Signal Training Bulletin

COMMITTEE G: Education & Training
Communication & Signal Section, AAR

C-3 Direct Current Neutral Relay: Contacts

Approved October 1973

Definition: Contact: A conduction part which co-acts with another conducting part to open or close an electrical circuit.

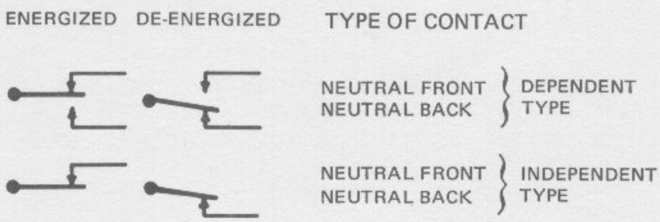
Back Contact: A part of a relay against which, when the relay is de-energized, the current carrying portion of the movable neutral member rests so as to form a continuous path for current.

Front Contact: A part of relay against which, when the relay is energized, the current carrying portion of the movable neutral member is held so as to form a continuous path for current.

Dependent Contact: A contacting member designed to complete on any one of two or three circuits depending on whether two or three way device is considered.

Independent Contact: A contacting member designed to complete one circuit only.

Symbol:



Description: Figure 1 is a cut-away of one manufacturer's typical dc relay. The principal parts are identified in the illustration and will be frequently referred to in further studies of relays. Relays of other manufacturers will contain similar parts which may be arranged differently. Compare location of binding posts and contacts with those illustrated in Figure 2.

Attached to the armature, but thoroughly insulated therefrom, are metallic movable or heel contacts. The contacting surface of the movable contacts are metal, silver impregnated carbon or similar composition, depending on the type of relay and service in which it is to be used.

Figure 2 illustrates another model of a neutral relay shown in an energized position.

When the coils are energized the armature is attracted upward and carries the heel or movable contact with it. The heel contacting surface makes with the front contact. When energy is removed from the coil the armature drops away by gravity because the magnetic force is removed. The heel contact surface leaves the front contact surface and comes to rest on the back contact.

To utilize the contacts, electrical circuits are wired to the external binding posts. Note that the heel contact is joined to its binding post by a heel ribbon or flexible connector. This allows the contact to move freely with the armature without impeding the armature's motion.

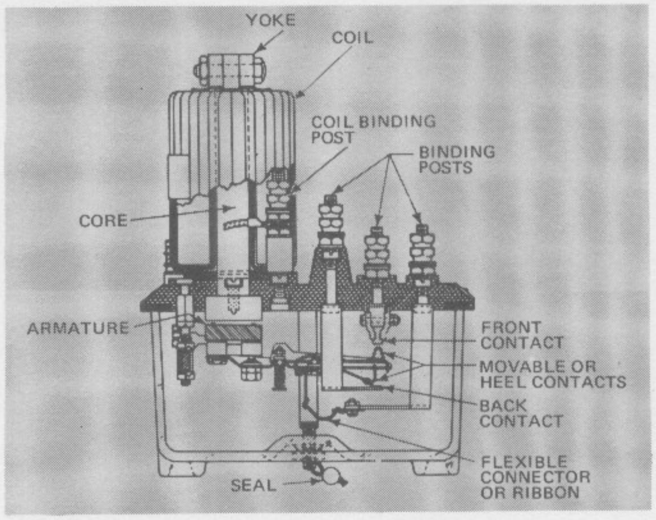


Figure 1

Shelf or wall mounted relays are most commonly supplied with either two, four, or six contacts; i.e. two fronts, two backs, two heels, etc.

Direct current relays equipped with heavy duty contacts are available for use in high current or high voltage circuits.

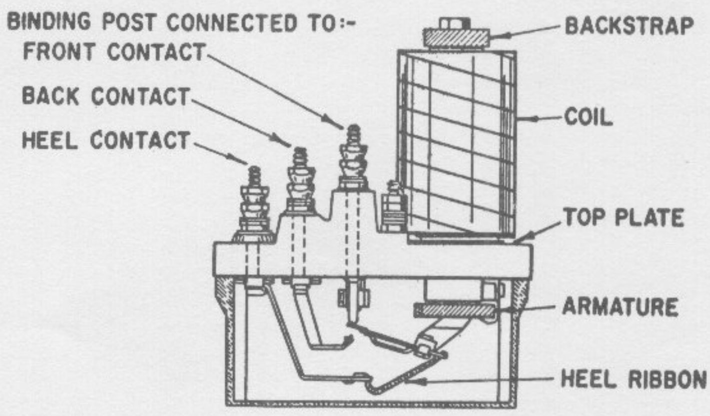


Figure 2

Purpose and Application: AAR symbols are used in this bulletin to represent the relay components shown in circuit plans.

The circuits in Figure 3 are designed so that relay Y will not pick up unless relay X is energized. There is a circuit in which the lamp will not illuminate unless both relays are de-energized. These circuits were

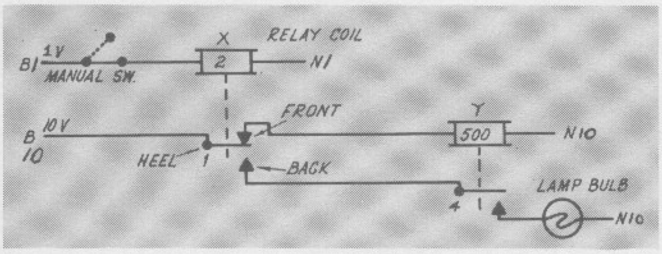


Figure 3

selected to demonstrate the use of contacts.

For simplicity a manual switch to control relay X has been used. The dotted line represents the switch in the open position.

In Figure 3, B1 and N1 denote positive and negative connections respectively to a 1-volt dc power source. Similarly B10 and N10 are connections to a 10-volt dc power source. When the switch is closed there is a complete electrical circuit between B1 and N1. Current will flow from B1 through the switch, through the coil of relay X and N (negative) terminal. The current in the coil magnetizes the core which in turn picks the armature up. The heel contact is moved up by the armature to make with the front contact surface. This establishes a path for current flow from the 10-volt source to energize relay Y, specifically from B10 to the heel of relay X, through the heel. This energizes relay Y; with both relays up, the light is out. The lamp cannot be lit unless both relays are de-energized since the current path for the lamp is closed through the heels and backs of both relays. Use of one of the relay contacts would have been sufficient to control the lamp. Two were used here to illustrate that often contacts of several relays will be inserted in the control of a device to check the conditions of several circuits.

When the switch is opened relay X is de-energized, the armature drops by gravity, the heel from the front to the back contact. With the front and heel of relay X open energy is removed from the coil of relay Y dropping its heel to the back. There is now a path for current from B10 to N10 through the heel and backs of both relays and through the lamp.

Further study will indicate that relay circuitry is versatile and advantages which will become apparent include:

A. One circuit can control many secondary circuits, e.g. by controlling the energy through the coil of one relay many secondary circuits are possible through use of its contacts.

B. A low voltage circuit may control a higher voltage circuit i.e. in the example circuit used in this bulletin, a relay that was operated from a 1-volt source controlled a 10-volt circuit through its contacts. In some cases the voltage and current in the secondary circuits are quite high, requiring relays with special contacts.

C. Functions may be controlled remotely, e.g. in traffic control systems a code may be produced at a central location by the opening and closing of relay contacts in a predetermined sequence. The code is transmitted over line wires to distant locations where other relays respond to the information and control switch or signal operations in the field.

D. Functions may be controlled in a definite sequence, e.g. at a crossing protection location a relay connected to the rails of the track is de-energized when a train occupies the specific track section. When the track relay (TR) drops, its contacts open the control circuit of another relay at the crossing. When this crossing relay (XR) is de-energized, its back and heels close to energize a relay which controls the flashing light circuits. Then the flasher relay (FR) is energized, its contacts open and close at a predetermined rate. The lamp circuits are connected through these contacts and their oscillation causes the lamps to turn on and off.

E. Storage of information may be stored by means of a stick circuit. A stick circuit can be defined as a circuit used to maintain a relay energized through its own front contact.

Briefly, a stick circuit is so designed that the stick relay receives its pick-up current through contacts of other relays. These contacts must all be in the proper position to pick the relay up. Once picked up, a second current path to the stick relay coil is established through a heel and front of the stick relay. This secondary or holding circuit will keep the stick relay energized even though the energy supplying the pick-up circuit is interrupted.

By remaining up after the pick-up circuit is opened the stick relay is storing the information that the proper pick-up circuit did exist previously.

General Information: Contact replacement or adjustment is normally a shop operation; therefore contacts do not require any field maintenance but as mentioned in the initial bulletin on Direct Current Neutral Relay, field forces are responsible for periodic visual inspection of the relay interiors. Corrective action must be taken if contacts are found to be badly burnt, pitted or cracked.

Detailed Operation: Information regarding contact and voltage capacities along with contact materials, adjustment, etc. is available in the manufacturer's service specification bulletins.