

Tech Notes

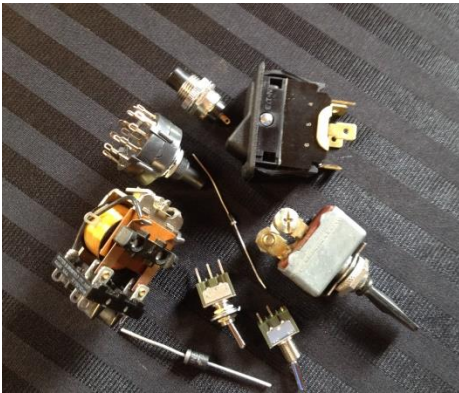
Switches- Relays and Diodes

Before we get going on the new column I want to pass along an editing error that was in the last Tech Notes covering OHMs Law, the rules of electric circuits.

The printed version reads; Ohms Law says: Volts= amps X watts. WRONG!

Should have been; Ohms law says: **Volts = Amps X Ohms**. With that correction, the balance of Tech Notes is accurate and makes sense. If you save these columns for reference or distribute them to your field techs please be sure to pass along that important change.

I apologize for the error and the editors tell me they will be extra careful in the future.



This month we're going to explore common electric components including Switches, Relays and Diodes.

Switches make and break the electrical connection to give control to the operator. Switches come in all sizes, shapes and current handling capacity and are selected to best fill the need. When you're replacing switches there will be a lot of times you will find a different looking switch could fit the need.

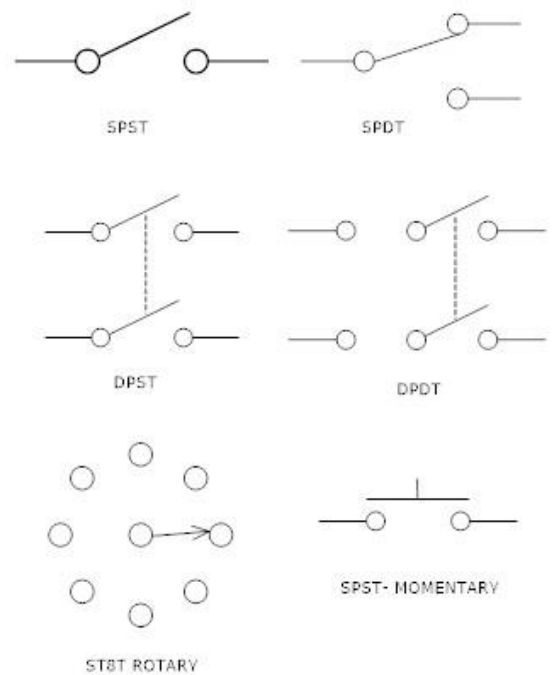
POLES and THROWS. You will find the electrical operation of a switched is specified as poles and throws.

"Single pole- single throw", or "single pole- double throw" or perhaps "double pole- single throw" or "double pole- double throw" would be typical switches.

Basically more than one electrical switch can be built into a single switch body. "Poles" are the individual switches built within the switch body and the "Throws" are the number of switch position.

A basic on- off switch would be called a "single pole- single throw" and referred to as a SPST switch.

A "double pole- single throw", DPST switch, is basically two SPST switches activated by a single lever action.



When a single wire needs to switch to multiple contacts or wires the switch action is referred to as THROWS. Rotary switches could connect a single contact point or wire to many other contacts through the circular movement. A "SP12T" rotary switches to 12 different contacts.

A SPDT switch will have one contact open and the other in a closed state. They are marked "NO" for normally open and "NC" for normally closed.

An almost unlimited number of contact arrangements are available. The other consideration in switch selection is the "ACTION". Basically how you want to move the switch. The "toggle action" could be "push button", "rotary", "slide", "key operated", "rocker" or pretty well any way you want it to move.

Toggle switches use a lever to control movement. The lever could be short or long, round or flat. When replacing switches the required mounting hole size is extremely important.

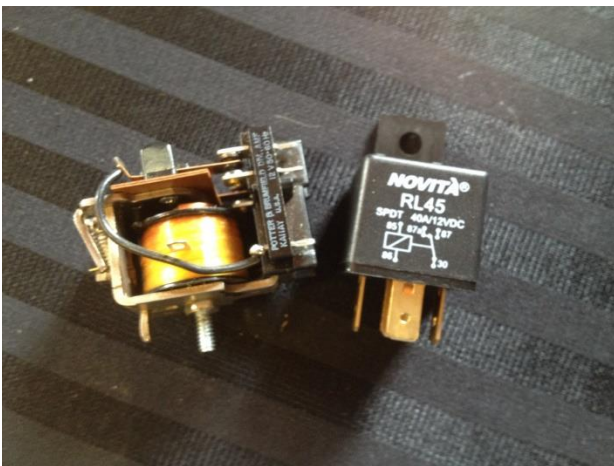


You'll find some toggle switches may have a "CENTER OFF" position. A "DPDT CENTER OFF" switch has a neutral position in the center where a "DPDT" switch from one connection to the other without the neutral position at center.

Another DPDT switch might be "momentary" on one side or both.

The contact type" is also important. You can get solder terminals, spade terminals, screw type, printed circuit board and others. Make sure what

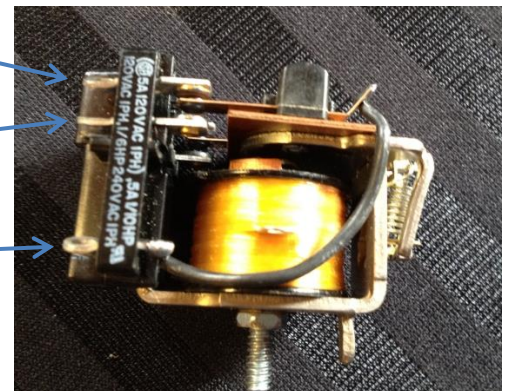
you order is really what you want.



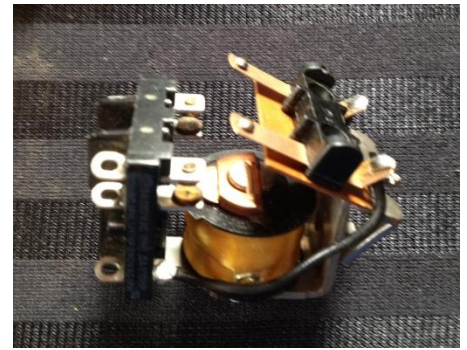
Relays can be thought of as remote control switches. A single small "signal switch" can activate a high current circuit great distances away. The relay could have multiple switches built in the design allowing multiple circuits to be activated by a single switch.

The open construction of the relay shown allows a better understanding of how switches are constructed. This is a double pole- double throw relay. The pole contact uses a wire to make the connection. When power is applied to the coil, the "normally open" contact closes.

Normally OPEN Contact
Normally OPEN Contact
Switching Pole



Releasing the spring return allows a better look at the contacts. There are really two SPDT switches as part of this relay making it a DPDT Switch.



When you need to switch on and off the main power wire feeding your precision equipment or even the main batteries, the easiest way is to use a relay. Otherwise you need to bring the large wires into the cab to be switched. You can buy relays at the auto parts store for about 10 dollars with a 40 AMP capacity relay that can be mounted outside of the cab.

Much larger 100 and up relays are available from suppliers. Check out supplies at waytekwire.com. They have a great selection of relays, wire, terminals, connectors, shrink tubing and other things needed buy field techs.

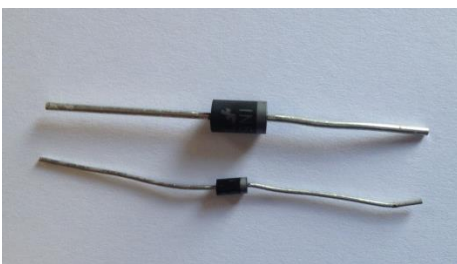
Relays have a coil for activation like a solenoid with a 12 volt connection and ground. The relay itself could be mounted on the chassis or tool using a simple on-off switch in the cab to control it. From the cab then, send out two wires to the relay; one for power activation and the other as ground. Chassis grounds could be unreliable.



Sometimes “switches aren’t switches”. Several years ago we started to find that the switches built into tractor cabs and sprayers didn’t act like switches. For years we could tie into existing switches to activate the booms or engage auto-steer systems.

Today the switches are part of a CAN module that is recognized by the on-board computer. Recently I bought a new window control for my GMC truck. When I installed it I then had a condition where no functions worked. I gave up and went to Mr. Good Wrench. The mechanic told me my new switch module would not take programming. I hadn’t realized it was really a CAN module.

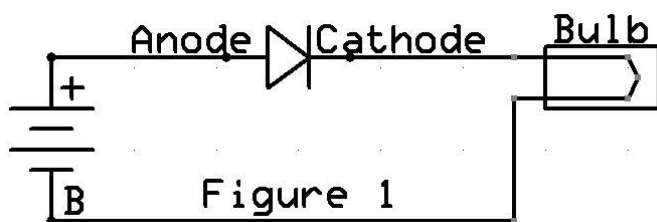
Diodes act like a “check valve” in an electrical circuit. They will only allow current flow in one direction. They are used behind the scene within the electronics and they can be used in field work very effectively to solve a few situations.



The diodes we use in the field pretty much all look like those in the photo to the left. The larger the diode physically, the higher the current handling capability. The smaller of the two shown is a one amp capacity and the larger is a 7 amp.

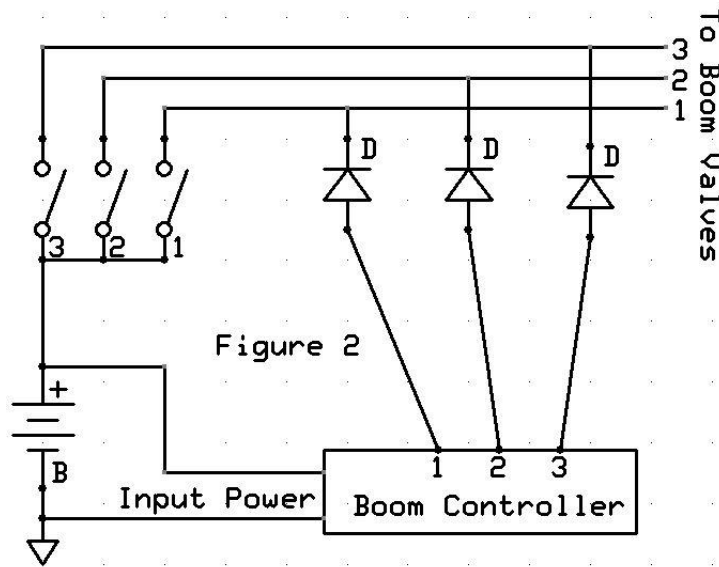
The BAND on one end indicates the polarity of the connection. The banded side is called the CATHODE and the other side is the ANODE. Anytime the ANODE has a higher voltage than the CATHODE current will flow. Just like a check valve for

an electric current.



The circuit shown in figure 1 shows a simple circuit with a lamp, a power source and a diode. The bulb lights because the diode when installed correctly does not block the flow. If the diode was flipped, the bulb wouldn’t light.

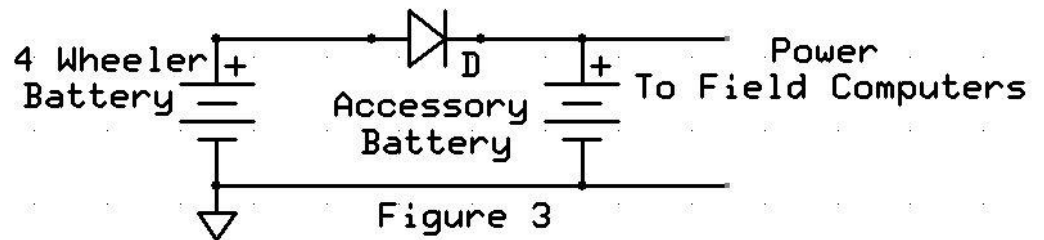
When electronic boom control systems are installed the system switches the booms on and off. If you wanted to add manual switches for control you would want to install diodes to protect the control system from the voltage sent by your manual switches.



Installing diodes as shown in figure 2 will protect the boom control system.

I've also used the same hook up with automatic vertical control systems on tile machines. Automatic operation is great but the manual switches give the operator full control.

The other area I've found diodes to be very useful in the field has been, adding a "back-up" battery on four wheelers to provide for gps electronics. The battery is not big enough on the 4 wheeler to supply power reliably to the gps electronics. Figure 3 shows a second battery can be added in parallel. "Parallel meaning" hooked directly plus to plus and minus to minus. You want the 4 wheeler to charge the add-on battery when running but not drain current from the add-on battery at other times. Installing a diode at the connection point solves the problem.



Hope this issue of Tech Notes was helpful. Remember, Tech Notes is written for the field techs. Please pass them on to the field guys! You can contact me at johnd@agtester.com. Please visit my web site, agtester.com and check out my tools for technicians. Your feedback and suggestions is appreciated.

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