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PRODUCT TRAINING MODULE ▶▶▶

POWER SWITCHES

# INTRODUCTION

## **Purpose:**

To teach the customer about power switches and all their features and functions, and to display the variety of power switches E-Switch offers.

## **Objectives:**

- What defines a power switch
- Resistive and inductive loads
- Most common poles and throws
- Environmental ratings and agency approvals
- Illumination and termination options
- Temperature range and life cycles
- Summary of our most common power switches



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# WHAT IS A POWER SWITCH?

**Definition:** A switch with a range between 48 and 277 volts.

## Three Power Levels



- **Low Power:** Switching less than 2 amps at rated voltage



- **Medium Power:** Switching above 2 amps and less than 10 amps at rated voltage



- **High Power:** Switching above 10 amps at rated voltage



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# POWER SWITCH LISTING BY CATEGORY



**Pushbutton**



**Rocker**



**Rotary**



**Slide**



**Snap Action**



**Toggle**



**Trigger**



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# LOADS



**Resistive Loads**



**Inductive Loads (Inrush)**



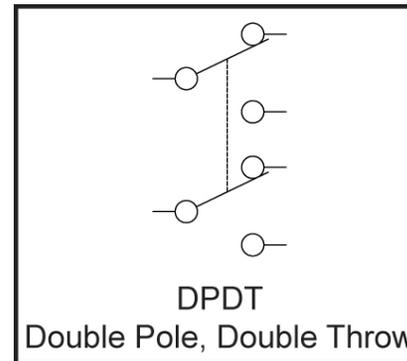
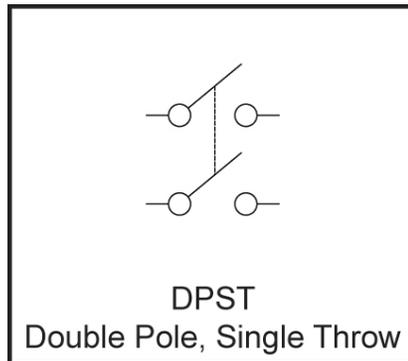
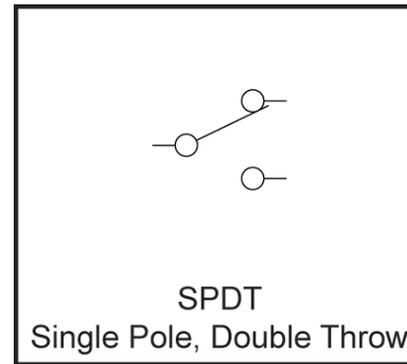
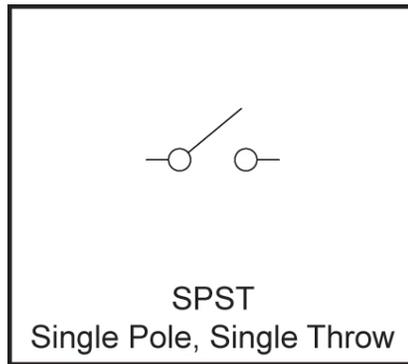
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# POLES AND THROWS

## Most common functions



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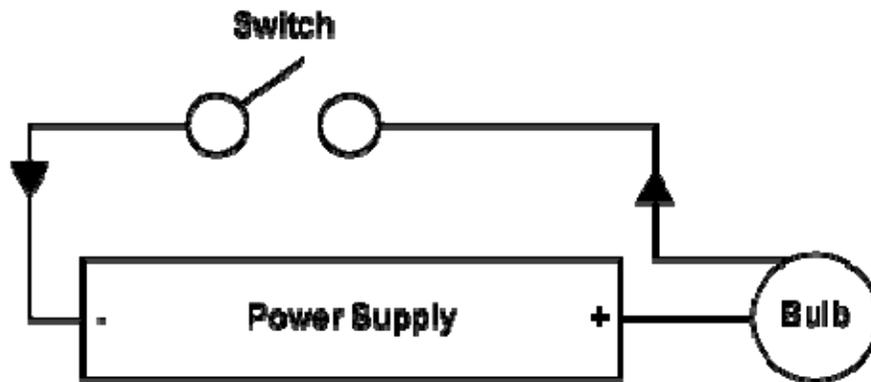
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# Single Pole Single Throw (SPST)

## Example: On-Off (SPST)

- When the switch is actuated, the circuit is complete, and the bulb will turn on.



Flashlight



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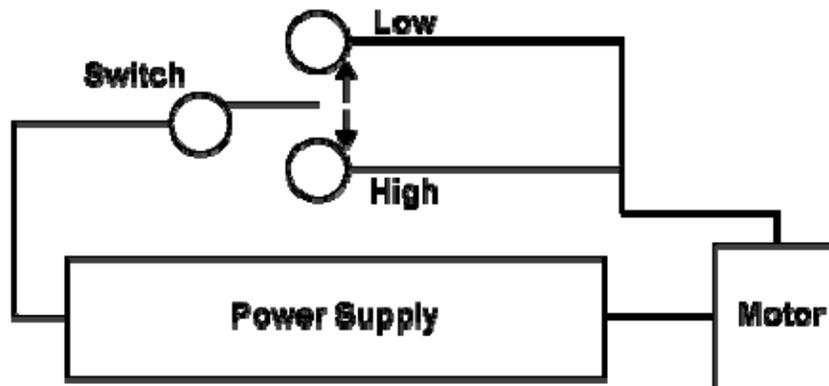
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# Single Pole Double Throw (SPDT)

## Example: On-Off-On (SPDT)

- The user decides what power setting to turn the vacuum to, either low or high.



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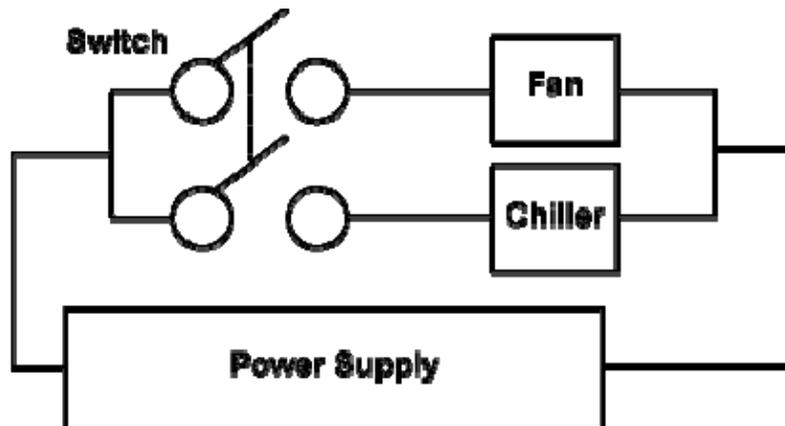
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# Double Pole Single Throw (DPST)

## Example: On-Off (DPST)

- When the switch turns the unit on, both the fan and the chiller are turned on at the same time.



Air Conditioner



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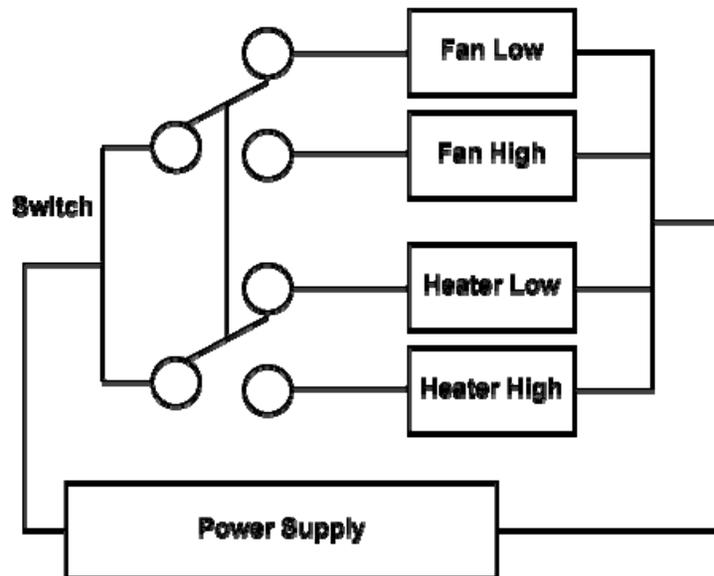
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# Double Pole Double Throw (DPDT)

## Example: On-Off (DPDT)

- When the unit is turned on, both the fan and the heater are turned on at the same time. The user will decide if they want it on low or high fan with low or high heat.



Blow Dryer



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# ENVIRONMENTAL RATINGS

## IP Ratings (*typically refer to components*)

- Common IP ratings for switches
  - IP40 – Most switches fall within this rating, where there is protection from solid objects larger than 1mm
  - IP54 – Typically referred to as weather resistant, meaning it is resistant to rain, but not a soaking with a hose
  - IP65 – Same as above, but can protect against a water hose
  - IP66 – Protected against strong jets of water
  - IP67 – Protected against temporary water immersion in less than 1 meter deep
  - IP68 – Protected against long periods of immersion under pressure

## NEMA Ratings (*typically refer to enclosures*)



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# IP RATINGS CHART

First Number (Protection against solid objects)	Definition	Second Number (Protection against liquids)	Definition
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 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 of 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



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# NEMA RATINGS CHART

Enclosure Type	Location of Use	Short Definition	IP Equivalent
1	Indoor	Protects against modest amounts of falling dirt. Mostly protects safety of user.	IP10
2	Indoor	Protects against drips of water/dirt	IP11
3	Indoor / Outdoor	Protects against weather elements	IP54
3R	Indoor / Outdoor	Protects against weather elements except dust particles	IP14
3S	Indoor / Outdoor	Protects against weather elements; external mechanisms are operable when iced	IP54
4	Indoor / Outdoor	Protects against weather elements and water hosing	IP56
4X	Indoor / Outdoor	Protects against weather elements, water hosing and is corrosion resistant	IP56
5	Indoor	Protects against settling dust particles, falling dirt and dripping non-corrosive liquids	IP52
6	Indoor / Outdoor	Protects against weather elements, water hosing and temporary submersion	IP67
6P	Indoor / Outdoor	Protects against weather elements, water hosing and prolonged submersion	IP67
12 and 12K	Indoor	Protects against circulating dust particles, falling dirt and non-corrosive dripping liquids	IP52
13	Indoor	Protects against dust particles, water hosing, oil and non-corrosive liquids	IP54



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# ILLUMINATION CLASSES

## Three Classes of Illumination

1. Independent
2. Dependent
3. Semi-independent



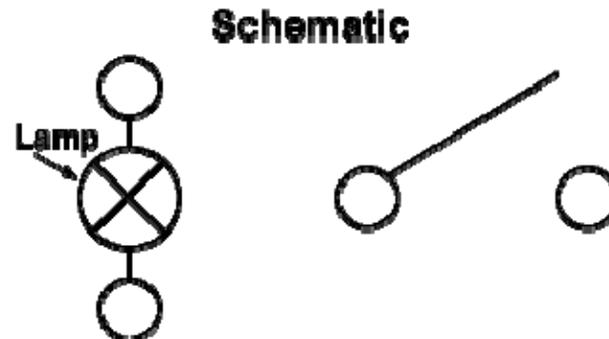
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# INDEPENDENT ILLUMINATION

- 1. Independent Illumination:** Where the switch and light are electrically connected, independent from each other.



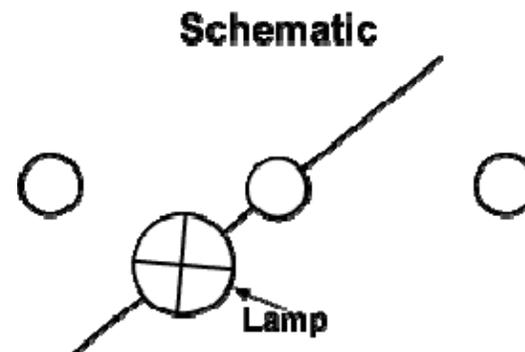
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# DEPENDENT ILLUMINATION

- 2. Dependent Illumination:** Where the switch and light are electrically connected and dependent on each other



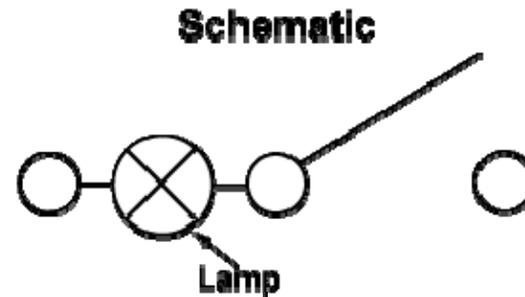
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# SEMI-INDEPENDENT ILLUMINATION

3. **Semi-independent:** Where the switch and light share a common electrical terminal. The customer can decide if the switch and illumination are wired independent or dependent on each other.



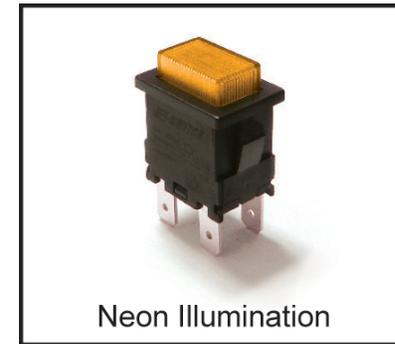
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# ILLUMINATION OPTIONS

## Possible Lamp Styles



- Neon lamp is rated at AC Voltage
- Incandescent and LED lamps are normally rated at DC voltage



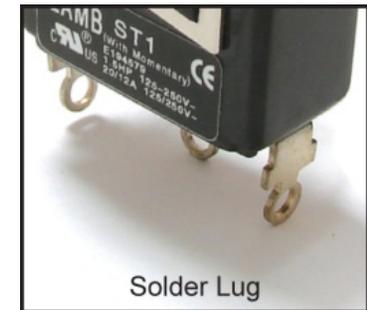
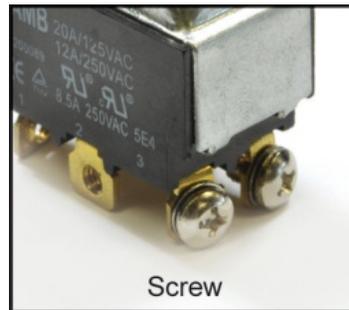
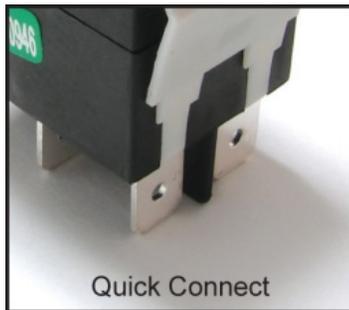
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# PANEL MOUNT OPTIONS

## Possible Panel Mount Terminations



- Typical panel thickness range is 1.5mm-4mm
- Standard panel cutout sizes (mm)
  - Rectangular: 11x30, 13x19, 22x30
  - Circular: 16, 20, 22, 25



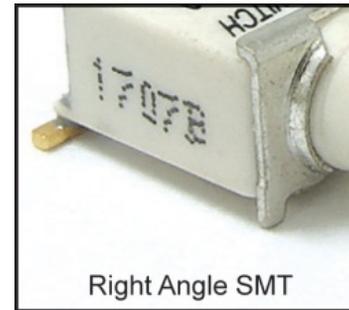
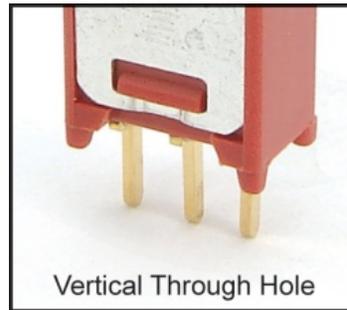
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# PC BOARD MOUNT OPTIONS

## Possible PCB Terminations



- All products are RoHS and lead-free soldering process compatible



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# AGENCY APPROVALS

North American Agency



Mexican Agency



European Agency



German Agency



Worldwide Agency



- Typically required on switches above 48 volts
- Country specific, so make sure you have the right approval for the country the final product will be sold in



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# TEMPERATURE RATINGS

- Most common temperature range
  - -30°C to 85°C

You can get any temperature tested, so if you need a higher temperature for your project, UL, VDE, ENEC, etc can test to your specified temperature.



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# LIFE CYCLES

- Power switches will typically have 2 ratings
  - Electrical
    - Range from 6,000 to 100,000
  - Mechanical
    - Range from 20,000 to 100,000
- UL and ENEC test switches to specific life cycles
  - UL starts testing at 6,000 cycles
  - ENEC starts testing at 10,000 cycles



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# PUSHBUTTON SUMMARY LISTING



700  
3A 120VAC



700 Panel Mount  
3A 120VAC



700A  
3A 120VAC



700C  
3A 120VAC



800  
3A 120VAC



800A  
1A 120VAC



800B  
3A 120VAC



D16  
8A 125VAC



KJD17  
16A 120VAC



LA  
8A 125VAC



MDP-16  
8A 125VAC



P16  
8A 125VAC



P197  
10A 125VAC



P227  
7A 125VAC



PA4  
16A 125VAC



PA5  
16A 125VAC



PB2  
20A 125VAC



PP1  
16A 125VAC



PP2  
16A 125VAC



PR1  
16A 125VAC



RP3508  
3A 125VAC

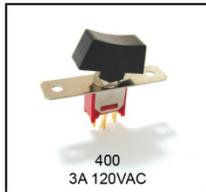
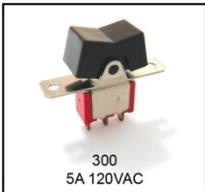


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# ROCKER SUMMARY LISTING



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# ROTARY SUMMARY LISTING



4RH  
25A 250VAC



X02  
10A 125VAC

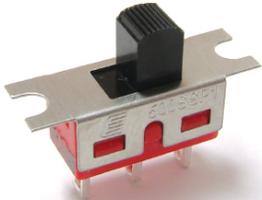


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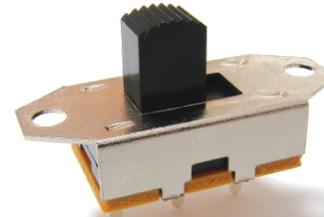
# SLIDE SUMMARY LISTING



500  
5A 120VAC



500A  
3A 120VAC



LSU  
11A 125VAC

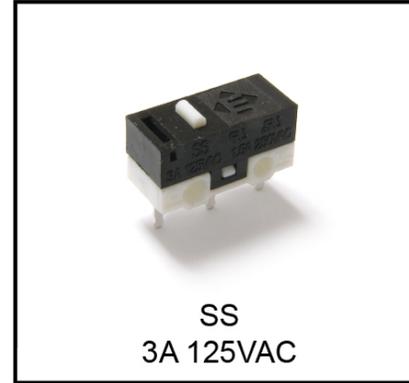
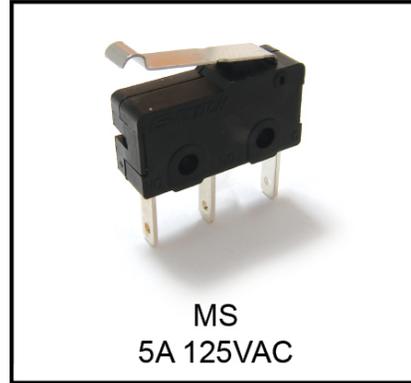


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# SNAP ACTION SUMMARY LISTING



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# TOGGLE SWITCH SUMMARY LISTING



100  
5A 120VAC



100A  
5A 120VAC



200  
3A 120VAC



200A  
3A 120VAC



ST1  
20A 125VAC



ST2  
20A 125VAC



ST3  
24A 125VAC



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# TRIGGER SUMMARY LISTING



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# SUMMARY

## Today we learned:

- What a power switch is and the most popular types of power switches
- What the most common functions of a power switch are
- About agency approvals and environmental ratings
- Types of illumination and lamp styles available
- Termination options for power switches
- Typical ratings and common temperature ranges
- About the power switches E-Switch has available.



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