



AUSTRALIAN RAIL TRACK CORPORATION LTD

Discipline: Engineering (Signalling)

Category: Standard

# Jeumont-Schneider Impulse Track Circuits – Set-up, Test and Certification

## SES 03

### Applicability

New South Wales	✓	CRIA (NSW CRN)	✓
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### Primary Source

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### Document Status

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### Amendment Record

Version	Date Reviewed	Clause	Description of Amendment
1.1	01 September 2004		Reformatting to ARTC Standard
1.2	14 March 2005	Disclaimer	Minor editorial change. Footer reformatted.
1.3	06 August 2010		Transferred Track Circuit History Cards to ESI-07-03 and updated references. Transferred document to new template.

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## About This Standard

This procedure describes the activities involved in commissioning and certifying GEC-Alsthom / Jeumont-Schneider high-voltage impulse track circuits, in a typical ARTC installation.

Commissioning a new track circuit consists of removing any old equipment, connecting the new equipment and any new bonding, powering-up the new equipment, then carrying out the final adjustments and certification checks.

This procedure applies to all forms of Jeumont-Schneider track circuit listed in Table 1, below.

Track Insulation	Electrified	Matching Device	Rx Type	Track Length		Tx Loop Res $\Omega$	Min Drop Shunt $\Omega$
				Min	Max		
Single-rail	Yes	TV-TH1	2-wire	18	500	20	0.5
Single-rail	Yes	TV-TH1	2-wire, double Rx	18	300	20	0.5
Single-rail	Yes	TV-THD2	2-wire	18	400	(multi-feed)	0.25
Single-rail	No	TV-THD2	2-wire	50	1500	20	0.25
Double-rail	Yes	CIT-1400 or 2000P	4-wire	50	1000	10	0.25
Double-rail	Yes	CIT-1400 or 2000P	2-wire	50	600	20	0.25
Double-rail	Yes	CIT-1400 or 2000P	2-wire, double Rx	50	300	20	0.25
Double-rail	No	TV-LV	4-wire	50	3000	10	0.25

Table 1 - Applicable Track Circuit Arrangements

## 1 Set to Work

This section covers removal of any old track circuit equipment and the connection and powering-up of the new equipment.

### 1.1 Bonding and Track Connections

Where an existing signalling system is being renewed, ensure that all old, redundant track circuit connections, including old feed and relay connections, impedance bonds, and spark-gap connections, are removed.

Bond out all redundant insulated joints, remove any temporary bonds around new insulated joints, connect any new parallel and series bonds.

Make all new rail connections, and close up all location terminal links.

Walk length of track circuit, checking track against the new track insulation plans. Check that all bonding and connections are complete, that spark-gaps connections are to the correct rails, and that no extra rail connections are left, and that there are no spark-gap or auxiliary equipment connections within the tuned loops.

## 1.2 Check Auxiliary Track Equipment

Check that any auxiliary track circuit equipment, such as traction tie-in bonds and electrolysis bonds have been reconnected.

## 1.3 Equipment Check

Check that all relays, transmitters and receivers are of the correct type, and that they are correctly positioned on the equipment rack.

Check that all lightning protection and earthing at locations and matching units is installed and correctly terminated.

## 1.4 Loop Resistance

20 Ohm Loop				10 Ohm Loop			
Measured Loop Resistance		Bridges to Set		Measured Loop Resistance		Bridges to Set	
0	to	2	C+ to 6	0	to	0.5	C+ to 4, 2 to 3
2	to	4	C+ to 5	0.5	to	1.5	C+ to 6, 3 to 5
4	to	5.5	C+ to 5, 2 to 3	1.5	to	2.5	C+ to 4, 2 to 3, 3 to 6
5.5	to	7	C+ to 6, 3 to 4	2.5	to	3.5	C+ to 3
7	to	9	C+ to 4	3.5	to	4.5	C+ to 5, 2 to 6, 3 to 5
9	to	10.5	C+ to 4, 2 to 3	4.5	to	5.5	C+ to 2
10.5	to	12	C+ to 6, 3 to 5	5.5	to	6.5	C+ to 6, 1 to 2, 3 to 5
12	to	14	C+ to 3	6.5	to	7.5	C+ to 3, 1 to 4
14	to	16	C+ to 2	7.5	to	8.5	C+ to 6, 1 to 5
16	to	17	C+ to 6, 1 to 3, 3 to 5	8.5	to	9.5	C+ to 5, 1 to 2, 3 to 5, 2 to 6
17	to	19	C+ to 6, 1 to 5	9.5	to	10	C+ to 1
19	to	20	C+ to 1				

Table 2 - Transmitter loop resistance adjustment- 20 Ohm Loop

Adjust the transmitter loop resistance tapping to suit the measured loop resistance, using Table 2 or 3, according to the loop resistance specified in Table 1.

## 1.5 Terminations

Check that all rail connections and location terminal connections are made and properly tightened.

## 1.6 Power-up

### Caution

**Exercise care when working on this equipment. Potentially hazardous voltages are present between the transmitter and matching unit (or impedance bond), and receiver, matching unit, and relay.**

**Note also that at no time should the transmitter or power supply be plugged in or unplugged nor bridging changed while the power is on.**

**A Jeumont-Schneider transmitter should not be left feeding into an open circuit as this may cause it to be damaged. It should not be operated with the track terminals open for an extended period.**

Insert fuses and links to power up the transmitter. Observe that the transmitter operates, and that the relay energises cleanly.

Check the track polarity, and check that there is correct polarity reversal between it and adjacent track circuits. If the track polarity needs to be changed, reverse the feed cable connections.

## 1.7 Check Rail Connections

Inspect and physically check that all rail connections are secure, with securing nuts done up tight, and locknuts installed where applicable.

Where impedance bond sideleads are terminated to rail, the contact voltage drop check will be useful, but only if traction return currents are flowing in the area.

Using a suitable digital meter, measure the AC millivolts drop on each track connection, between the cable core (or the crimp lug, if the core is not accessible), and the rail head. Each connection should read 1 millivolt or less. If any connection is over 5 millivolts it should be retightened. If this is not successful, the connection should be removed, cleaned and reconnected to achieved the low millivolt drop.

## 1.8 Shunt and Correspondence Check

Using a fixed shunt (in accordance with the Table 1), applied at the relay end of the track, shunt the track and observe that the relay de-energises.

Where the track circuit is indicated on a signal box diagram, check the correspondence of the track circuit to the diagram indication as part of this shunt check.

# 2 Final Adjustment

With Jeumont-Schneider high-voltage impulse track circuit equipment, there is almost nothing that is adjustable in the field. On double-rail tracks there is limited adjustment available of the receiver input levels.

The test-and-certify team is responsible for the preparation of track history cards for all tracks commissioned. These should be completed at the end of the day, using the data recorded on the commissioning master sheets prepared by the set-to-work and test-and-certify teams.

## 2.1 Receiver Adjustment

There is no adjustment possible on single-rail Jeumont-Schneider tracks.

With double-rail tracks, the matching transformer or impedance bond output can be adjusted to suit a range of track lengths.

## 3 Certification

Certification covers the proving of correct operation of the track circuit, and the completion of all documentation activities.

### 3.1 Equipment for Test and Certification

A suitable Pulse integrator (See Appendix 1) is required for all measurements of impulse track circuit operating levels. Note, that the integrator must be correctly polarised, for correct measurement and recording of track circuit polarities

### 3.2 Zero-feed Receiver Voltage

With all adjacent tracks operating, disconnect the feed from the track under test, and measure the track voltage at the receiver end.

If the remaining voltage exceeds 5 volts on the 'high' side of the pulse, this must be reported as a track circuit fault, and the cause of the excessive voltage located and rectified.

### 3.3 Polarity Reversal

Check that correct polarity reversal occurs at each blockjoint where another impulse track circuit abuts.

### 3.4 Test Shunt

Test shunt the track, using the correct value of fixed shunt. Sets of three shunts should be made at the following points, at least:

At the Tx end

Mid-track

At both ends of any parallel-bonded section of track (where points are involved) At the Rx end

Note the successful completion of all test shunt. Measure and record all equipment serial numbers and voltages listed on the history card (a sample history card is reproduced below)

The 'receiver volts when shunted' value is taken either while the track is shunted with the correct value of test shunt resistance at the receiver end, or while the track is actually occupied by a train.

### 3.5 History Cards

When all track work is complete fill in an individual history card for each track tested by the team. The responsible member of the test-and-certify team signs the cards.

## 4 Appendix 1 - Technical Notes

### Note 1: Use of Pulse Integrator for J/S Measurements

The Jeumont-Schneider pulse is intermittent in nature and asymmetrical in waveform. This makes it impossible to measure with any normal measuring instrument. For this reason, pulse measurements are made using a Pulse Integrator, such as shown in the diagram below.

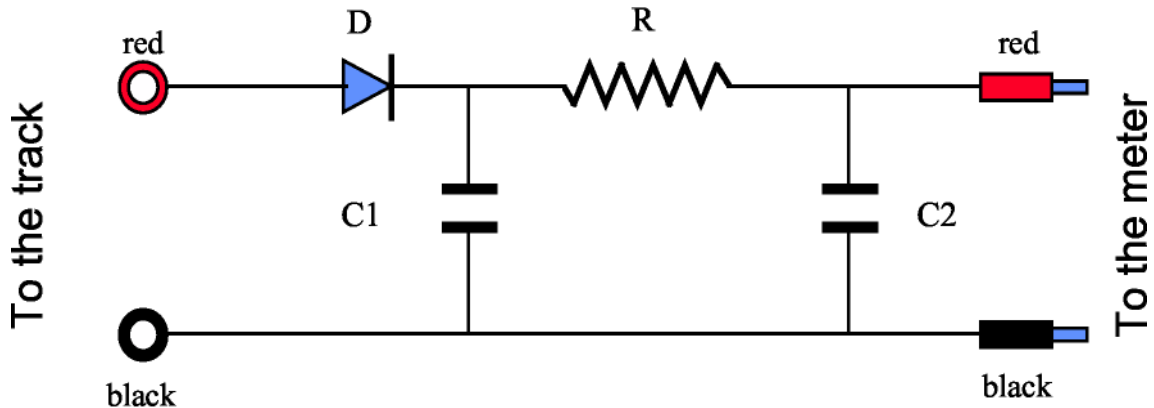


Figure A1.1 - J/S Pulse Integrator

The integrator consists of a capacitor/resistor network, with a long time-constant, which is charged up via a diode to the peak pulse voltage by successive pulses. A normal high-impedance multimeter can read the peak pulse voltage, held on the capacitor. The peak value measured can be 550 volts or over.

### Note 2 : Polarity Checks

The polarity switch on the integrator is arranged to point towards the input terminal on which the positive half-wave is being measured. The meter reading then shows whether this is the 'high' or 'low' pulse.

The integrator must be polarised such that a positive-going pulse applied to the positive (red) input terminal will be integrated with the polarity switch in the '+ve' position.

### Note 3 : Track Connection Resistance

It is critical that the rail terminations of track connection cables are as low-resistance as possible, in view of the high DC and AC currents flowing through them, and especially in view of the need to keep traction return currents balanced. As a guide, the voltages to be expected on good new connections should be less than 2mV.

Measure the AC voltage drop at each connection between the connecting cable conductors and the head of the rail near the termination. If the cable cores are not accessible, measure from a point on the connection lug, as close as possible to the insulation.

Note that, where duplicated leads are fitted, a low millivolt reading will be measured on both, so long as at least one is making good contact.

Any reading over 5mV should be taken to indicate a suspect connection. Check the tightness of the securing nuts and, if this does not work, dismantle the connection, clean all mating surfaces with abrasive or solvent as required, reassemble and tighten carefully.

## 5 Appendix 2 - Track Circuit History Card

The ESI0703F-06 GEC-Alsthom/Jeumont-Schneider Track Circuit History Card is available on the ARTC Engineering Extranet.