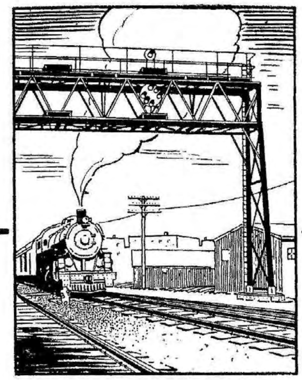
What's the ANSWER?



Track Relay Release Time

"What is your experience as to the maximum time required for a track relay to release by train shunt action? Please explain the resistance and contact capacity of the relay used as well as the length of track circuit, ballast and rail conditions."

Quick Release Features

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The releasing time for relays on short track circuits has been a problem requiring special handling for many years. Standard track relays when applied to the short track circuits involved in electric detector locking have required special treatment to make them release faster than the standard relays that are suitable for track circuits in automatic signaling where detector locking is not involved, and the means to make these relays quicker releasing have varied considerably. In many cases, sufficiently fast releasing time has been accomplished by merely adding copper shims 0.005 in. thick at the backstrap connection on the upper end of the cores so as to introduce this additional air gap in the magnetic circuit. In some cases, special coils have been used, and in other cases the standard track relay coils have been connected in multiple and a series resistance used between the rails and the relay. The means used to decrease the shunting time depend upon the amount of decrease that is needed for the track circuit and moving equipment conditions.

It can be stated that the retardation of release for track relays is affected by various factors as follows:

(1) The time increases with increase of train shunt resistance because with a higher train shunt resistance a larger proportion of the battery current passes through the relay coils when shunted.

(2) The time increases as ballast dries out on a given track circuit because of higher energization of the relay due to less voltage drop in battery lead resistance on account of less ballast leakage.

(3) The time increases with increased length of track circuit because the lower battery lead resistance passes more current when shunted, a definite proportion of which passes through the relay coils.

(4) The time increase on long track circuits due to ballast drying out is more pronounced than on short track circuits due to increased energization of the relays because the leakage current on longer track circuits is a greater percentage of the total, thus the voltage at the relay increases more rapidly with increase of ballast resistance.

Relays made in accordance with A.A.R. Specification 105-37 are of a higher efficiency than those made in accordance with A.A.R. Specification 105-20, and due to the greater num-

Time Required for Track Relay to Release by Train Shunt Action

Ballast Resistance—Ohms per 1000 ft.	2.5		20.		infinity	
Train Shunt Resistance—Ohms	0.01	0.06	0.01	0.06	0.01	0.06
Release time—Sec. 100 ft. track	0.866	0.900	1.016	1.016	1.033	1.050
Release time—Sec. 200 ft. track	0.900	0.900+	1.150	1.175	1.180	1.208
Release time—Sec. 500 ft. track	0.917	0.917+	1.317	1.333	1.382	1.417
Release time—Sec. 1000 ft. track	0.933	0.933+	1.514	1.616	1.584	1.650
Release time—Sec. 5000 ft. track	0.966	1.016	1.716	1.966	1.780	2.08

Note: (1) Track Relay is U. S. & S. Co. Std. DN-11, 4 ohms, 4F-4B, in accord with A.A.R. Spec. 105-37. (2) Relay is adjusted on track circuit with 2-volt battery and series resistance between battery and track to just give 0.070 amp. through relay when ballast resistance is 2.5 ohms per 1000 ft. of track. This adjustment is not changed when ballast resistance changes, thus giving service conditions for increased energy level on relay when track leakage decreases. (3) Train shunts of 0.01 and 0.06 ohms applied at relay end of track circuit and time measured from application of shunt to release of relay. (4) Rail resistance is 0.1 ohm per 1000 ft. of track. (5) Ballast resistance is 2.5 ohms per 1000 ft. when relay is adjusted, and then changed to 20 ohms per 1000 ft., and to infinity.

To Be Answered in a Later Issue

(1) What is the best circuit for an a-c. primary track circuit and how may adjustments be made to best advantage?

(2) Where manually-controlled machines are used for part-time control of highway-railroad crossing protection, what means is provided to insure that the watchman does not leave the levers in position to cut out the operation of the protection when he departs from the control station at the termination of his tour of duty?

(3) What means have you employed in interlockings to improve shunt of track circuits, including turnouts and crossovers which are not used enough to keep the rail surfaces from rusting?

(4) How do you test the various types of lightning arresters in use on your railroad to determine whether they are in condition to operate when needed?

If you have a question you would like to have someone answer, or if you can answer any of the questions above, please write to the editor.

ber of turns and the larger volume of copper in the coils, and also due to the higher efficiency of the magnetic structure, the time required for these relays to release by train shunt action is somewhat longer than was true with the earlier relays, and therefore there is probably more need at the present time for taking special action to insure quicker releasing of such relays on short track circuits.

In order that these conditions can be appreciated, reference should be made to the table below, giving the actual release time in seconds due to train shunt action for a DN-11 4-ohm 4-point relay meeting A.A.R. Specification 105-37. The notes in connection with this table explain clearly the typical track circuit used for arriving at these comparative figures. This table shows data for 100-ft. track circuits, as well as 5,000-ft. track circuits, and illustrates the trend due to increased train shunt resistance, changes in length of track circuit, and changes in ballast conditions.

If the standard DN-11 relay used in this illustration is made quick-acting by the use of copper shims under the backstrap, the shunting time will be reduced approximately 50 per cent. If the track relay is a 2-point relay, such as our standard DN-22, the releasing time will be reduced 70 per cent, and if special means are used, such as operating the coils in multiple and with additional resistance between the rails and the relay, the time can be reduced to approximately one-sixth of the time taken for the standard DN-11 relay.

Testing Automatic Signal Controls

"What is the proper procedure for testing automatic block signal controls at a hand operated switch including a switch circuit controller connected to track shunt circuits and line break circuits?"

Preliminary Inspection Important

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Atchison, Kansas

The switch should first be inspected for loose or broken bolts and misplaced cotter pins. The switch rods and lugs should be inspected for defects and they must be properly secured to the switch points. The proper distance must be maintained between the switch point and stock rail at all times. The switch should be tested for proper tension upon the switch point and ease of operation. A check should be made to be sure the switch rods do not drag on ties or plates, or rub against the rail.

After the switch is in good order and proper adjustment the switch circuit controller should be tested and inspected. The switch circuit controller should be securely fastened to one of the head blocks. The operating rod should be in proper alignment and properly connected to the switch point and to the circuit controller. When any lost motion is found it must be taken up immediately. Electrical connections inside the switch circuit controller must be tight. The bearings should be well oiled and free from dust and dirt. The finger contacts should be in proper alignment, and should be kept clean. The contact surfaces should be clean and bright to insure proper contact.

A test of the automatic block signal controls can now be made. The work thus far is all preliminary, but highly important because one unit not functioning properly will give false results in testing the automatic block signal controls.

In the case of shunt circuits, when a ¼-in. gage is placed between the switch point and the stock rail, the switch circuit controller should shunt the track, stop the flow of battery to the relay and cause the track relay to be down. When the track relay is down the automatic signal control is open and the signal control relay will be down because its coils are de-energized. A voltage test with a voltmeter should be made across the terminals of the track relay to determine if the relay is properly shunted by the switch circuit controller. A voltmeter is connected across the terminals of the signal control relay to determine if any voltage is present. If there is any reading on the voltmeter the source of the battery should be determined immediately, and the situation promptly corrected.

In the case of line break circuits, when a ¼-in. gage is placed between the switch point and the stock rail the switch repeat should be down to open the automatic block signal control circuits. The signal control relay will be down because its coils will be de-energized. A voltage test should be made across the coils of the switch repeat relay to be sure the switch circuit controller is operating properly. The switch repeat relay should be completely de-energized. The voltmeter should then be connected to the terminals of the signal control relay to determine if any battery is present. If any battery is present immediate action should be taken to locate the trouble, and to promptly correct it.

Testing the automatic block signal controls proper does not require much time or work. All the preliminary tests as listed should be made because the proper functioning of the automatic block signal controls depends upon the proper operation of track relays.

The track relay is affected by the switch circuit controller, and the position of the switch circuit controller is determined by the switch.

Track Circuit Connection in Electrified Territory

"On electrical propulsion territory what is the advantage and disadvantage of attaching the track circuit connection directly to the rail as compared with attaching it to the lug in the impedance bond?"

Added Protection with Lug Connections

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San Francisco, Cal.

On our San Francisco-Oakland Bay Bridge Railway, except in a few locations where no impedance bond is available, all our track connections are made to lugs in the impedance bonds.

The insulated joints are installed exactly opposite. For the track circuit leads we use a heavily protected (trenchlay type) No. 6, 2-conductor cable, with the protection removed and the two conductors separated only inside the bond housing. Each connection to the rail consists of two 350,000 c.m. copper conductors (flexible bond stranding) soldered into a bond lug, and welded to the rail about four inches apart.

Advantages of our practice are the good mechanical protection obtained