fischertechnik® e-m5

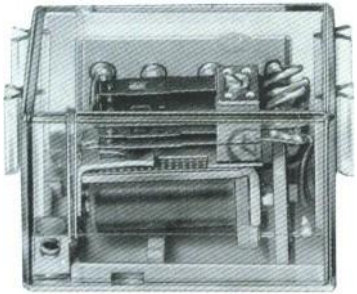
Relay

for Experiments with the fischertechnik Expansion Kit

Elektro-Mechanik em
Elektronik ec
hobby 3
hobby 4

®

Order No. 30075



1. Technical Data

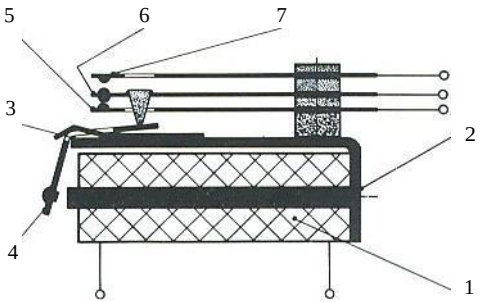
Relay	Part-No. 6 39033 5
Relay Coil:	
Resistance	100 Ω
No. of Windings	2800
Operating Voltage*	≤4.6 V
Max. Voltage	12.0 V

*also called pull-in voltage or pick-up voltage

Relay Contacts:	
Switch Type	2 x Change Over
Current Rating	1 A
Voltage Rating	40 V

About the Relay

A relay is an electromagnetic switch. It consists essentially of two assemblies.



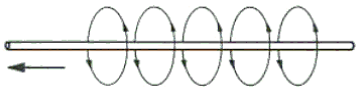
1.) Magnet coil 1 with a copper wire winding and a U-shaped iron core 2. The armature 4 rotates on the bearing 3. One arm of the armature 4 is attracted by the core 2 when sufficient current flows through the coil.

2.) Contact set with two movable centre contacts. These can be designated as a normally open contact (contact makes when coil is energised) or as a normally closed contact (contact breaks when coil is energised). If the contact set is built with 3 connections, it can be used alternatively as a changeover, normally open or normally closed contact. Such a relay with one change-over contact set is shown in the figure above. If the armature is not attracted by the relay's core, the center contact 6 presses against the contact 5 (normally closed contact) by its own spring action. If the armature is attracted by the relay's core, the armature pushes the center contact 6 with the "V" lug, against contact 7 (normally open contact). Our relay is equipped with two of these changeover contacts.

Operation of the magnetic coil

In order to understand the function of a relay, it is important to know how a magnetic coil operates.

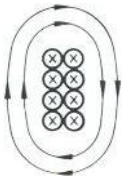
If a current flows through a conductor a magnetic field is produced in concentric circles, the intensity of which depends on the magnitude of the current. The direction of the magnetic field depends on the current's direction.



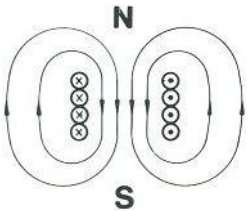
The rule of thumb applies to the detection of the magnetic field direction. With the four fingers of the right hand extend the thumb to point in the direction of current through the conductor, the curved fingers will then give the direction of the magnetic field as concentric circles. If a conductor shown in the cross-section below has current flowing downwards (Current direction is from the positive pole to the negative pole), a magnetic field is produced in the direction indicated. The arrows show from the north to the south magnetic pole. The current direction is represented by an 'x' in the case below.

If the current flows in the opposite direction, represented by a dot below, the magnetic field changes its direction.

If multiple insulated wires are placed side-by-side with the same current direction, the individual magnetic fields sum to a common stronger magnetic field. The magnetic coil of our relay has 2800 turns, so there are 2800 wires adjacent to each other.



When the wires are wound into a coil, the magnetic fields of the respective opposite wires add to a common magnetic field inside the coil because the opposing wires carry current in the opposite direction. The figure below shows a coil in longitudinal cross section.



Since iron has a much better conductivity for magnetic field lines than air, the magnetic effect of the magnetic coil is again significantly increased by inserting an iron core.

The magnet coil thus provides, in principle, an electro-magnet as is contained in e-m 1 and e-m 2.

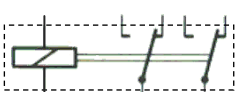
Further explanation and numerous suggestions for the Relay Module can be found in the hobby experiment and model books, volumes 3 / 3-1 / 3-2.

Circuit symbols of the relay

Relay coil (electro-magnet)

Changeover Contact

Mechanical contact between the relay coil and the changeover contact.

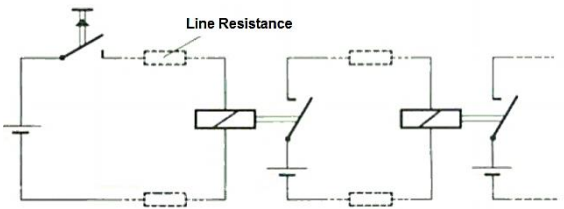


Complete switching symbol for a relay with 2 change-over contacts, the illustration applies to the de-energized relay. The two change-over contact sets are mechanically coupled, but electrically independent of one another. The dotted line represents the relay housing.

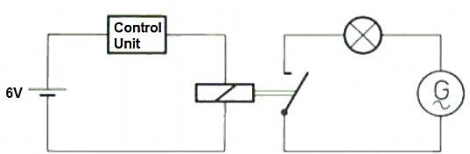
Applications of the relay

1.) Switching Amplifier

A relay can be used as a switching amplifier. A relatively large switching current can be controlled with a relatively small control current. This is used, for example, in telegraphy transmission. Because of the high electrical resistance of long transmission lines, the transmitted voltage is greatly reduced. Intermediate relays "amplify" the attenuated signal.



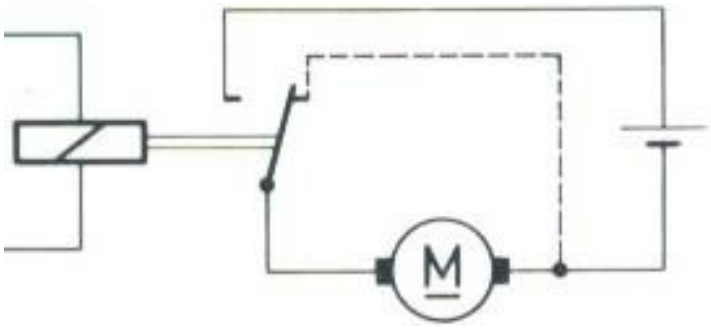
2.) Decoupling (isolation between 2 circuits) The relay can be used to ensure the control circuit and the switching circuit are independent of one another. That is, for example, if a control circuit fed with DC voltage is to switch a load which is supplied with alternating voltage. The same applies if different voltages are applied in the control and switching circuit.



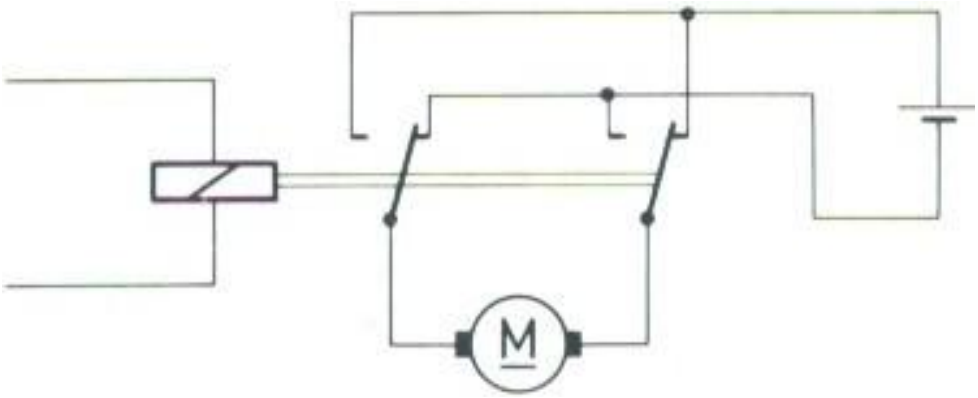
Logic and memory functions can also be implemented using relays.

Circuit Technology

If a motor is not to be slowed down gradually after switching off, but must be stopped quickly, as is the case with safety circuits, the motor may be short-circuited when switched off. The connection indicated by a dashed line below causes this short-circuiting of the motor. This function is referred to as "Dynamic Braking".



A frequently used circuit in motor control is the polarity reversal.
If the 2 change-over contact sets are connected by 2 connections according to the following circuit diagram, the electric load, in this case the fischertechnik motor, is reversed in each case when the relay is switched on and off.



Translated by: Peter King, www.procontechnology.com.au
with the assistance of Google.

Fischer-Werke · 7241 Tumlingen
Printed in Germany · Ref. No. 39 · 12/70/5