Signal Training Bulletin

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

D-3 Direct Current Coded Track Circuit

Approved November 1978

Definition: (a) Track Circuit: An electrical circuit of which the rails of the track form a part.

(b) Coded Track Circuit: A track circuit in which the energy is varied or interrupted periodically.

Symbol: None

Description: The basic differences between the steady energy track circuit and the coded track circuit are described below and shown in Figures 1, 2 and 3:

(a) A dc-controlled code transmitter (CT) is used to interrupt the energy to the rails. The usual code rates are 75, 120 and 180 pulses per minute.

(b) A track relay of the code following (CF) type is used. This type of relay is energized during each on period of the code and released during each off period.

(c) Bleeder resistors are connected across the rails at the battery and relay ends of the circuit. These resistors dissipate the voltage which is stored in the rails during the off period due to the capacity effect. This capacitance has the same effect as reducing the ballast resistance.

(d) A slow release repeater relay (BTPR) is added to remain energized during the deenergized period of the BTR. This repeater relay will release if the track relay ceases to respond to the coding impulses due to a condition such as the shunting action of a train.

(e) A code detector relay (CDR) is added to receive current through the back contact of the BTR and the front contact of the BTPR. This circuiting will cause the CDR to become deenergized should steady energy be applied to the track circuit because of a condition such as foreign current.

Purpose and Application: (a) While the steady energy track circuit serves its purpose well, the coded track circuit affords a more flexible arrangement, not attainable with the steady energy type. One application is its use in automatic signal territory to control signal aspects by the use of various code rates. This can partially or in some cases entirely eliminate the need for line wires. With a variation known as reverse code, approach lighting and approach locking can also be accomplished.

(b) The dc coded track circuit provides higher shunting sensitivity than the dc non-coded track circuit because the train shunt only has to reduce the relay current to just below the pick-up value instead of below the drop-away value. This is because the relay drops during the off period of the code and therefore the train

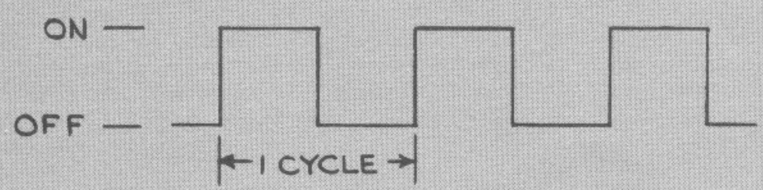


Figure 1

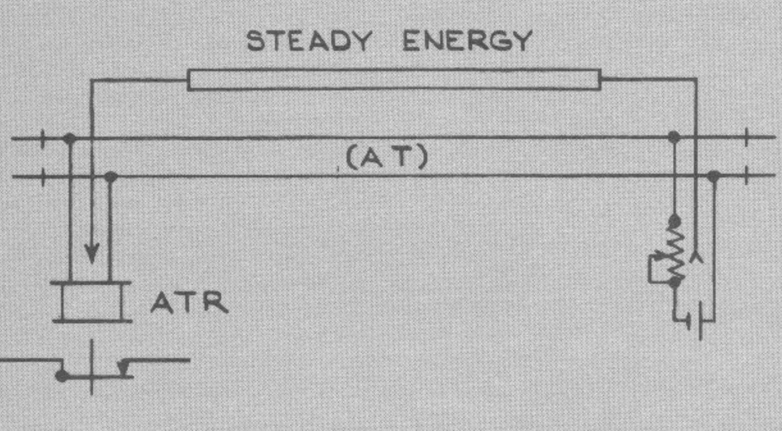
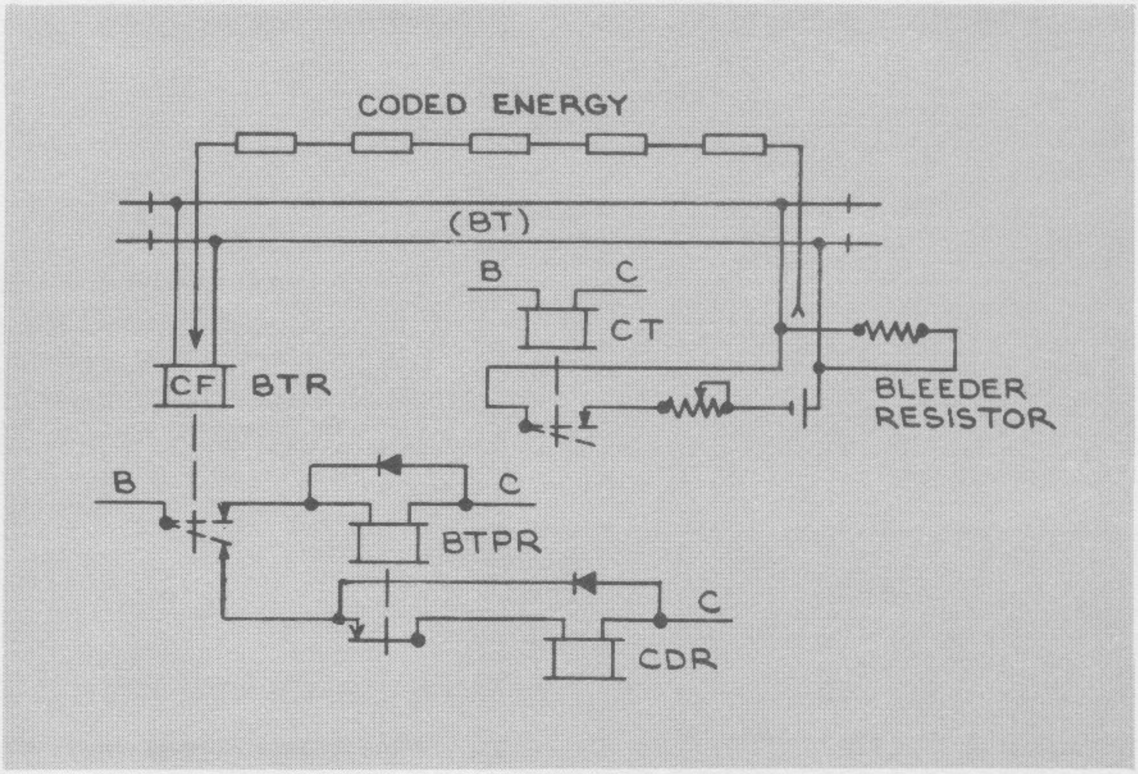


Figure 2

Figure 3



shunt only has to keep the relay current below the pick-up value of the relay. For the same reason, broken rail protection is improved.

(c) DC coded track relays are not as susceptible to dc foreign current as dc non-coded track relays because they have considerably higher values of relay pick-up current.

(d) DC coded track circuits have higher interrail potentials and high shunting currents which help break down rail film and improves the shunting.

(e) DC coded track circuits can work satisfactorily at lengths which are generally longer than dc non-coded circuits, therefore fewer track circuits are required.

(f) DC coded track circuits are very flexible and can be expanded by using different code rates. By superimposing line information onto coded track circuits, line wires can be reduced or eliminated.

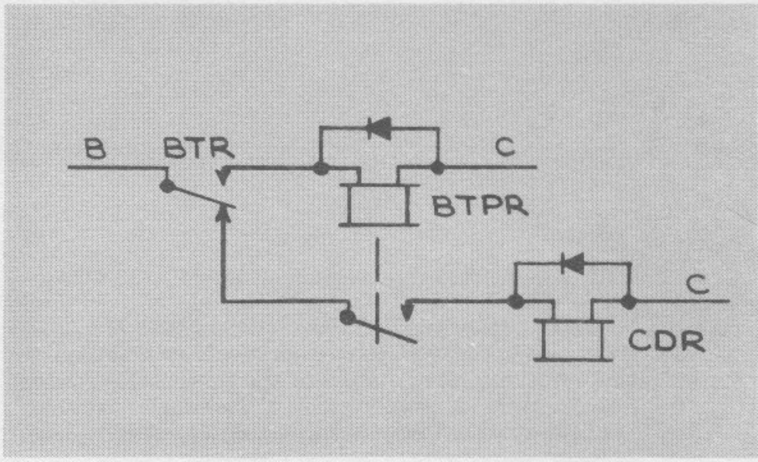


Figure 4, Step 1: Operation of track repeater relay and code detector relay

BTR— De-energized because of no current on the track or train occupying the track section.

BTPR— De-energized.

CDR— De-energized.

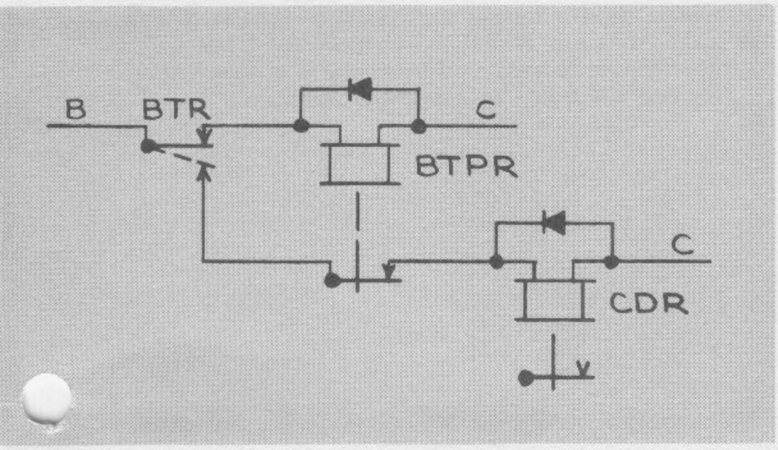


Figure 5, Step 2: Operation of track repeater relay and code detector relay.

BTR— Energized during on period.

BTPR— Receives current through BTR heel and front contacts. The diode across its coils will hold BTPR up during off period.

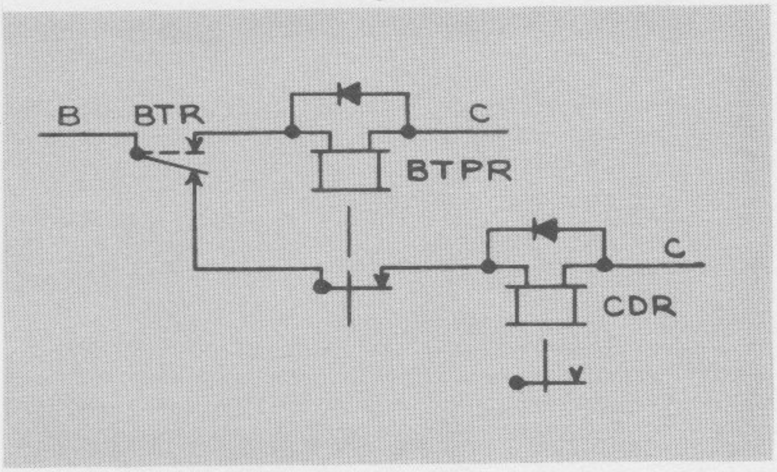


Figure 6, Step 3: Operation of track repeater relay and code detector relay.
BTPR—Energized during off period.
BTR— De-energized during off period.
CDR— Energized during off period. It receives current through heel and back contacts of BTR and heel and front contact of BTPR. The diode across its coils will hold CDR up during on period.

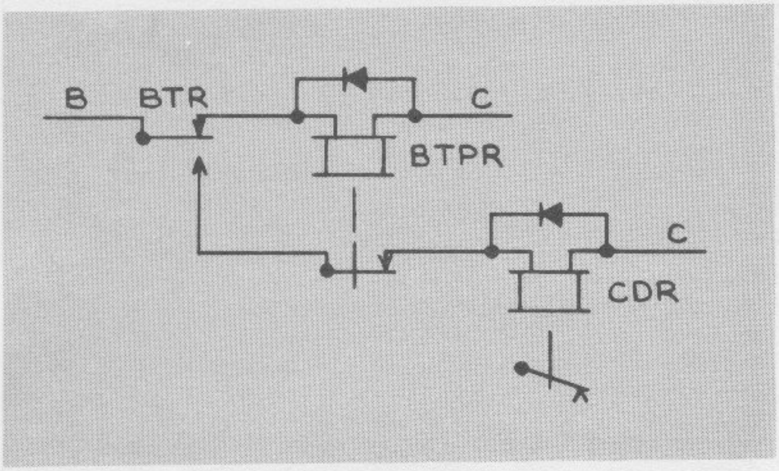


Figure 7, Step 4: Abnormal operation of track repeater relay and code detector relay.
BTR— Energized constantly.
BTPR— Energized constantly.
CDR— De-energized because of no current through back contacts of BTR. Should a fault such as foreign current on the rails keep the BTR steadily energized, then the BTPR would remain up through the heel and front contacts, but the CDR would be de-energized because of no current from back contact of BTR. It therefore serves as a detector of foreign current.

General Information: The various pieces of equipment used in coded track circuits should be maintained and tested according to rules of the particular railroad. Because of the on and off action of the circuit, contacts, particularly those of the code transmitter, are subject to damage because of burning and pitting.

Detailed Operations: The most significant difference between the coded track circuit and conventional track circuit is the introduction of the code transmitter contact at the battery end. The opening and closing of the CT contact interrupts the battery energy to the rail, sending it out in pulses. The period of time that energy is applied to the rail is called the on period and the period of time that the CT contact opens the battery energy to the rails is the off period. Figure 2 shows the steady energy track circuit for comparison with Figure 3 which shows where the additional coded track components are used in the circuit.

When energy impulses are received from the rails by the code following track relay BTR, its contacts will operate up and down in response to the on and off periods. A track repeater relay BTPR is used which will be energized whenever the BTR is receiving code pulses from the rails. The BTPR remains continuously energized when the code following relay is receiving code. That is, the repeater relay contacts will not follow the on and off periods of the code. In order to keep the BTPR energized during the off period intervals of the code, a diode is used. The opposite happens with the CDR. It receives current during the off period of the BTR but is in series through a heel and front contact of the BTPR. The CDR remains energized as long as the BTR is receiving code because of the diode across its coils, but if the BTR should cease receiving code its contacts would remain down allowing the BTPR to become de-energized. With the BTPR de-energized the CDR will be de-energized because it receives current in series through the heel and front contacts of the BTPR.