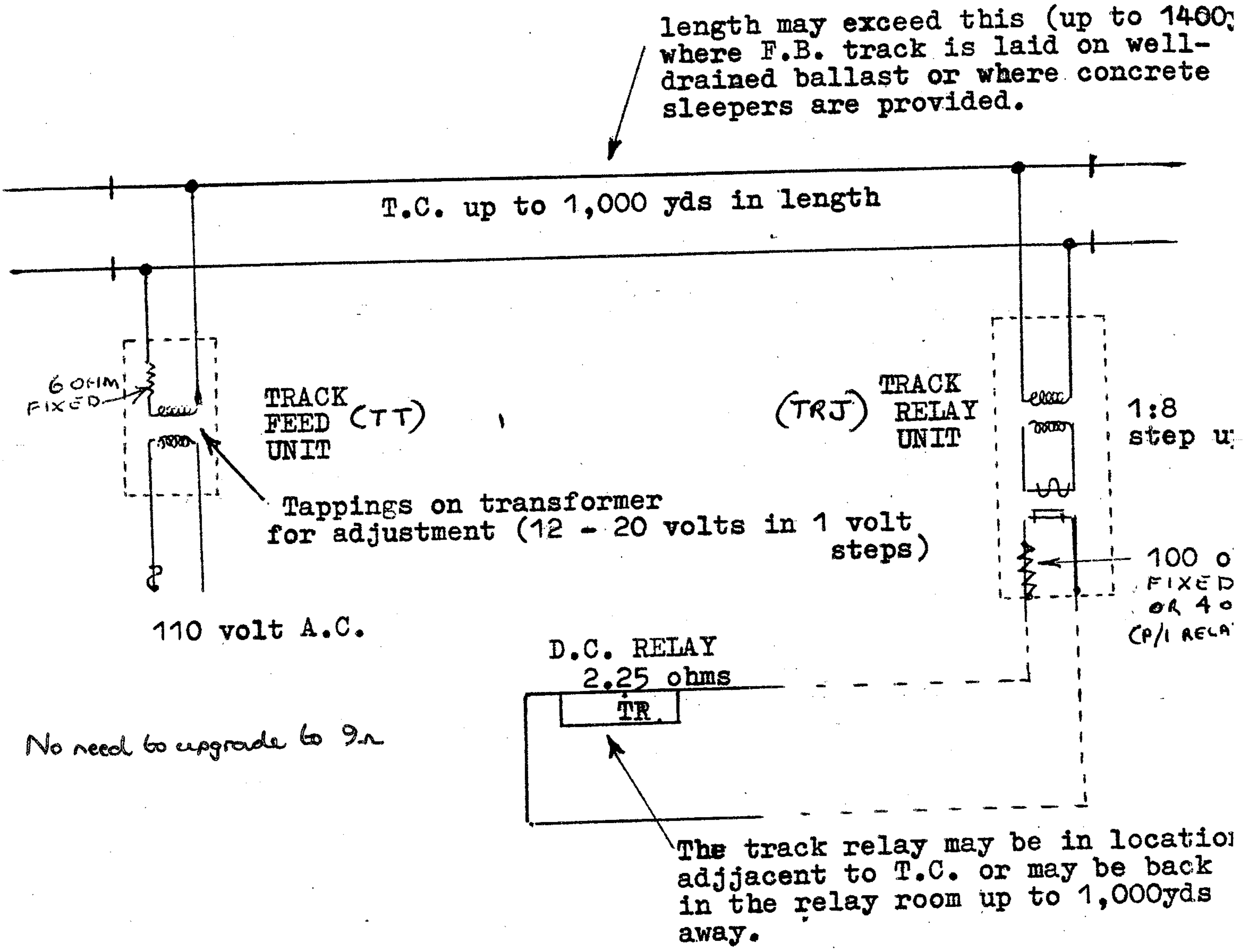
'QUICK RELEASE' TRACK CIRCUIT



No need to upgrade to 9Ω

CABLES

Lead resistance between rails and units must be kept as low as possible - not to exceed 1 ohm at each end.

This type of track circuit having specially quick release characteristics, has been developed as an economical replacement for the capacitor fed A.C. vane relay type, hither to generally used for power signalling schemes.

T.R.J. SMOOTHING CAPACITOR ON LATER UNITS (YELLOW)
NORMALLY USED WITH plug in P/I. RELAYS
TO STOP CONTACT ARCING WITH 25 Ω RESISTOR.

OLD P/I TRJ'S HAVE 4 Ω RESISTORS.

100 Ω RESISTORS ARE FOR SHELF TYPE RELAYS.

BRITISH RAILWAYS - WESTERN REGION

Chief Signal & Telecommunications
Engineer's Office,
READING.

W.B.S. "Quick Release" Track Circuit
Description and Adjustment Notes for
the Guidance of Maintenance Staff

1. Introduction

1.1 A new form of track circuit having specially quick release characteristics has been developed as an economical replacement for the capacitor fed A.C. vane relay type, hitherto generally used in power signalling schemes for road holding and aspect changing purposes. Extensive use of the new type of track will be made in future Signalling Modernisation schemes, the apparatus referred to in these notes being of the W.B. & S. Co's manufacture. These notes are intended as an introduction to the equipment and as a guide to the setting up procedure essentially for the benefit of installation and maintenance staff.

1.2 The quick release track circuit consists of a standard 2.25 ohm D.C. track relay of normal characteristics, which is energised from the 110v. A.C. supply by two special transformer units in such a way that pure A.C. is applied to the rails. The alternating voltage arriving at the relay end of the track is stepped up, rectified and applied via a 100 ohm series resistor to the track relay. This method has the effect of reducing the time constant of the relay circuit with the result that drop away is achieved in a matter of milliseconds after shunting, instead of in a second or even longer as in the case of the normal D.C. track circuit.

2. Feed End Unit

2.1 The feed equipment comprises a transformer with tapped primary and secondary windings and a non-adjustable feed resistor 6 ohms in value. Adjustment of the track is achieved by selecting appropriate transformer secondary tappings to attain the desired train shunt value. Section 4 gives details of the method of adjustment to be adopted.

2.2 The transformer primary winding has tappings of 90, 100, and 110 volts and the tapping in use should always be that which most nearly approximates to the actual voltage of the mains supply.

2.3 The secondary winding has tappings at each end chosen so that voltages between 12 and 20 volts in one volt steps may be obtained. Tap changing is carried out by means of two wander leads and terminal blocks. The tappings are inscribed 2, 1 and 0v. and 12, 15 and 18v. the voltage obtained being the sum of the values indicated against the tappings in use, e.g. one wander lead connected to the 2v. tap and the other to the 15v. will give a transformer output of 17 volts.

2. Feed End Unit (Continued)

2.4 The secondary winding of the transformer is connected to the rails in series with the 6 ohm feed resistor. When high output tappings are in use the unit may run noticeably warm due to the power dissipated by the feed resistor, particularly after long periods of occupation. The resistor is adequately rated for this application and moderate temperature rise need cause no concern.

3. Relay End Unit

3.1 At the relay end of the track circuit a step up transformer, rectifier and 100 ohm resistor are mounted in a common housing, the transformer providing compromise matching between the track impedance and that of the rectifier/resistor/relay combination thus permitting reasonably efficient transfer of power from the rails.

3.2 No adjustment can be made to this unit but as a rough guide it may be considered functioning normally if the A.C. voltage at the "Track" terminals of the unit is about 8 to 10 times the D.C. voltage on the track relay. Typical values would be 3v. A.C. and 0.3v. D.C. respectively, but these may vary widely, depending on the length of track, length of rail leads and prevailing ballast conditions.

4. Adjusting a Track for Service

4.1 A satisfactorily adjusted track circuit provides a compromise between two conflicting requirements. To assist in detecting the presence of high resistance shunts such as may be offered by isolated vehicles standing on rusty or sanded rails the maximum shunt resistance capable of releasing the track relay (the "drop shunt" value) should be as high as possible. This also assists in improving the timing characteristics. On the other hand, the minimum shunt resistance which will permit the relay to re-operate (the "prevent shunt" value) should preferably be low since this sets the lower limit of ballast resistance to which the track circuit can operate. Both drop and prevent shunts are related and one cannot be raised or lowered without raising or lowering the other.

4.2 Both the drop and prevent shunts are affected by ballast resistance. When the ballast resistance is low the measured shunt value will be high and if a track was set up under such conditions an unsafe drop shunt might apply when ballast conditions improve by drying or severe freezing, for example.

4.3 To ensure that a safe and consistent standard of track circuit adjustment is achieved it is laid down that, with any type of track circuit, the drop shunt resistance at infinity ballast resistance shall be not less than 0.5 ohm. Obviously, even in ideal conditions, ballast resistance always has some finite value and it is not possible directly to carry out a practical test for compliance with this requirement. If, however, the ballast resistance value is determined before carrying out shunt tests the subsequent shunt results may be converted to those which would apply if the ballast resistance was infinity, by means of a simple calculation.

Continued.........

4. Adjusting a Track for Service (Continued)

4.4 It is appreciated that, in installing track circuits in connection with a large signalling scheme, it may not always be possible to carry out the full track circuit test procedure before bringing them into use. In such circumstances the following simplified method of setting up may be adopted. This will always provide a safe drop shunt setting and, except where ballast conditions are abnormally poor or rail leads exceptionally long, the prevent shunt value will be adequate to permit satisfactory operation down to the minimum value of ballast resistance.

4.5 The simplified setting up procedure is as follows:-

(1) Ensure that the feed unit mains tapping is correctly selected in accordance with paragraph 2.2.

(2) Adjust the feed units secondary tappings according to the length of the track in conformance with the table below.

Approx. length of track (yds.)	Feed Unit Output V.	Feed Unit Secondary Tappings
1000	20	2 and 18
900	19	1 " 18
800	18	0 " 18
700	17	2 " 15
600	16	1 " 15
500	15	0 " 15
400	14	2 " 12
300	13	1 " 12
less than 300	12	0 " 12

(3) Apply a shunt resistance of 0.7 ohm between the rails and check that the track relay releases correctly, and re-operates when the shunt is removed.

4.6 The transformer tappings specified in the table must not be exceeded unless the drop shunt at infinity ballast resistance is checked. If circumstances are such that a track circuit so adjusted fails, due to the ballast resistance falling below the infinity ballast resistance prevent shunt value, some increase in feed voltage is admissible if, as a result, the drop shunt at infinity ballast resistance does not fall below 0.5 ohm. To verify this:

(a) Measure: Alternating voltage across the rails at the feed end ... ... Vf
Alternating current to the rails at the feed end ... ... If
Alternating voltage across the rails at the relay end ... Vr
Alternating current to the relay end unit ... ... Ir

(b) Calculate ballast resistance (Rb) by substituting the values so recorded in the equation:

$$Rb = \frac{Vf + Vr}{2(If - Ir)}$$

e.g. Vf = 3.7v., If = 2.2A, Vr = 2.4v. & Ir = 1.11A.

then Rb = 3.7 + 2.4 ... 6.1 ... [illegible]

4. Adjusting a Track for Service (Continued)

4.6 (Continued)

(c) Connect a shunt box across the rails at the relay end of the track and commencing with it adjusted to its highest value, gradually reduce the shunt resistance until the relay releases. Note the value of shunt at which this occurs and record this as the drop shunt. Then reduce the shunt resistance to zero and commence gradually increasing the setting until the relay just picks up. Record the value at which this occurs as the prevent shunt.

(d) The drop and prevent shunts at infinity ballast resistance may now be calculated from the equation:

$$\text{Shunt @ infinity Rb} = \frac{\text{Shunt} \times \text{Rb}}{\text{Shunt} + \text{Rb}}$$

e.g. Drop shunt = 0.9, Prevent shunt = 1.7, Rb = 2.8

then Drop shunt @ infinity Rb =

$$\frac{.9 \times 2.8}{.9 + 2.8} = \frac{2.52}{3.7} = 0.68 \text{ ohm}$$

and prevent shunt @ infinity Rb =

$$\frac{1.7 \times 2.8}{1.7 + 2.8} = \frac{4.76}{4.5} = 1.06 \text{ ohms}$$

4.7 The foregoing paragraphs can be summarised as follows:-

(a) The drop shunt at infinity ballast resistance is the measure of safety of the track circuit and must never be less than 0.5 ohm.

(b) The prevent shunt at infinity ballast resistance sets the lower limit of ballast resistance to which the track will function.

(c) A track may be safely put into service without checking the drop shunt at infinity ballast resistance if adjusted in accordance with the table in section 4.5.

(d) If this setting proves unsatisfactory the feed transformer tappings may be raised above the values laid down in the table but each increase in feed voltage must be followed by a check that the 0.5 ohm minimum drop shunt at infinity ballast resistance is complied with.

T.R.J. BLUE 88/84245 2.25Ω RELAY Shelf

T.R.J. YELLOW 88/84246 4.0Ω P/L RELAY

T.T. 88/84244

T.R.J. WHITE.

BR 938 PC 101
4.0Ω P/L RELAY
(USE WITH D.C. POINT
HEATING REF. E10K/11/15

T.T. - Grey - Grey TRJ - NTI relay
- Red -

WK QK 'ICs

TT	TRJ	TR
Grey	Grey	NTI
Red	Blue	2.25Ω shelf
Red	Yellow	938
Red	White (300mA min pu)	938 4.0Ω PLUG IN RELAY P/C 101

FOR USE WITH
D.C. POINT HEATING.

SEE E10K/11/15