occur due to induction when high-voltage lines or power lines are wired within the same conduit or duct as switch wires, wire them in separate ducts.

- When using the switch with LED, keep the current below 10mA.
- 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.

#### ● Connecting to a load

- Do not attempt to drive an inductive load directly with these switches. Direct driving can damage the switching parts and semiconductors of the internal circuitry.
- In case of driving an inductive load, connect a surge absorber in parallel with the load, and connect an external load such as a relay or transistor allowing an adequate flow of current for load driving.

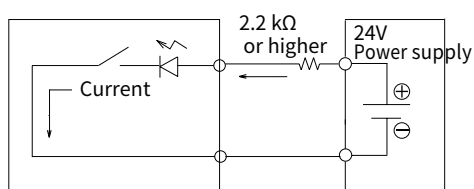
## ■ Operating environment

- Use in the environment in where cuttings and dust don't prevent switch movement.
- Choose protective cover option in case cuttings may damage the rubber boot. Further, choose a suitable cover such that coolant and cutting chips do not enter from the cover gap.
- An extra cover is recommended to avoid direct hit by highpressure coolant or heavy cuttings.
- Periodically remove cutting chips and dust. Apply force to the movable parts only in the direction of measurement. Do not apply force in the other direction.

## ■ Confirmation of Switch Operation

Connect the switch in the manner shown in the diagram below.

- Limit the LED forward current to about 10 mA by inserting a resistor.
- Resistance value = (power supply voltage - LED forward voltage) ÷ current =  $(24-2) \div 0.01=2.2 \text{ K}\Omega$  The LED forward voltage is about 2 V.
- The resistor may be installed on the DC 24 V or 0 V side.
- If the contact is closed and LED glows, the switch operation is normal.
- In case of using a sequencer, a resistor is not required if the outflow current of the sequencer is about 7 mA.
- Operation might not be properly confirmed using a digital tester (multi-meter).



### ● Confirming operation by using resistance

- Set the tester to a resistance range of X10, and connect the minus lead of the tester to the switch output (brown), and connect the plus lead of the tester to the switch 0 V (blue).
- The deflection of the tester needle indicates around  $0 \Omega$  when the switch tip is pushed in and roughly infinity ( $\infty$ ) when switch tip is returned.
- For switches with LED, note that the tester may not swing.

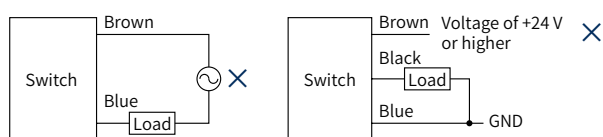
### ● Confirming operation by using voltage

- Set the tester to a voltage range of 50 V and measure the voltage between the switch output (black) and 0 V (blue).
- For NPN output type, when the tip of the switch is pressed, the indicator of the tester changes from 24 V down close to 0 V.
- For PNP output type, when the tip of the switch is pressed, the indicator of the tester changes from 0 V up close to 24 V.

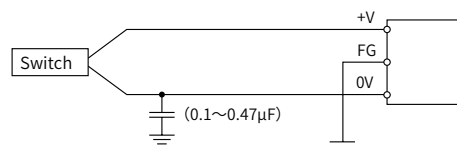
## ■ Precautions for Switch Connecting

**Always make sure to turn off the power before installing or removing switches. This is to prevent damage to the device caused by improper wiring or short-circuits of output lines.**

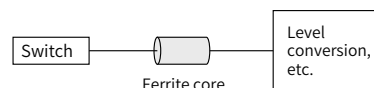
Application of an excessive voltage or application of an alternating current power supply (AC 24 V or higher) to switches using a direct current power supply has the risk of damaging the switch.



Either ground the switch with 0 V of a switching power supply in close proximity to the switch or ground through a capacitor (approx. 0.1-0.47  $\mu\text{F}$ ) for the purpose of lowering the impedance of the frame in order to increase resistance to entrance of induction noise by servo drivers or similar devices.

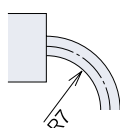


Alternatively, attach a ferrite core to the switch cable.



## ■ Wiring Precautions

- Do not subject cabtyre cable or core wire cable to excessive pulling or twisting of 30 N or more. The bending radius of the cable should be R7 (7 mm) or larger.
- If you want to extend the cable on site, please make the distance as short as possible as it will otherwise be susceptible to the increase in the residual voltage and waveform distortion and induction due to the influence of the line resistance and line-to-line capacity. In addition, please use the cabtyre cable with the crosssectional area of 0.2 mm<sup>2</sup> or more.
- Since operating errors may occur due to induction when high-voltage



lines or power lines are wired within the same conduit or duct as switch wires, wire them in separate ducts.

- 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.
- If waterproofing is required, please mold the terminal so that there will be no exposed portion.
- Use braided wire or protective tube when using under harsh environment such as where there are scattering of cutting chips.

## ■ Terms of Warranty

Before using our products, we would like to request that our customers have an understanding of our warranty policy and the functions and specifications of applicable products as indicated by our catalogs, instruction manuals and website to ensure that they are used properly under specified conditions.

### 1) Applicable Products

The warranty defined below is applicable to products manufactured and sold by METROL (to be referred to as the "applicable products").

### 2) Warranty Period

The warranty for applicable products is valid for 1 year and 3 months from the original delivery date to the location designated by the customer.

\* Durability, life time and repeatability are described based on our test conditions. Please note that the performance is not guaranteed under your specific usage environment.

### 3) Range of Coverage

a. A replacement product will be provided on an exchange basis or the malfunctioning product will be repaired free of charge within the warranty period. If the product is or becomes defective and, at the sole discretion of METROL, the defects are due to faulty materials or workmanship. However, applicable products will not be covered by the warranty in the case of the following malfunctions even within the warranty period.

(1) Malfunctions due to use of a product in a manner that deviates from standards, specifications, environments, usage procedures or usage precautions described in the catalog, instruction manual or specifications.

(2) Malfunctions having occurred for reasons other than those attributable to the delivered product.

(3) Malfunctions having occurred due to disassembly, modifications or repairs made by someone other than a METROL representative.

(4) Malfunctions or damage that results from external causes outside our control which shall include accidents, fires, natural disasters, or other force majeure.

b. The range of coverage is limited to the warranty of the applicable product only, and any other secondary loss or damage resulting from the malfunction of an applicable product is not covered by the warranty.

c. Please be aware that we do not offer installation, uninstallation, on-site confirmation, or on-site repairs.

### 4) Applications

Applicable products are designed and manufactured as general-purpose products used in ordinary industrial environments. In the case of incorporating an applicable product in an apparatus, machine or system, please confirm the suitability of the application or any related standards, regulations, and restrictions. With respect to the applications indicated below in particular, customers are requested to conduct the necessary tests regarding usage conditions and other details on an actual product in advance. Please consult us for samples for evaluation.

- ① Applications for which usage conditions or environment are outside those presumed by the manufacturer or applications unable to be confirmed as being appropriate by the manufacturer when using applicable products.
- ② Applications likely to have an effect on human life or property (such as nuclear power equipment, transportation machinery or medical devices), applications used in public utilities (such as electricity, gas, or water lines), or applications applying correspondingly thereto.
- ③ Applications in harsh environments (special environments, environments requiring heat resistance, vacuum, magnetic fields, and the like)

### 5) Attention

- Durability, life time and repeatability are described based on our test conditions. Please note that the performance is not guaranteed under your specific usage environment.
- The rightmost number of the Ingress Protection (IP) code represents a product's resistance to water only and may not apply to coolants.
- The contents of this catalog, including specific models, specifications, and any other contents, are subject to change without notice at METROL's sole discretion.

The specifications and descriptions are subjected to change without notice due to improvements in products.