इरिसेट

गाड़ी डिटेक्शन प्रयोगशाला

प्रयोग **सं :** टी डी एल **- 0**2

IRISET

TRAIN DETECTION LABORATORY

EXPERIMENT NO.: TDL – 02

नाम
Name : _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

अनुक्रमांक
Roll No : _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

पाठ्यक्रम
Course : _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

दिनांक
Date : _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

प्राप्तांक
Marks Awarded :

अनुदेशक के आद्यक्षर
Instructor Initial :

Single Rail DC Track Circuit in RE Area

INTRODUCTION

Track circuit is vital circuit because it is used to detect the presence of vehicle on track. In this circuit Rails are the part of a circuit. Since it is vital circuit, if in case it fails, failure must be on safe side.

Aim of this experiment is to study “working" of a ‘Single Rail DC Track Circuit’ and also safety precautions required for its working.

EQUIPMENTS:

Indoor Equipments:

a) TPR (QSPA1)
b) Repeaters of TPR
c) Power supply for TPR (24 V DC)

Outdoor Equipments:

a) Secondary Cells - 2/3/4 (40 AH / 80 AH / 120 AH)
b) Battery Charger 2 - 12 V DC O/P
c) Fuse – non detorating type - 5 Amps
d) Regulating Resistance 0 - 30 Ω (adjustable)
e) Protection choke B – type (R= 3 Ω & Z= 120 Ω)
f) DC Neutral Track Relay QBAT RELAY
g) Signal cable connection in between TR (front contact) and TPR.

- (Voltmeter & 0.5 Ω TSR are required for this experiment)

WORKING PRINCIPLE:

a) Track circuit jurisdiction is limited by insulation joint.

b) Each track circuit works independently.

c) Its circuit is normally energized to keep track relay in pick up condition.

d) After shunting of two rails by axle of vehicle concerned track relay drops.

e) Track relays energisation and de-energisation also affected by Ballast resistance and its TSR value.

f) One rail of this track circuit is dedicated to traction return current path; always this rail carries negative polarity of track circuit.

g) For smooth flow of traction return current path bonds are provided on negative rail as below

- Transverse bond –connected to two adjacent negative rails of track circuits
- Longitudinal bond- connected at rail joints of track circuit.
- Cross bond- connected to two negative rails of track circuit of adjacent lines.
- Structure bond- connected to negative rail of track circuit and OHE structure.

h) For safe side working of track circuit staggering of polarity is maintained.

i) 'B' type choke is provided on feed end and also relay end to suppress AC content coming from the rails.

DESCRIPTION

a) Resistances in track circuit

Resistance	Description
R_T	**Regulating Resistance** is the resistance which is adjustable when used with a fixed voltage battery and connected in series with the track.
R_B	**Ballast Resistance** is the net resistance offered by the ballast and sleepers across the track to leakage of rail currents. It varies according to the dry or wet condition of the ballast and soil
R_r	**Rail Resistance** is the resistance offered by the continuity rail bonds, which is rather more than the resistance of the rails themselves. It is in fact negligible under normal conditions, but varies according to bond conditions.
R_R	**Relay Resistance** is fixed for a relay and type of its coil connections.
R_S	**Resistance of the shunting vehicles** is the resistance offered by the shunting vehicle axles. It varies according to the condition of rail table (top), weight of the vehicles and their speed. The highest resistance which, when applied across the track, can open the track relay front contacts is known as its **'Train Shunt Resistance'** (TSR) value. It is the measure of its dependability.
R_{fc}	**Resistance of track lead cable at feed end**
R_{rc}	**Resistance of track lead cable at relay end** is generally very low and Rrc is the main constituent of cable resistance.

b) Additional resistance in this track circuit is choke resistance 3 Ω on both side relay end and feed end.

c) Safety checks

- When track relay is in pick up condition voltage on relay should not exceed 300% of pickup value.
- When track relay is in drop condition voltage on relay should not exceed 85%of drop away value.
- TSR value should not be less than 0.5 Ω
- TSR must be checked regularly.

The Length of Track Circuit shall be restricted according to the immunity level of track relays as below.

Sl. No.	Type of Track relay	AC Imm. Of Track Relay	Max. Catenary Current in Section Type of TC Sleepers	Type of TC Sleepers	Max. Length of TC permitted	Remarks
1.	ACI shelf type or QTA2 type	**50 V**	600 Amps.	Wooden	450 m	A 10 V drop is considered in 90 m long rail length @ 600 Amp current.
2.	QBAT type	**80 V**	600 Amps.	Wooden	750 m (with relay end choke)	
3.	ACI shelf type or QTA2	**50 V**	800 Amp. In S/L Sec. 1000 Amp. In D/L Sec.	Wooden Wooden	200 m 200 m	The voltage drop will be correspondin gly more
4.	QBAT type 80V	**80 V**	800 Amps. In S/L Sec. 1000 Amp. In D/L Sec.	Wooden Wooden	450 m 450 m	
5.	ACI shelf type or QTA2 type	**50 V**	600 Amps. 1000 Amp.	Concrete	350 m	The workable length is restricted to a lesser value due to 0.6/Km Ballast Resistance minimum permitted.
6.	QBAT type	**80 V**	600 Amp. 1000 Amp.	Concrete	750 m	

QBAT relay with chokes at feed end, relay end and with 4 secondary cells at feed end, maximum length of track circuit of 750 meters can be implemented. ('B' type chokes at both ends, under minimum ballast resistance of 2 ohms/km).

QBAT relays shall be used in conjunction with QSPA1 relays conforming to BRS 933A. (Ref: 68th SSC Para 22.11.5.7)

Track Relay (QTA2) READINGS:

S. No.	Description	parameter	Calculate 300% of P.U Value(Volts)	Calculate 125% of P.U Value (Volts)	Calculate 85% of D.A value (Volts)
1	Track Relay P.U. Value (Volts)	……V DC	……..…V DC	……..…..V DC	
2.	Track Relay D.A. Value (Volts)	……..V DC			……..…..V DC
3*	Voltage on track relay with existing ballast resistance (Volts)	……..V DC	***(Shall not be more than 300% of P.U. Value and not less than 125 % of PU value of track relay)**		
4*	Voltage on track relay when 0.5 Ω resistance across the rail connected (Volts)	……V DC	***(shall not be more than 85 % of DA value of track relay)**		
5	Regulating resistance	……. Ω	$R_B = \frac{(\text{Average Rail Voltage})}{\text{Leakage Current}} = \frac{(V_F + V_R)/2}{(I_F - I_R)} = \frac{(V_F + V_R)}{2(I_F - I_R)} =$ where, V_F = Feed End track voltage V_R = Relay End Track Voltage I_F = Feed End Track Circuit current I_R = Relay End Track Circuit current		
6	TR Coil resistance	……. Ω			
7	**VF=** Feed end voltage (Volts)	……..V DC			
8	**IF=** Feed end current	……..…Amp			
9	**VR=** Relay end voltage (Volts)	……..V DC			
10	**IR=** Relay end current	……..…Amp			
11	Length of given Track Circuit (TC) {Model}	…….. mts			
12	Minimum permitted **R_B** for the given TC {Model}	……. Ω	What is the minimum **Ballast Resistance (R_B)/km** Station section =..... Ω . Block Section =……. Ω		
13	**Calculate existing R_B** (As per formula given)	……. Ω	Compare with the point '**12'**, whether it is in the good condition or not (**YES/NO**) = ……		

EXERCISE:

1) Draw the circuit diagram from board

2) Why QSPA1 shall be used as TPR with Q Series Track relays in AC electrified section?

Note;

a) QBAT track relay pick up time = 250 milliseconds

b) QSPA1 Track repeater relay is slow to pick up = 540 to 600 milliseconds

c) OHE Tripping time = 300 milliseconds

3) Why staggering of polarity is required where continuous track circuits are provided?

4) Why rectifier fed DC Single rail track circuit considered unsafe in 25 KV AC areas?

5) What action you will take if ballast resistance is less than specified?

Date: **Signature of the Trainee**