

## Basics of Basic Switches

### General Knowledge of Basic Switches

#### Introduction

Sensors in the past were considered one of the common electronic components used as complements to the functions and performance of electric appliances, machines and mechanical equipment. Today, with the advent of IoT, sensors and other electronic devices directly connect to the Internet and will play a vital role in the future IoT society - not limited to merely an electronic component that plays a complementary role.

“Basic switch” is a mechanical sensor that detects (senses) the presence or absence of an object as well as its position by activating a plunger when the object physically comes into contact. With the emerging IoT, Omron’s basic switches have been widely adopted for position detection installed in customers’ newly developed electric appliances, machines and mechanical equipment. Furthermore, electrical signals outputted from the basic switch that indicates normal and abnormal conditions when detecting positions can be transmitted to remote monitoring systems over the Internet.

#### Definition

The following is the definition of a basic switch provided by the Nippon Electric Control Equipment Industries Association (NECA).

“A miniature switch, also known as snap-action switch, achieves a very small contact separation and the contacts are enclosed in a case in which these contacts open and close according to the specified movement and force. An actuator is equipped outside the case”(Figure 1)



Figure1 ● Basic Switches

With a snap-action mechanism, the contacts will instantaneously switch at a specific operating position regardless of its speed. The mechanism allows the basic switch to operate using a specified movement and force.

## Basics of Basic Switches

### General Knowledge of Basic Switches

#### Features

<Miniature and high-capacity switch>

In general, when the switch closes the electrical circuit, an electric spark, known also as an electric arc, occurs between the contacts. The greater the amplitude of the current, the higher the tendency of arc becomes and it takes longer time to arc when the switch is closed slowly, which causes contact wear. With snap-action basic switch, contacts are instantaneously switched which reduces the chance for arcing. Miniature basic switch is capable of controlling a circuit with relatively high currents while it requires less mounting space.

<High accuracy switching>

A basic switch allows switching at approximately the same actuation point in repeated on and off operation and hence has very small position detection error. They are suited for applications where high level of repeat accuracy is required. This is a feature unique to snap-action basic switch.

<Durability>

Basic switch provides high durability as it reduces the arcing time and minimizes contact damage from arcing.

<Clicking sound and feel of basic switch button>

Snap-action basic switch produces a unique clicking sound and snap-action feel that are immediately recognizable.

#### Types of Basic Switch

Basic switch is available in four different types: miniature, subminiature, ultra-subminiature, and non-of-the-above switches. Basic switches are used in many applications including home appliances and industrial machinery(Figure 2).

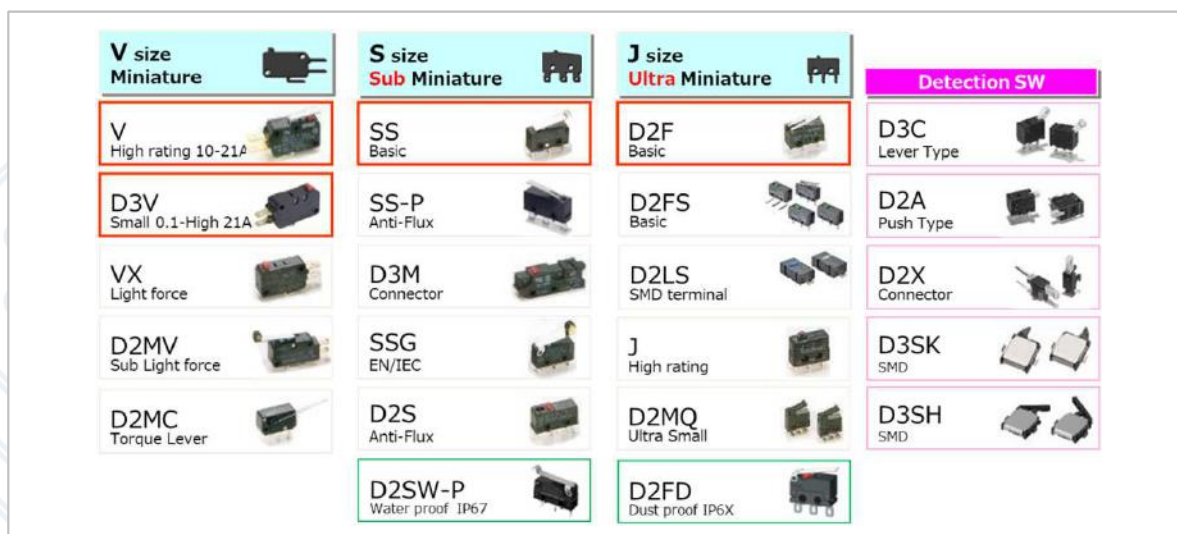


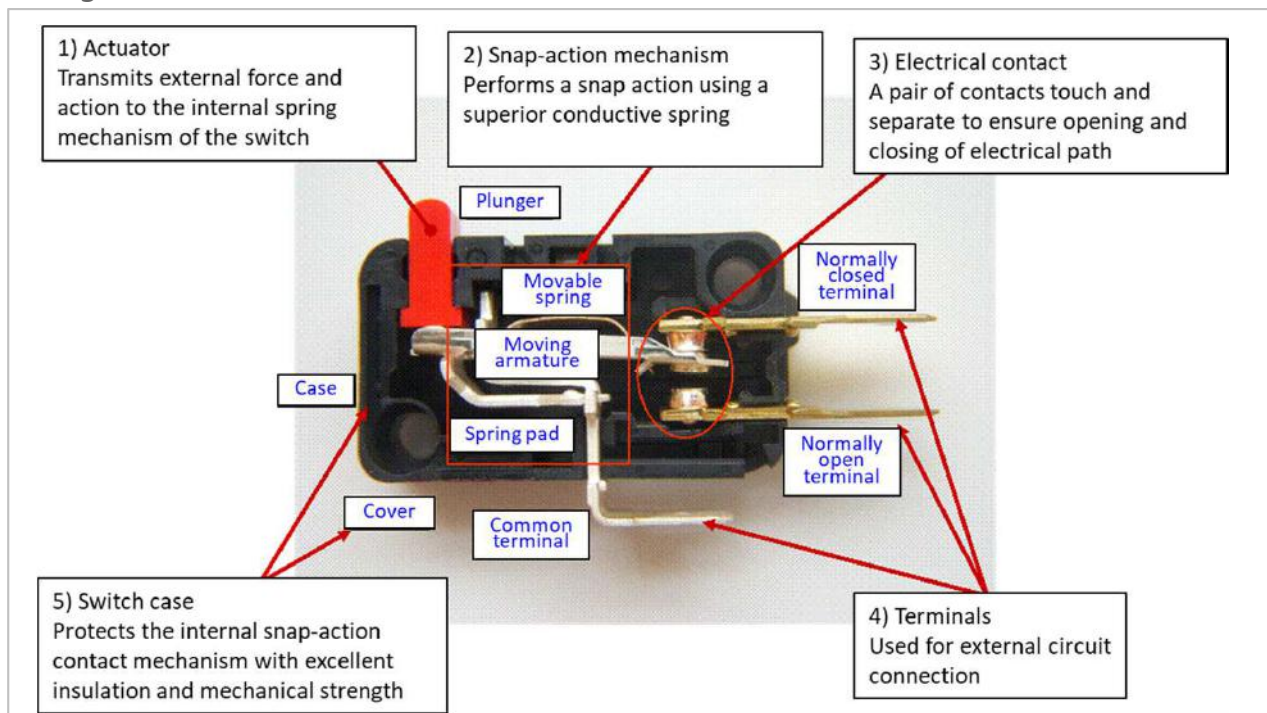
Figure2 ● Types of Basic Switch

## Basics of Basic Switches

### General Knowledge of Basic Switches

#### Basic structure

Basic parts of a basic switch include (1) an actuator; (2) snap-action mechanism; (3) electrical contacts; (4) terminals; and (5) a switch case. The descriptions of these parts are described below (Figure 3).



**Figure 3** ● *Basic structure of Basic Switches*

#### (1) Actuator

An actuator transmits external force and action received such as from an operating body, to the internal spring mechanism of the switch. Various types of actuators are selected to match the shape and movement of the operating body. Typical actuators include pin-plunger, hinge lever and hinge roller lever types (Figure 4).

A pin-plunger type actuator is appropriate for linear short stroke action, to allow position detection with high degree of accuracy. A hinge lever type has more design flexibility as it has longer stroke length and is suitable for a variety of applications. A hinge roller lever is suitable for high-speed operating condition such as high-speed cam operation.



**Figure 4** ● *Actuator types*

## Basics of Basic Switches

### General Knowledge of Basic Switches

#### (2) Snap-action mechanism

Parts of a snap-action mechanism include a movable spring, a moving armature, a common terminal, and a spring pad. When force is applied to a plunger, it increases the force of the moving spring on the moving armature at which it moves downward immediately after the plunger approaches a specific operating point and the moving contact switches from normally closed position to normally open position (terminal).

To give a better image of this movement, imagine bending a flexible plastic writing board (that you place under a sheet of writing paper to provide smooth writing surface), and as you press the top of the arch of the bent board downward, the arch springs towards the other side when it reaches a certain point. This movement of a flexible plastic writing board is very similar to that of a snap-action mechanism.

#### (3) Electrical contact

An electrical contact plays a main and critical role in the basic switch operation that opens and closes (on and off) the electrical circuit. The choices of contact material and shape to be used depend on the circuit voltage and the current flow. Most commonly used materials are gold or gold-plated, silver or silver-plated, or gold-silver alloy. Choices of contact forms include cross-bar type and rivet type (Figure 5).

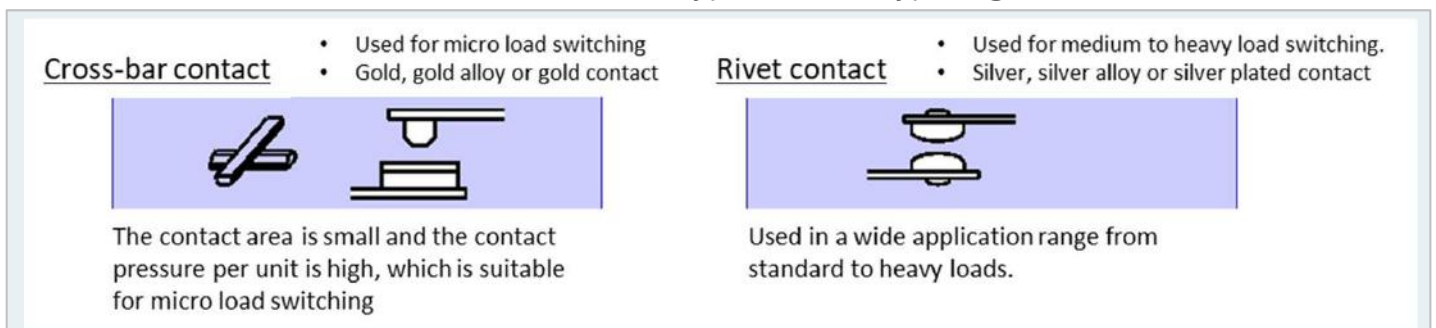


Figure5 ● Contact shape

#### (4) Terminals

Terminals connect the switch and the external circuit. There are several types of terminals for electrical connections including soldering terminals, tab terminals (quick-connect), screw terminals, and PCB terminals (Figure 6).

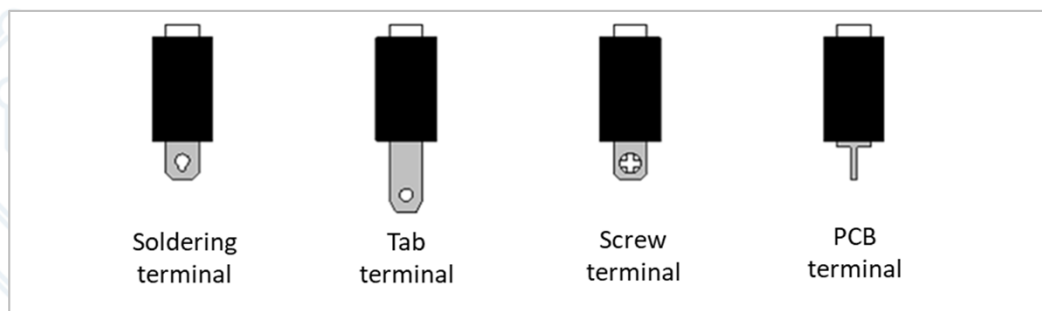


Figure6 ● Terminal shape

## Basics of Basic Switches

### General Knowledge of Basic Switches

#### (5) Switch case

A switch case protects the enclosed snap-action contact mechanism. There are two major materials for switch cases: recyclable thermoplastic resin and non-recyclable thermosetting resin. Thermoplastic resin is the most common material used, but in applications where high mechanical strength, heat resistance, and flame retardance are required, thermosetting resin is used.

It is crucial for the position detecting function of basic switch used in different applications to have durability (robustness) and failure-free (reliability). Omron has succeeded in reducing variations in operational characteristics by strictly controlling quality at every single stage in the production process.

Omron basic switches can be customized according to customer requirements and maintain high quality by guaranteeing high accuracy and high reliability based on our long-standing experience and achievements.

## Applications

### ■ Cover Detections of commercial equipment and industrial machinery

By using switches to detect that the door or cover is set correctly, the professional equipment / industrial machinery can be operated correctly and safely. By using a small size basic switch equipped with a highly flexible actuator, and adjusting the operating force and stroke, the movement of the door or cover in a limited space can be reliably detected.

### ■ Position detection of built-in parts of equipment requiring remote communication

For devices that automatically operate by remote control such as IOT devices, switches can detect that the built-in components are operating correctly, and prevent them from pinching and interference, enabling safe operation.

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