THE INSTALL DOCTOR™

Relays, The Basics Of
(How They Work)

Document# 999403

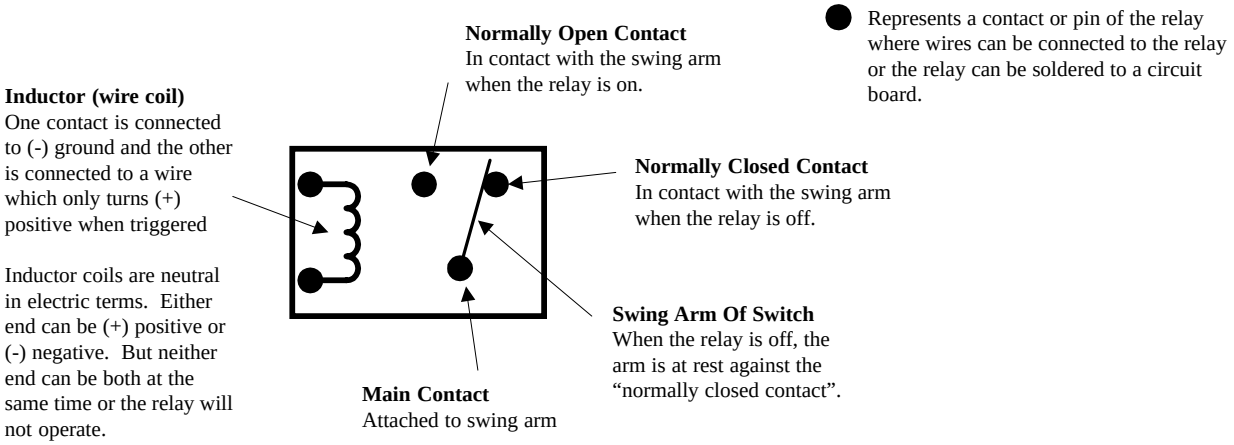
What Is A Relay?

A relay is an electromechanical switch. More importantly, relays are used in virtually every type of electronic device to switch voltages and electronic signals. The most common electromechanical switch is a simple wall switch used to control the lights in your home. The difference with this type of switch is that wall switches require a human to perform the "switching" between on and off. Relays operate differently. Relays require no human interaction in order for the switching to occur. In fact, electronic pulses actually perform the switching. Relays are very powerful devices in the fact they can be used in virtually every industry: your automobile, telephone systems, medical devices, and yes - car stereo systems.

A relay operates based on the principals of electromagnetics. Inside a relay is an inductor (a wire coil) that, when energized with an electric pulse, will generate a magnetic field. The second part of a relay is a system of metallic arms which make up the physical contacts of the switch. When the relay is off, or no electric pulse is given to the relay, the arms of the switch is in one position. When the relay is on, or an electric pulse is sent to the relay, the swing or switching arm of the switch moves to another contact of the switch. The arm moves as the generated magnetic field pulls the swinging arm toward the inductor (or wire coil). There are many different configurations of relays but this is the simplest form of the internal switching. Relays can have as few as 1 moving arm up to many inside of a single relay box.

A Look At A Relay?

To help make sense of what a relay is, here are some diagrams of what a relay looks like.



When the relay is in the "off" position, the **swing arm** is in contact with the **normally closed contact**. This means that when the relay is in the "off" position, the **normally closed contact** is also conducting to the **main contact**. When the relay is activated, the magnetic field created by the **inductor coil** pulls the **swing arm** until it makes contact with the **normally open contact** connecting the circuit connected to the **normally open contact** to the circuit connected to the **main contact.**

This is what makes relays so powerful, they can be used to switch between circuits or turn a circuit on and off.

<u>Relay Terms</u>:

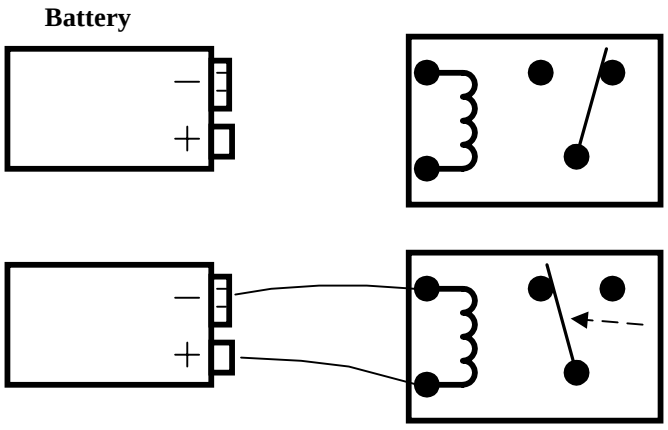
Inductor Coil: generates a magnetic field inside the relay housing when voltage is applied.
Swing Arm: the only moving part of a relay. Switches between contacts of the relay when pulled by the magnetic field generated the inductor coil.
Normally Open Contact: the contact or pin that is NOT in contact with the swing arm when the relay is in the off position but is the contact the swing arm switches to when the relay is activated.
Normally Close Contact: the contact or pin that IS in contact with the swing arm when the relay is in the off position but is the contact the swing arm switches away from when the relay is activated.
Main Contact: connected to the swing arm. The primary purpose of the switching of the relay allows the primary contact to jump or switch between the circuit attached to the normally open and normally closed contacts when the relay is turn on and off.

Understand A Relay By Testing One Out

The best way to understand how a relay works and some of the applications for a relay is to test one out. Here is a simple test to see how a relay turns on and off and the **swing arm** switches between the **normally closed** and **normally open** contacts.

Connect the (-) negative of the battery to one of the contacts of the **inductor coil** of relay and connect the (+) positive of the battery to the opposite contact of the inductor coil.

You should immediately hear the relay "CLICK" as the **swing arm** switches between the **normally closed contact** pin to the **normally open contact** pin.



We will use a multimeter to test the **swing arm** switching between the **normally closed** contact pin to the **normally open** contact pin.

This test will demonstrate a relay connecting and completing a circuit when the relay is activated.

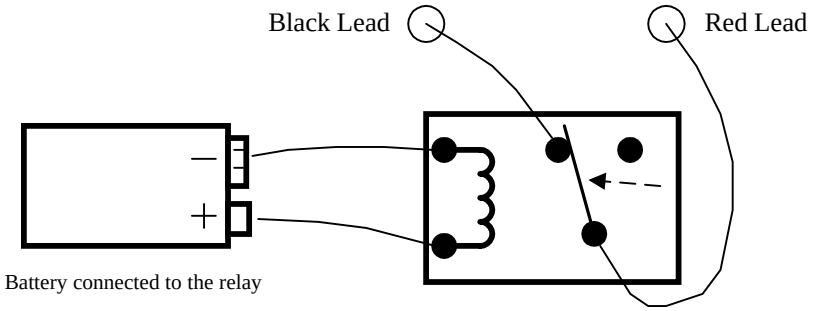
There are two ways to test the switching.

Method One: set the multimeter to "diode check" if available. Connect the "common" (black) lead of the multimeter to the **normally open contact** pin of the relay and the other lead (red) to the **main contact** pin of the relay.

Method Two: set the multimeter to "ohms Ω". Connect the common lead of the multimeter to the **normally open contact** pin of the relay and the voltage/ohm lead to the **main contact** pin of the relay.

Multimeter Display

Multimeter Set To: **Diode Check**	Multimeter Set To: **Resistance**
Beep Sounds	0 ohms

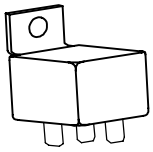


Battery connected to the relay

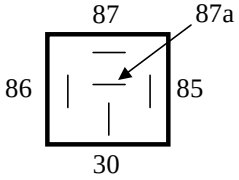
Common Relays Used In The Mobile Electronics Industry

The two most popular brands of relays used in the mobile electronics industry are BOSCH and Potter & Brumfield. Both of these companies supply many different body styles and internal relay configurations to the automotive industry, but there is one common body style used by most professional installers. This body style is termed a SPDT (single pole, double throw) body style which is the style shown in all diagrams above.

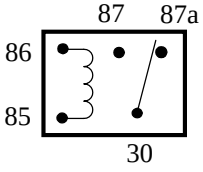
The contacts are labeled by a numbering system. Here are the contact numbers for this style of relay.



3D View



Bottom View



Schematic View