E-SWITCH®

ELECTROMECHANICAL SWITCHES

A COMPREHENSIVE GUIDE

An overview of essential
switch products and markets

e-switch.com


E-SWITCH®
WE WILL ALWAYS
DELIVER SELECTION,
SERVICE AND SPEED.
E-Switch, headquartered in Minneapolis, Minnesota, has been delivering quality electromechanical switches since 1979. Our mission, as the premier provider of integrated switch solutions, is to deliver exceptional customer service and simplify the process for engineers to select and source innovative solutions.
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ABSTRACT

This eBook offers insight into electromechanical switches: their history, what they've become, why they're so ever-present and how they've improved all the technologies and devices that have given us our modern way of life.

This eBook covers the wide range of switches now available for different applications. It shows how they share common features and benefits while also demonstrating why certain switch types are more likely to be integrated into specific products and markets.

Finally, it looks ahead to see how switch technology can overcome the technical and commercial challenges that engineers face to bring further levels of convenience, productivity and wellbeing into our daily lives.

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ENERGIZING INNOVATION

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INTRO/HISTORY

While rapid early progress in electrical science was made in the early 19th century by renowned names like Benjamin Franklin, André-Marie Ampère and Georg Ohm, the late 19th century would see incredible progress in electrical engineering with the likes of Thomas Edison, Alexander Graham Bell and Nikola Tesla helping turn electricity from a scientific curiosity into an essential tool for everyday life.

These advances, in turn, drove the need for new and different electromechanical switches due to the increasing complexity and sophistication of electrical systems. Electric pushbuttons would come on the market in the 1880s. In 1891, Almon Brown Strowger invented the first commercially successful, fully automatic rotary switch for use in telephone systems. In 1917, inventors William J. Newton and Morris Goldberg patented the design for the first toggle light switch.

As technology evolved, devices and components became smaller, more efficient and capable of handling higher power densities. In 1979, E-Switch began developing switches with enhanced durability and greater versatility. These innovations have proven crucial for applications ranging from consumer electronics to industrial automation and medical devices, where the reliability and performance of switches directly impacts the overall functionality and safety of the systems they control.

7 STEPS FOR SELECTING THE RIGHT SWITCH

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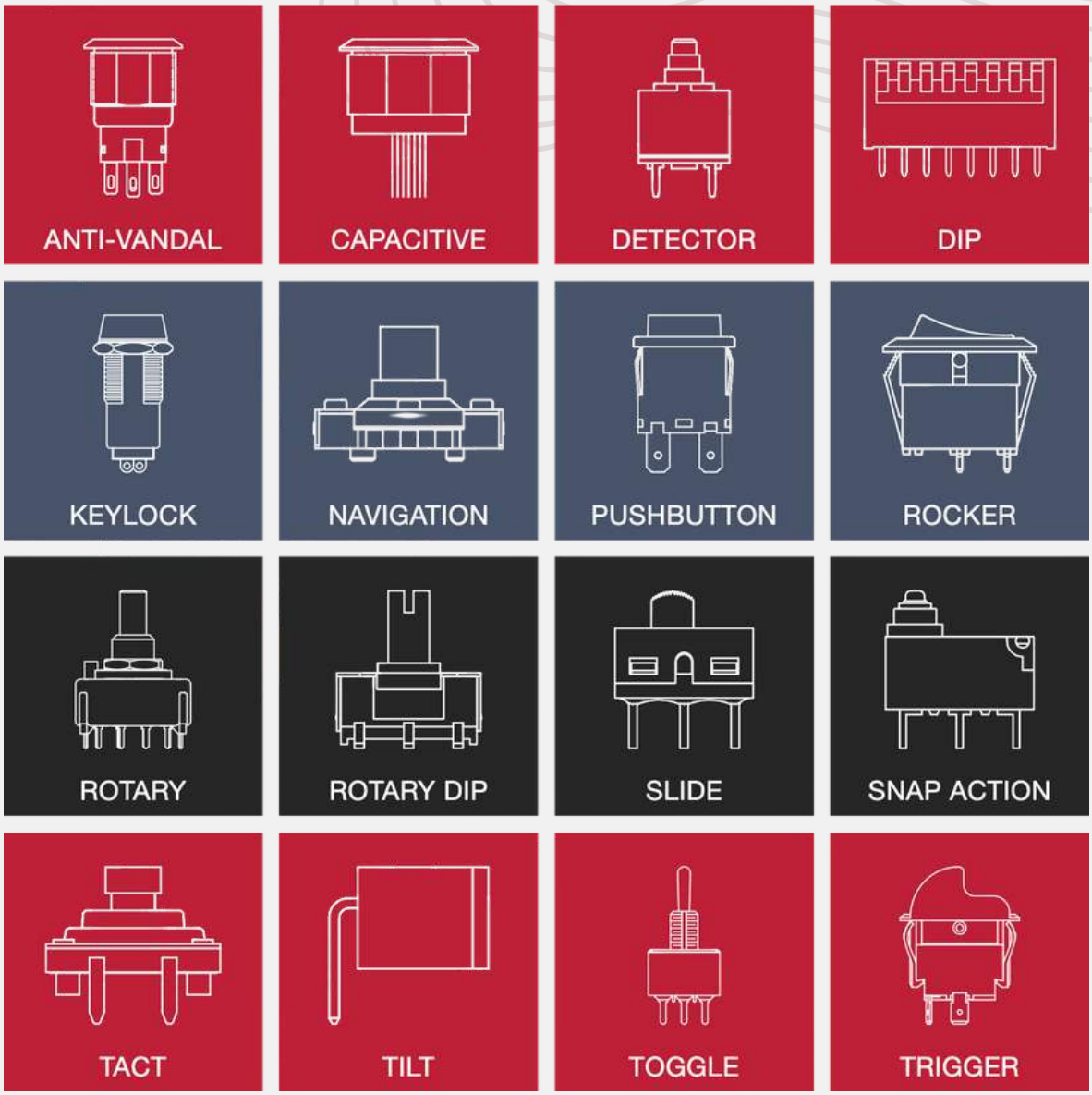
WHAT TYPE OF SWITCH ARE YOU LOOKING FOR?



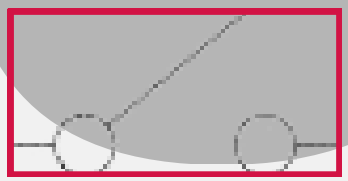
WHAT ELECTRICAL RATINGS ARE NEEDED?

1. **Is the product AC or DC?**
   - Common voltages for AC: 125VAC, 250VAC
   - Common voltages for DC: 3, 6, 12, 24 and 48VDC
2. **How many amperes does the switch need to handle?**
   - Low Power is in the milliamps
   - Medium Power is from 2 amps to 5 amps
   - High Power is greater than 6 amps
3. **If you're looking at medium to high power, what agency approvals are needed?**
   - Where the product is sold determines what approvals are needed

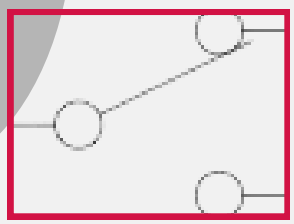
HOW MANY POLES & THROWS DO YOU NEED?

Poles are the number of closed independent circuits.
Throws are the number of positions in which a given pole is closed.

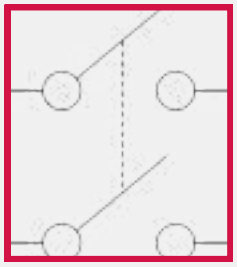
SPST
Single pole
Single throw



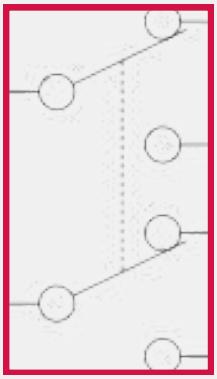
SPDT
Single pole
Double throw



DPST
Double pole
Single throw



DPDT
Double pole
Double throw



Basic examples

SPST - Flashlight: 1 pole for turning the light on/off
SPDT - Vacuum Cleaner: 1 pole for power, 1 throw for low speed, 1 throw for high speed

DPST - Air Conditioner: 1 pole controls the chiller, 1 pole controls the fan
DPDT - Hair Dryer: 1 pole controls the heater, 1 pole controls the fan, 1 throw is for low speed, 1 throw is for high speed

HOW DOES THE SWITCH ATTACH TO YOUR PRODUCT?

1. **Panel Mount**
   - What's the panel cutout size?
   - What's the thickness of the panel?
   - What type of termination?
   - Quick connect or solder lug?



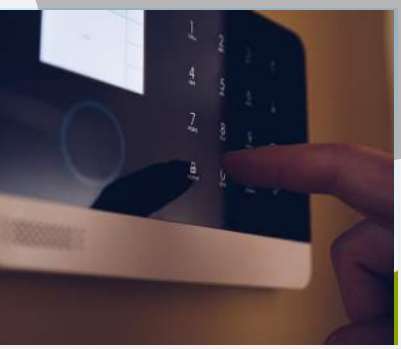
2. **PCB Mount**
   - What type of termination?
   - Through hole or surface mount?
   - What type of actuation?
   - Right angle or vertical?
   - Do you need a process sealed component?




WHAT IS YOUR APPLICATION?

Knowing the application that the switch goes into aids us in the ability to look for unique instances where certain switches work better than others.







ARE THERE ANY ADDITIONAL REQUIREMENTS?

Many products have requirements that are not initially thought of. Some might make the switch more aesthetically pleasing and others will help the switch perform better under special circumstances.

- Momentary or Latching
- Illumination
- Sealed Protection (IP Rating)
- Custom Cap Options
  - Colors
  - Graphics
  - Styles
- Long Life Expectancy
- High Inrush or Horse Power Rating
- Extreme Temperature Rating
- Custom User Requirements

WHAT'S THE ESTIMATED ANNUAL USAGE (EAU)?

If you're looking for a custom switch, it's important to know an accurate EAU for your project. Once we know, we're able to determine how feasible certain customizations are.

Since unique requirements sometimes incur additional tooling charges, knowing in the beginning will help expedite the process.

ENERGIZING INNOVATION

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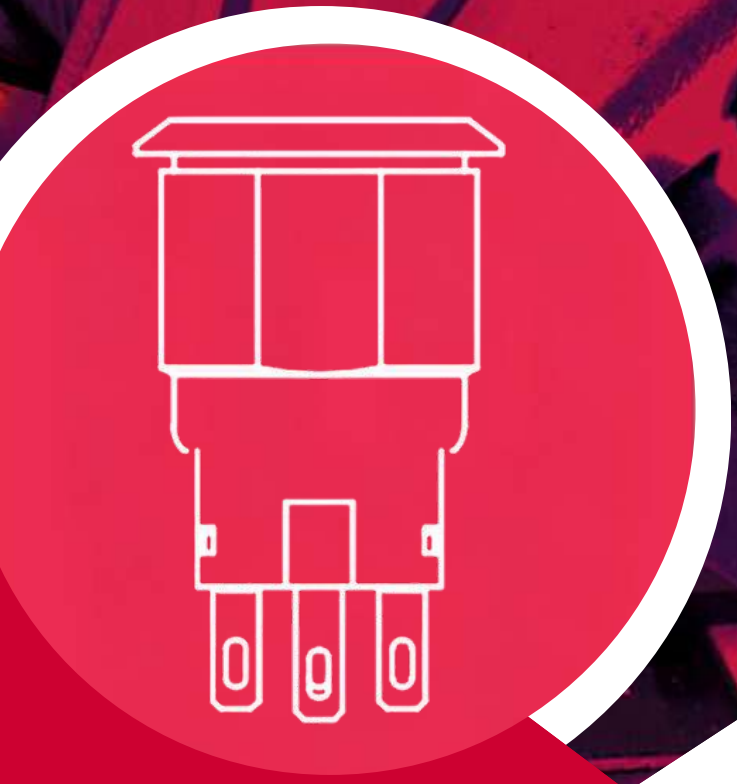
SWITCH TYPES:
ANTI-VANDAL



- Tamper Resistant
- IP65, IP67 Ratings
- 6mm to 40mm diameter
- Multi-Illumination Options
- Wire Leads Available

- Durability and long-life expectancy for high security locations and industrial-use environments.
- LED illumination potential, including bi-color and RGB.

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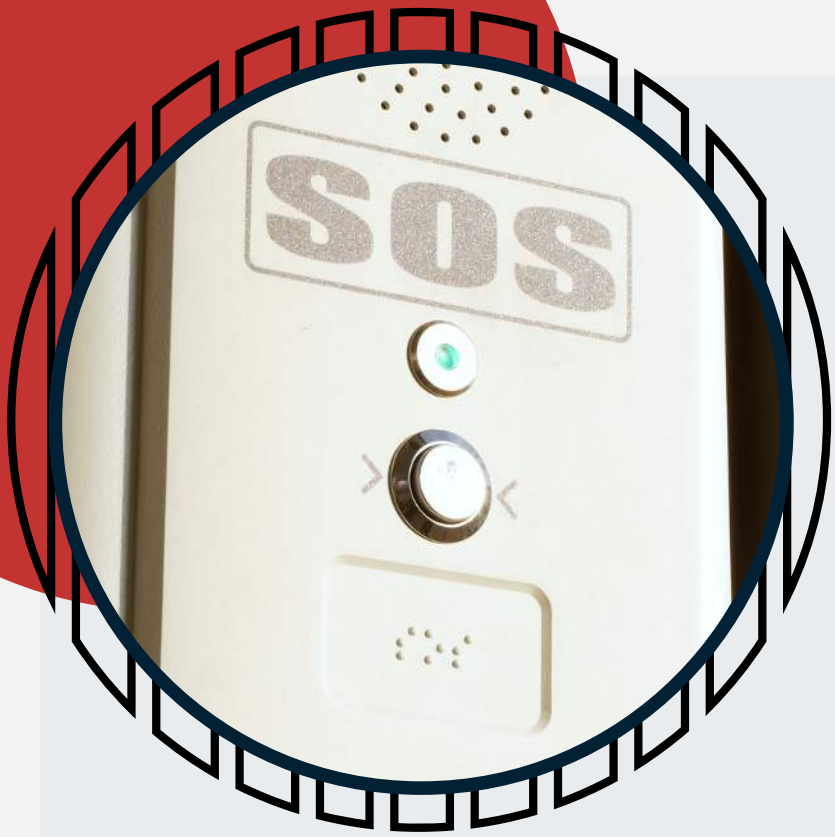

PVHC4

ULV8

PV0

PV7

PZ4

ANTI-VANDAL SWITCHES

Our PV Series ranges from a 12mm panel cutout (PV0) all the way to a cutout sized 40mm in diameter (PV10). These are IP67-rated anti-vandals come with long life expectancies, comprehensive illumination choices and various terminal options, including solder lug, wire leads, molded boot and a detachable socket. Our UL-certified ULV Series also features the same variety of terminal options to save you time and money by eliminating the need to second-source wire leads and assembly.

If you're looking for a power rated anti-vandal, our recently released PVHC4 and PVHC7 Series are high-current switches rated for 20A @ 250VAC and 25A @ 30VDC. We've also recently expanded our PZ Series of piezoelectric (momentary pulse function) switches to include three different sized cutout options.

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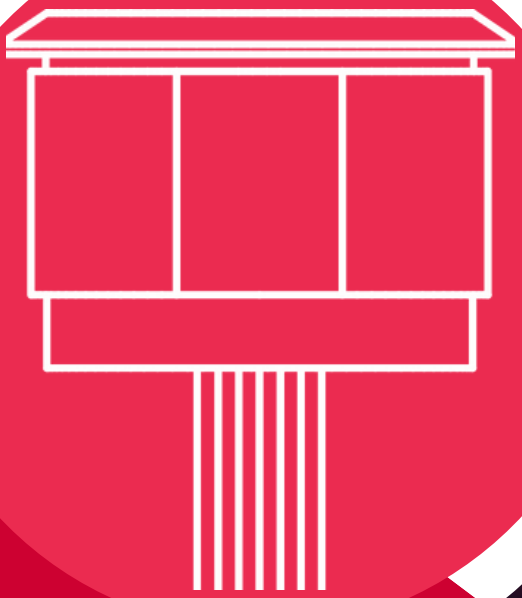
SWITCH TYPES:
CAPACITIVE



- Detects touch or proximity by measuring changes in capacitance, which is the measure of a system's ability to store an electric charge.

Touch Sensor Technology

19mm or 22mm Panel Cutout

Lens Illumination Styles

Wire Leads Available

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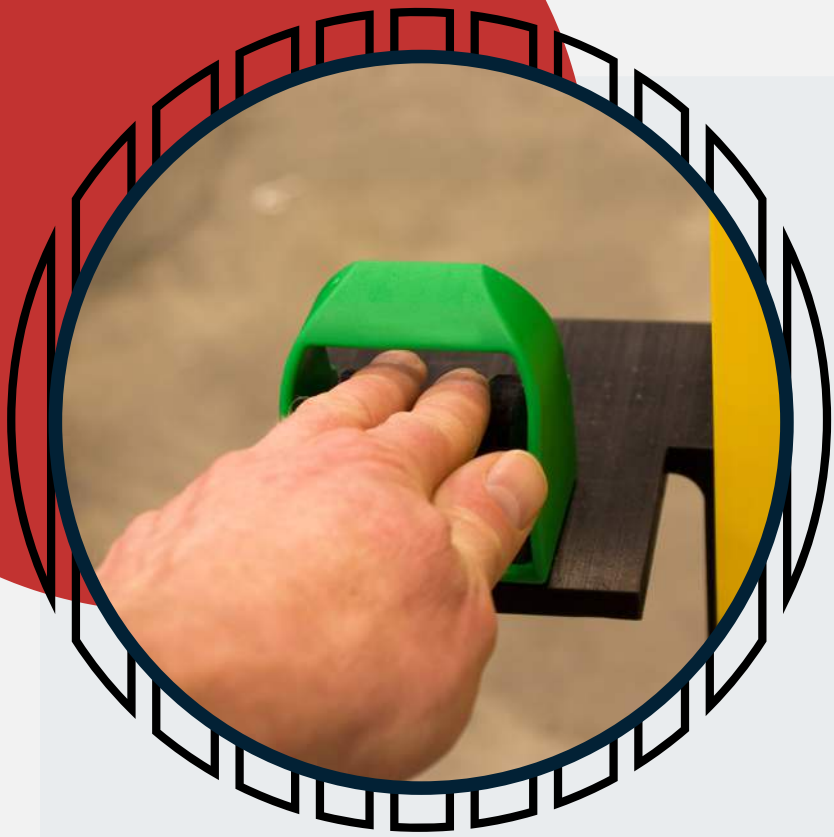
CS



CS

CS

CAPACITIVE SWITCHES

Capacitive touch switches are commonly used in various electronic devices and applications, including smartphones, tablets, touch-sensitive control panels and displays, laptops and computers, automotive interfaces, gaming consoles, home automation systems, industrial controls, medical devices and public spaces.

These applications showcase the versatility of touch switches in providing intuitive and responsive user interfaces across a wide range of electronic devices and industries. Since capacitive touch switches have no physical moving parts, they're more durable and longer lasting than mechanical switches.

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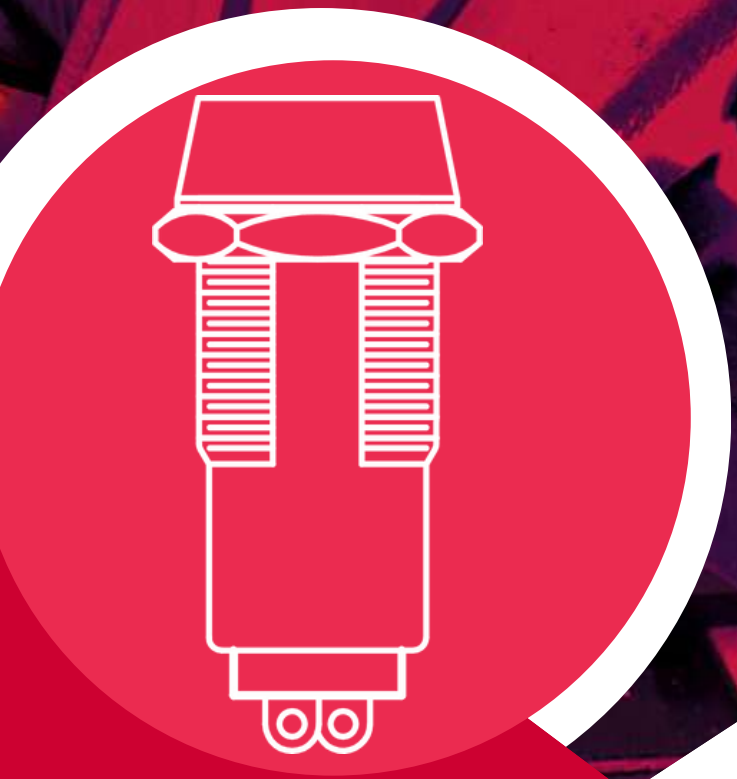
SWITCH TYPES: KEYLOCK



- Used to control access to electrical devices or systems. They offer a physical barrier to prevent casual or unauthorized operation of equipment. The switch typically has multiple positions or modes.

Variety of Key Types and Pulls

From 1 to 5,000 Unique Key Codes

Up to 4A, 125 Electrical Rating

Illuminated Selector Option

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PVK4

KO

PVK4

KEYLOCK SWITCHES

E-Switch offers both the KO Series and PVK4 Series for keylock products. The KO Series is highly customizable with a variety of size and product package selections for your application. You can choose between barrel or flat key options, as well as a variety of key types and key pulls. You can have anywhere from one to 5,000 key codes (the uniqueness of the key), dependent on the series. They have an electrical rating of up to 4A @ 125VAC and a panel mount design.

The PVK4 Series fits a 19mm cutout, and the selector actuator is rated IP65 for dust and moisture protection while the keylock actuator option is rated IP40. The selector arrow can be illuminated with many LED color and illumination voltage options.

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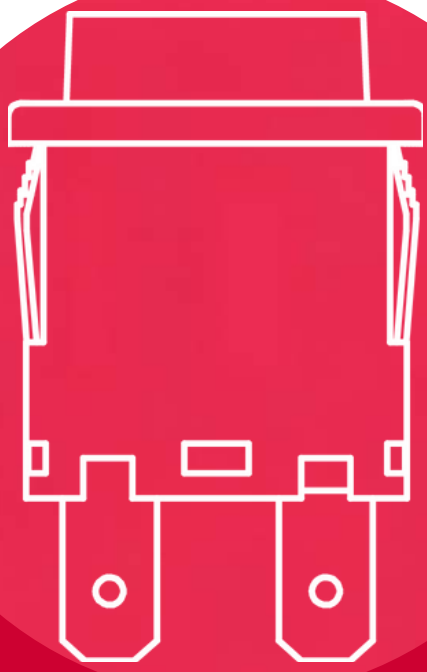
SWITCH TYPES:
PUSHBUTTON



- From miniature size with low current ratings to industrial-use with horsepower ratings.
- Shape options include square, round, oval and rectangle while some offer caps.

Industry leading selection

NEW: Emergency Stops

Multi-Illumination Options

Extensive Termination Options

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RP8100

TL2201

PB300

PA4

E100

PUSHBUTTON SWITCHES

Pushbuttons are ever-present in our daily lives, and there's a good chance you've interacted with our RP8100 Series — it's a round, SPST, LED illuminated switch with an IP67 rating and a threaded or snap-in panel mount design, along with a pre-wired option. The TL2201 Series is a great example of a popular subminiature pushbutton switch with DPDT or 4PDT functionality.

We also have heavy duty, industrial power pushbutton switches like the PA4 Series, which is rated for up to 16A (UL, cUL certified) and comes with customizable illumination, marking and terminal options.

The latest introduction to the pushbutton category is our new emergency stop switches, the E100 and E200 Series.

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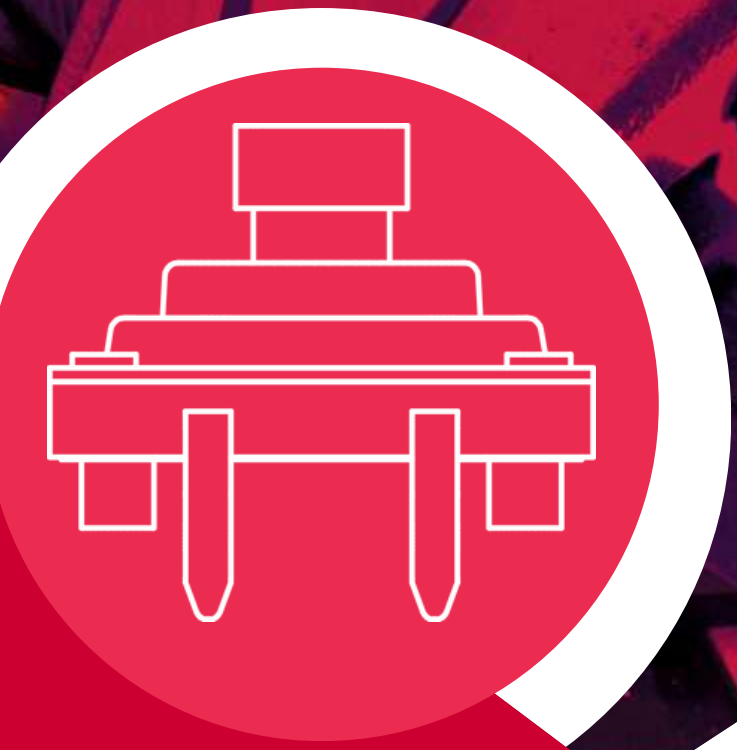
SWITCH TYPES:
TACTILE



- From Miniature to 12.4mm Square
- Extremely Low Profiles
- Wide Range of Styles and Shapes
- SMT, Through Hole and Right Angle

- Reliability, long operation and compact size make them ideal for wearable tech, handheld devices and printed circuit boards (PCB).
- Numerous styles: Illuminated, non-illuminated, caps, round, square, rectangle and oval.

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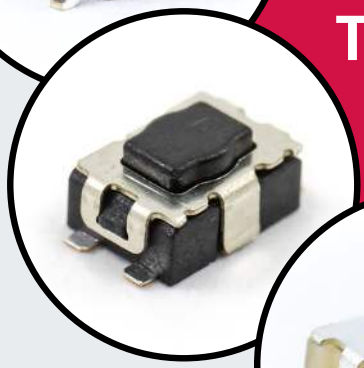
TL3315

TL3340

TL3301

TL6330

TL1015



TACTILE SWITCHES

Here at E-Switch, we've made our name in the tactile switch product category. Currently, we boast 75 unique tact product series (each with their own styles, dimensions, benefits and features) for use in application designs.

Think of any size (ultraminiature, low profile, etc.), any mounting option (SMT, right angle, reverse through hole, etc.) and any unique product feature (operating temperature range, operating force options, long life cycles, etc.) and you'll be sure to find the appropriate tactile switch for your project within our complete product catalog.

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SWITCH TYPES: ROCKER

- Miniature to Industrial Size
- Low Current to High Power Ratings
- Multi-Illumination Options
- Extensive Termination Choices

- **Known for their intuitive ease of use, tactile feedback and wide range of application. Rockers come in different sizes, colors, styles and possess robust durability and reliability.**

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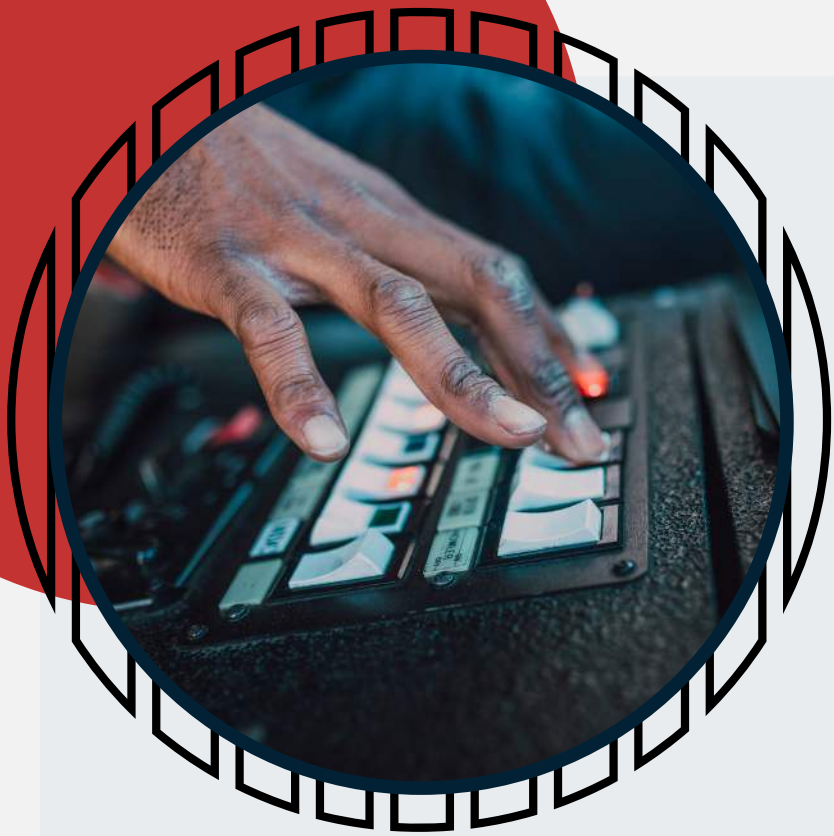

300

WB2

R1966

RBW2

RB5

ROCKER SWITCHES

Sealed miniature, subminiature and ultra-miniature products meant for either panel mount or compact PC mount installation. Other options include illumination, custom actuator markings (bi-color as well), slim actuators, power rocker switches and PVC caps for protection against water and dust in harsh environments.

The versatility and customization offered by our rocker switches is best exemplified by the recent release of the RB3 and RB5 Series sealed, illuminated power rocker switches. They both feature an IP67 rating and are certified to handle up to 25A. They can feature single or double-illumination (various colors and voltages to pick from), eight different actuator markings and multiple actuator and housing colors.

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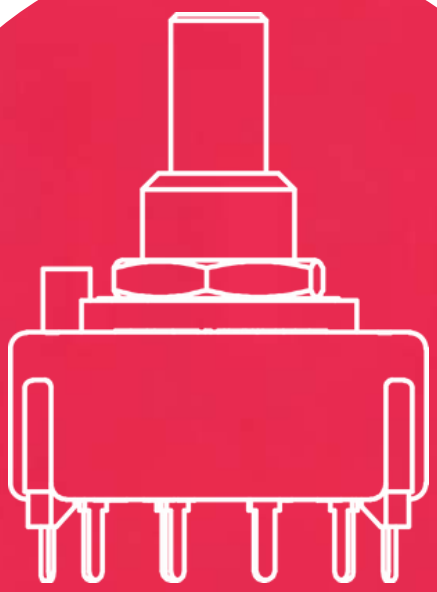
SWITCH TYPES: ROTARY



- Uses a rotating mechanism to select one of several positions or settings. Commonly used to control and configure circuits in a wide range of applications.

Up to 4 Poles and 12 Positions

Through Hole and Solder Lug

Shorting or Non-Shorting

Actuator Style, Length Options

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KC

KC

KC1901

KC

ROTARY SWITCHES

The KC Series features anywhere up to four poles and 12 positions with no stop option. It can be configured as non-shorting break-before-make (BBM) or shorting make-before-break (MBB). You can select a flat, round or slotted actuator while customizing the length. The switch has a panel mount or through hole mounting design.

The KC1901 Series has a through hole mounting design and SP9T (single pole, nine positions) functionality with positive detents. The switch has only 9.8mm height off the PCB and a length of 12.40mm.

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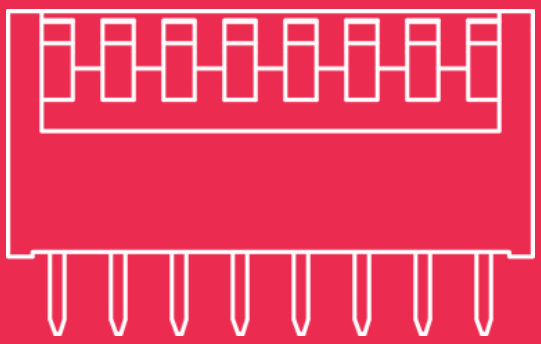
SWITCH TYPES:
DIP/ROTARY DIP



- From 1-16 Positions
- Simple, Flexible, Low Cost
- Easily Customizable Configuarations
- Ability to Quickly Change Positions

- A set of electrical switches packaged in small housing, allowing a range of inputs to a device based on the position of the individual switches within the line or circle.

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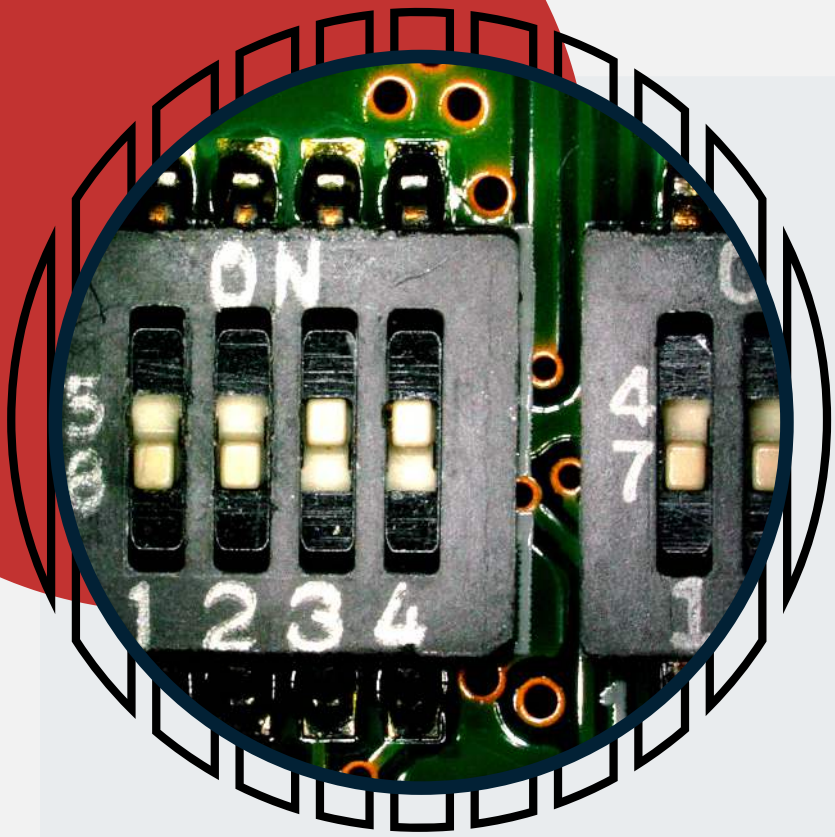
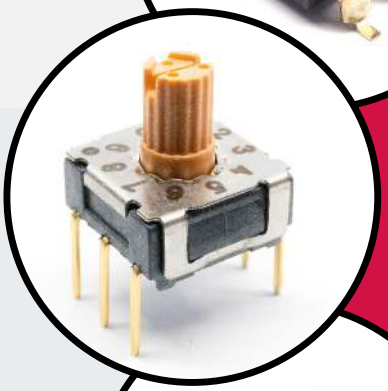


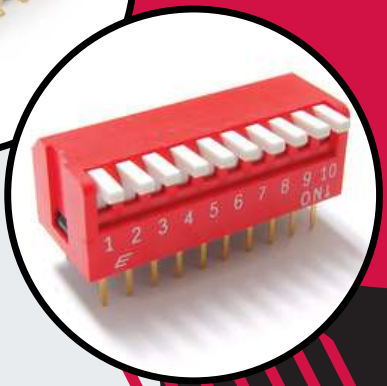
KAG



RDM

KAE

KAP



DIP/ROTARY DIP SWITCHES

Our selection of DIP switches includes products with slide, piano and rotary actuators. The slide actuators are low profile, feature from one to 12 positions, gold contacts and include tri-state and half pitch options. Actuators can also come extended, recessed and with a tape seal.

Rotary DIPs are used in situations where manual configuration is necessary, and the binary-coded positions allow for a straightforward way to set various options in circuits. E-Switch rotary DIPs include up to 16 positions, PCB termination and IP67 ratings.

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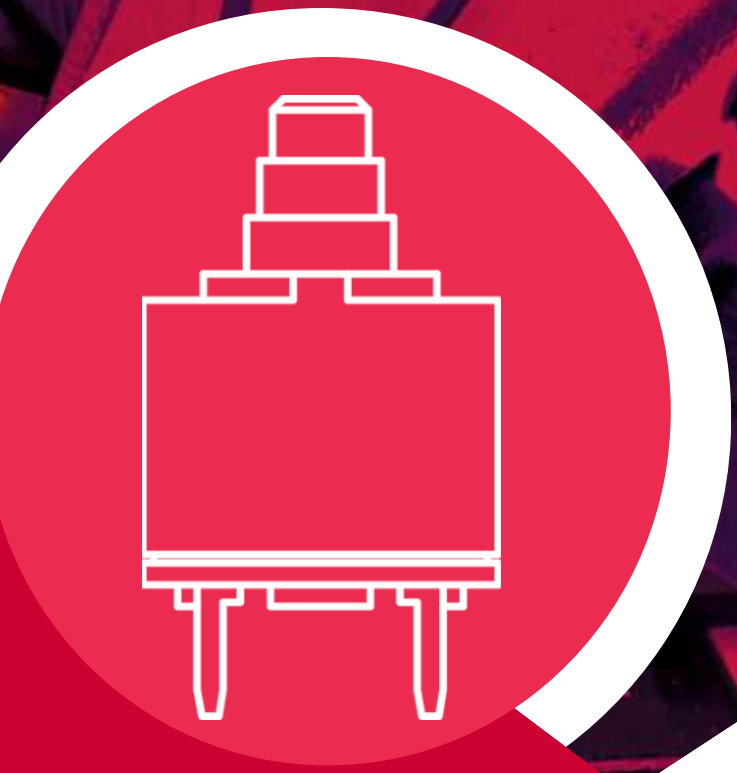
SWITCH TYPES: DETECTOR



- Limit and Reed Type Switches
- Long Life and Sealed Options
- Subminiature and Ultraminiature
- Variety of Termination Types

- Commonly employed in various applications where the detection of a specific state or object is necessary, such as industrial automation, security systems and electronic devices.

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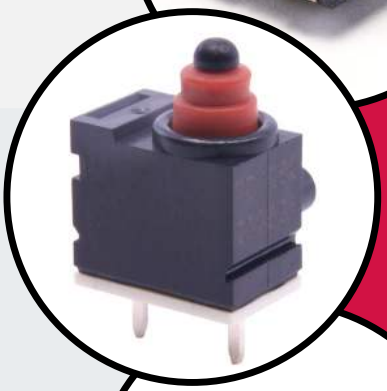
TD1146



TD1250

MR1000

PP1

DETECTOR SWITCHES

The specific operation of a detector switch depends on its type and technology. For example, in a limit switch, the movement of an actuator might physically open or close electrical contacts.

E-Switch has one of the largest selection of detector switches on the market with the following lineup: the 900 Series (subminiature, SMT right angle), MR1000 Series (recessed magnetic/reed type), PP1 Series (push-pull, UL approved up to 16A and 1HP), PP2 Series (push-pull, UL approved up to 16A and 1HP), TD1146 Series (SMT, ultra-miniature), TD1150 Series (IP67, through hole), TD1250 Series (long life, IP67) and TD4700 Series (ultra-miniature, SMT).

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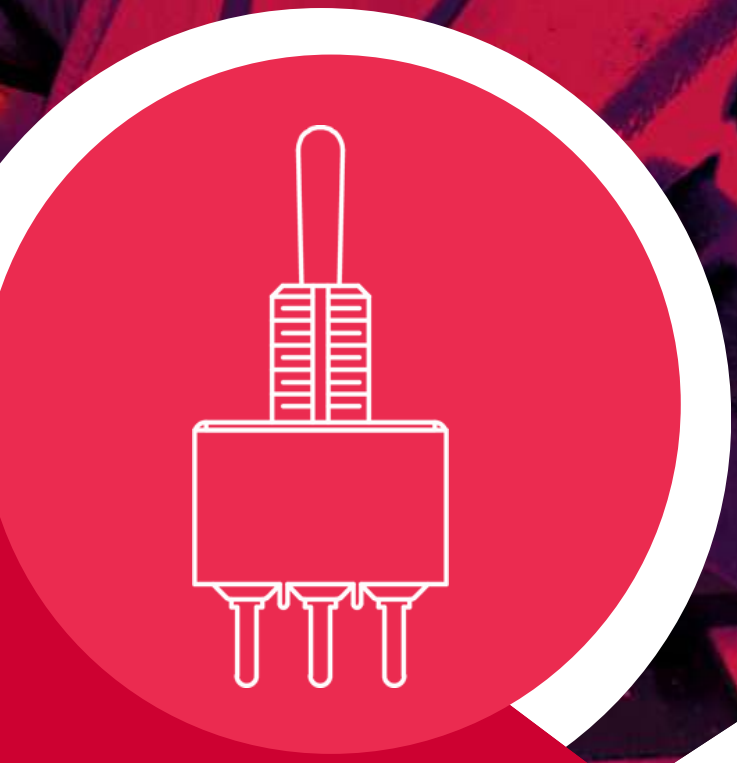
SWITCH TYPES: TOGGLE



- Characterized by the presence of a manually operated lever which controls the flow of electrical current from the power supply to a device.

Miniature to High Power

Mounting, Actuator, Bushing Choices

Durable and Cost-Effective

Versatile Functionality

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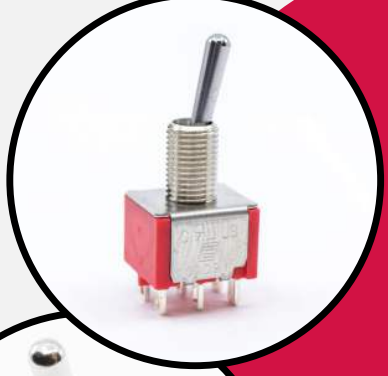
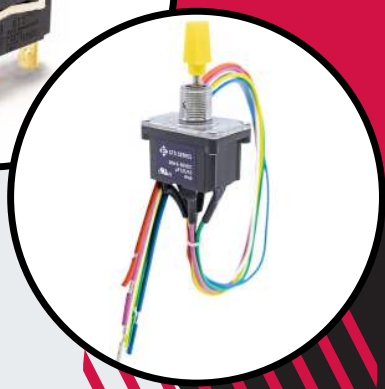


100

200A

ST1

ST5



TOGGLE SWITCHES

E-Switch offers toggle switches with multiple features and benefits, such as different actuator, bushing and terminal options. There are selections for low to high current ratings, as well as some toggle switches with horsepower ratings for industrial applications.

One of our most popular products is the highly versatile 100 Series. It's a miniature toggle featuring up to four poles, 17 types of mounting options, 11 actuator choices and 15 different bushing selections.

If you're looking for something with more power, our ST1 Series is a high-current toggle switch rated for up to 20 amps, along with the required agency approvals. Like all of our panel mount products, the ST1 Series is available pre-wired.

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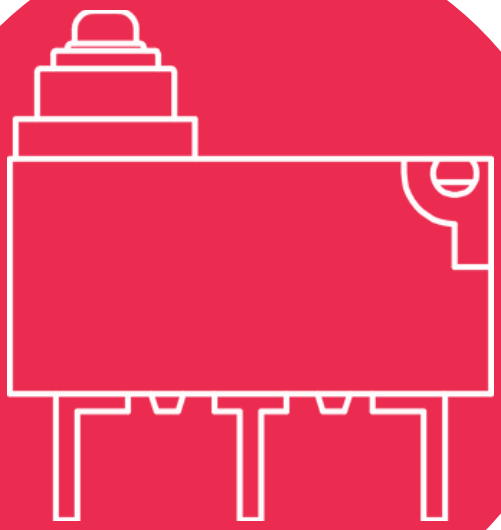
SWITCH TYPES:
SNAP ACTION



- Require little pressure to operate, feature a rapid and decisive switch action and produce a sharp "snap" sound when actuated. Also referred to as “micro switches.”

Quick, Reliable Switching

Simple, Flexible, Low Cost

Compact Design, Small Footprint

Sealed, UL Power Ratings

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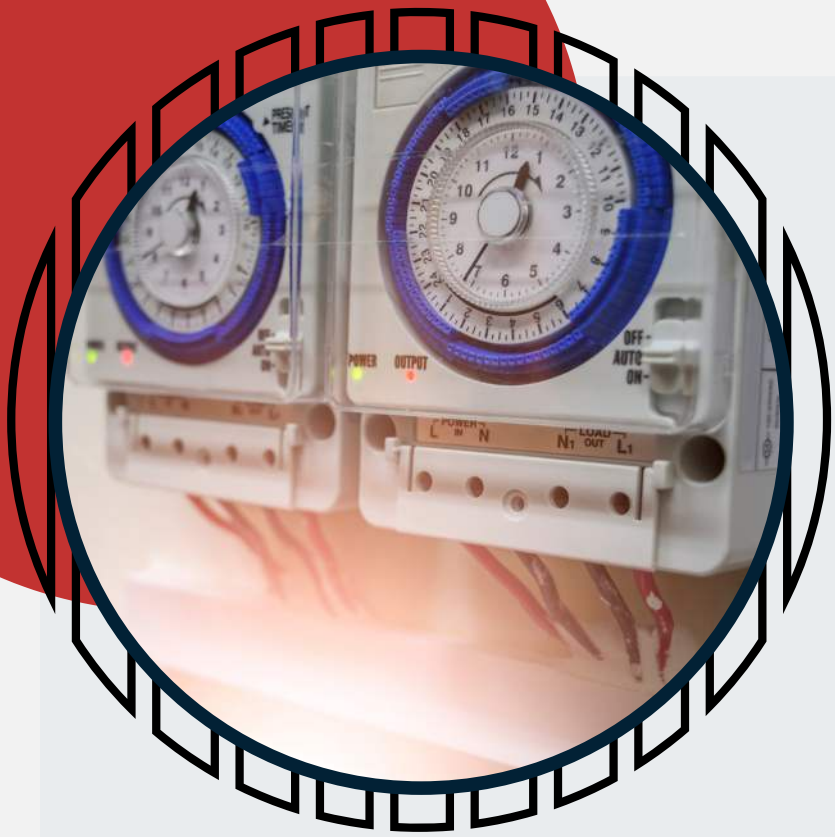

LS

MS

TS

SS

SNAP ACTION SWITCHES

Snap action switches provide a long life expectancy, numerous operating force options, exact precision and the ability to provide tactile feedback, which is important for user interaction and control in critical situations.

Reliability and dependability make these switches ideal for countertop appliances, the automotive industry, timer controls, medical devices, vending machines, electronics and robotics, aerospace, gaming devices, power tools, HVAC systems and industrial equipment.

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SWITCH TYPES:
SLIDE

- Intuitive, reliable components commonly used to turn devices on or off, select different operating modes or activate specific functions by moving a slider from position to position in a linear direction.

Multiple Positions, Terminations

Simple, Flexible, Low Cost

Compact Design, Small Footprint

SMT, Thru Hole Right Angle

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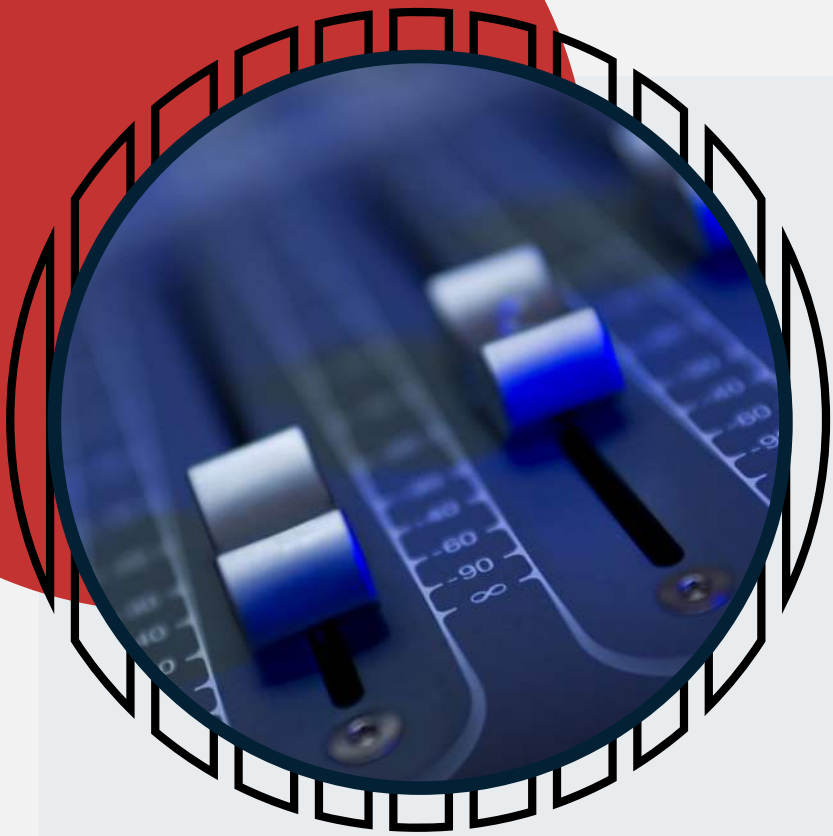

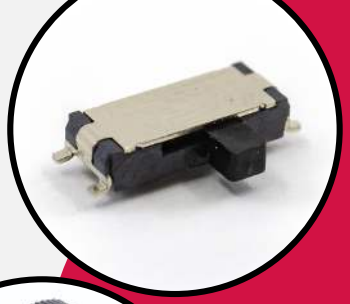

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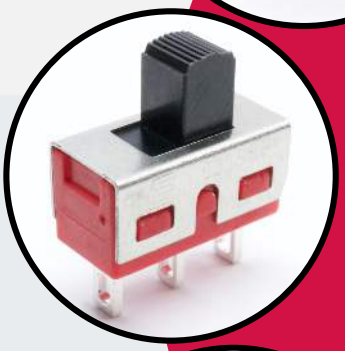
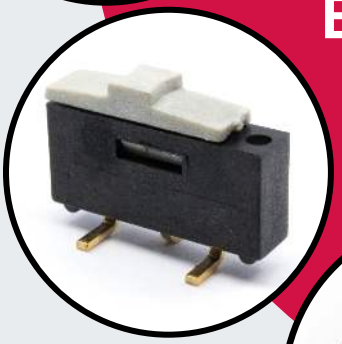


500

EGJ1210



600

SLIDE SWITCHES

E-Switch offers a wide selection of slide switches which provide engineers and product designers many choices regarding size (miniature options, short travel), function (SPST, SPDT, DPST, DPDT) and termination styles (SMT, PCB, panel, right angle).

Reliability and dependability make these switches ideal for consumer electronics (flashlights, remote controls, toys, radios), electronic appliances (kitchen products) and electrical equipment.

E-SWITCH®

SWITCH TYPES:
NAVIGATION

- 5-Position, 4-Way Direction
- Surface Mount Applications
- Compact Design, Small Footprint
- Long Life Expectancy

- Designed for applications that require regular user interface. Used for navigating through menus, options or interfaces on devices; provide users with an intuitive and tactile way to interact.

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JS1300

JS5208

JS1400

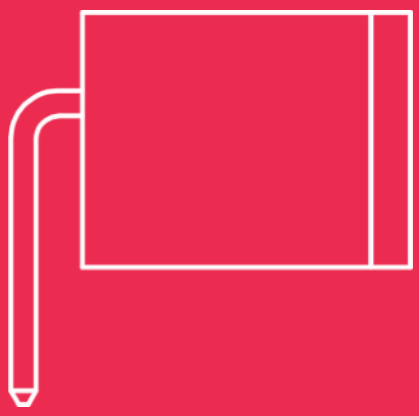
NAVIGATION SWITCHES

Navigation switches work by translating physical movements into electrical signals that can be interpreted by electronic devices. They can be found on gaming controllers, digital cameras or most consumer electronics that require any kind of navigational control, like smartphones, tablets, remote controls and control panels.

The JS1300 is a long life switch with very low surface mount, making it a great choice for applications with limited space. The JS1400 is even smaller and features options for actuator size and termination. The JS5208 is larger (12.4mm x 12.4mm) for applications that require precise, user friendly navigation.

E-SWITCH®

SWITCH TYPES:
TILT



- Miniature PCB Design
- Triggered when Tilted 45 Degrees
- 1,000,000-Cycle Life Expectancy
- Environmentally Friendly

- **Type of sensor that detects changes in orientation or tilt and then triggers actions, like making or breaking a connection, in response to the object's position.**

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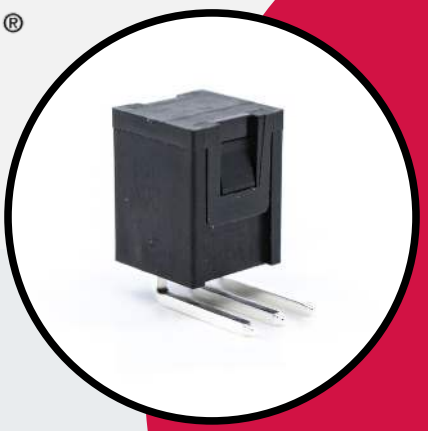
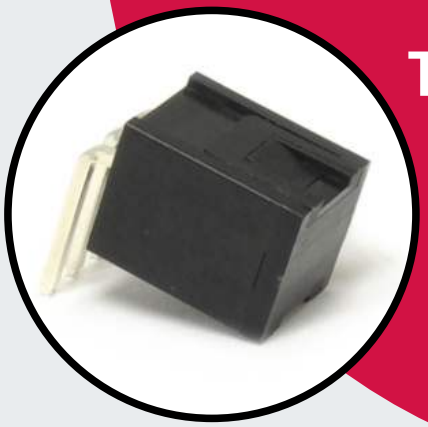


TM1000



TM1000

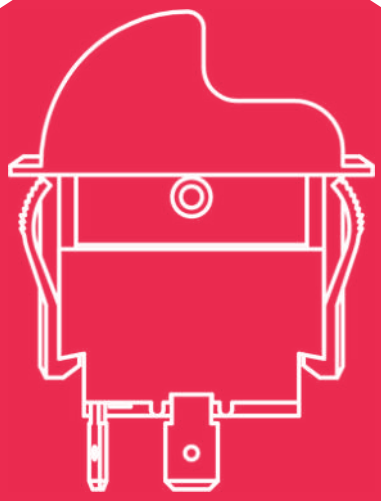
TILT SWITCHES

The TM1000 Series tilt switch is triggered when tilted 45 degrees of the horizontal and boasts an impressive 1,000,000-cycle life expectancy. While many tilt switches use mercury, the TM1000 is environmentally friendly and mercury-free.

The switch has silver contacts, SPST functionality, an electrical rating of 20mA @ 20V(AC or DC) and a robust operating temperature of -25°C to +70°C.

E-SWITCH®

SWITCH TYPES: TRIGGER



- Designed to be actuated by a trigger-like mechanism. Commonly used in various devices where a quick, manual momentary activation or deactivation of a function is required.

Custom Designs

Multiple Sizes and Body Styles

Custom Caps Available

Work with an Engineer Today

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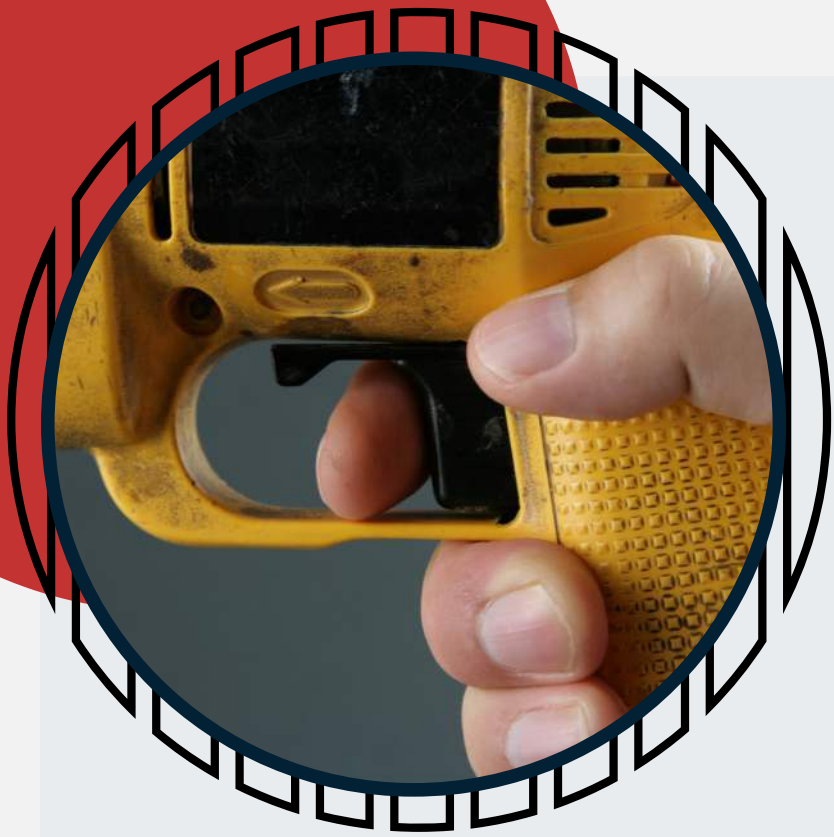
E-SWITCH®

HY55



HY15

HY37

TRIGGER SWITCHES

E-Switch offers a variety of trigger switches for any application. Because each project has specific requirements, almost every trigger switch is a custom design. Many custom caps, sizes and body styles are available to choose from.

Contact a customer service representative or regional sales manager to get your project started today.

E-SWITCH®

SWITCH TYPES: CAPS

- Sealed Solutions
- Standard and Custom Colors
- Custom Caps Available
- NEW: Sports Caps

- E-Switch offers many caps (color, shape, mounting style) to provide extra durability and sealed ratings to its lineup of switch products.

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TAG

2J

SPORTS

CAPS

E-Switch offers a variety of caps for supported switch types. Caps can add extra protection against harsh environments and use, while also potentially making desired adjustments to the sound and feel of the switch actuator.

E-Switch has also recently launched sports caps. These distinctive switch caps offer five different sports to celebrate — soccer, golf, baseball, tennis or basketball — and each comes with a uniquely illuminated LED dot that's viewable through a small window on the lens.

GLOSSARY/IP CHART

Actuator: The mechanical interface between the basic switch contacts and the means of operation, such as the operator's finger.
Actuation Force: The required force to change a circuit's electrical state.
Alternate Action Switch: A pushbutton style switch where the change of the electrical state is maintained between actuations.
Ampere: A unit of electrical current flow.
Base (Housing): A base of a switch is the main member to which the conducting parts or insulator unit are attached. It may also have parts of the operating or control mechanism attached.
Bounce: Rebounding of moving contact against fixed contact during transfer.
Break: Interruption of a circuit.
Double-Break: Occurs when a single mechanism interrupts two contacts simultaneously.
Break Before Make: The term given to a double throw circuit where the first circuit is opened before the second circuit is closed.
Capacity: Usually refers to the current handling capability of a switch.
Chatter: Rapid opening and closing of contacts, usually exhibited during extreme vibration and/or shock.
Clearance (Spacing): Distance through air between electrically live parts of opposite polarity or to ground.
Contact: The contact is a conducting part designed to be united by pressure to another conducting part for the purpose of carrying current.
Contact Bounce: Oscillation of the movable contact upon closure of the circuit.
Contact Gap: The minimum distance between the fixed and moveable contacts.
Contact Resistance: The resistance of current flow across closed contacts.
Dead-Break: Open circuit condition, usually caused when slowly actuating snap-action switches. Results from low contact pressure or contact lift-off.
Detent: Feature that indicates actuation point has been reached. Can also be referred to as tactile feel.
Dielectric Strength: The ability of an insulating material to resist voltage from arcing across its surface.
Differential: Distance between trip point (or force) and reset point (or force).
Double-Break: A mechanism that breaks the circuit at two points simultaneously by means of a "shorting bar" like device.
Double-Throw: Contact arrangement that alternately transfers normally open and normally closed circuits.
Dust-Tight: Sealed switch that will withstand sand and dust contamination.
Electrical Life: Expected cycle life when switch is operated at fully rated electrical load.
Free Position: Point at which plunger exists in the un-operated condition.
Insulation Resistance: The resistance to current flow of the insulating materials between contacts.
Lever Actuator: A device, hinged or spring type, applied to a basic switch to facilitate its application.
Make Before Break: The term given to a double throw circuit when the second circuit is closed before the first circuit is opened.
Momentary Action Switch: The term given to a switch where a circuit is continuously closed or opened only when force is applied. The electrical state returns to its normal position when the force is removed.
Normally Closed: The term given to a switch where a circuit is closed in the normal switch position.
Normally Open: The term given to a switch where a circuit is open in the normal switch position.
Operating Point: Point at which contacts transfer. Usually measured from the switch mounting holes.
Over Travel: The distance an actuator travels after the circuit is closed.
Pole: The term to denote a completely separate circuit, which passes through a switch at one time.
Pre-Travel: The movement of the actuator prior to closing the circuit. Sometimes identical to "Travel to Make."
Reset Point: Point at which contact resumes normal position.
Single-Break: Mechanism that transfers one contact.
Single Throw Switch: The circuit can be opened or closed by moving the switch blade into or out of one set of contacts only.

Snap Action: The abrupt transfer of contacts from one position to another. This action is relatively independent of the speed of actuator travel.
Splash Proof: Sealed switch that will withstand heavy rain or a stream of water.
Switch: A device for making, breaking or changing the connections in an electric circuit.
Throw: The term denotes the number of positions in which a given pole is closed.
Travel to Make: The distance parallel to the designated direction of the actuator movement at which point a circuit is closed.
Watertight: Sealed switch that will withstand submersion to various depths depending on specification level.
Wiping Action: Lateral travel of movable contact over fixed contact while pressure between the two contacts exists. Occurs during plunger travel. This action helps clean the contacts of contamination.

Switch Abbreviations

N.C.: Normally Closed circuit **N.O.:** Normally Open circuit
SPST: Single Pole Single Throw **SPDT:** Single Pole Double Throw
DPST: Double Pole Single Throw **DPDT:** Double Pole Double Throw
MBB: Make Before Break **BBM:** Break Before Make

IP Rating Chart

First Number	Definition	Second Number	Definition
Protection against solid objects		*Protection against liquids*	
0	No protection	0	No protection
1	Protected against solid objects over 50mm (e.g. accidental touch by hands)	1	Protected against vertically falling drops of water
2	Protected against solid objects over 12mm (e.g. fingers)	2	Protected against direct sprays up to 15° from the vertical
3	Protected against solid objects over 2.5mm (e.g. tools and wires)	3	Protected against direct sprays up to 60° from vertical
4	Protected against solid objects over 1mm (e.g. tools, wires and small wires)	4	Protected against sprays from all directions - limited ingress permitted
5	Protected against dust - limited ingress (no harmful deposit)	5	Protected against low pressure jets if water from all directions - limited ingress permitted
6	Totally protected against dust	6	Protected against strong jets of water (e.g. for use on shipdecks - limited ingress permitted)
		7	Protected against the effects of temporary immersion between 15cm and 1m. Duration of test 30 min.
		8	Protected against long periods of immersion under pressure

E-SWITCH®

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