LUCAS GIRLING PULSE TRACK CIRCUIT EQUIPMENT SW50 Installation & Maintenance

Work Procedure: SHRI-004-WPST-06

Signal & Telegraph Section

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LUCAS GIRLING PULSE TRACK CIRCUIT EQUIPMENT SW 50 - INSTALLATION & MAINTENANCE
Document No: SHRI-004-WPST-06

1.0 PURPOSE

To provide an instruction for the installation, maintenance and repair of SW50 Lucas Girling Pulse track circuits and associated equipment.

2.0 SCOPE

This instruction applies to all Signal Maintainers that inspect, install, service or repair this equipment either in the field or in the Signals Workshop.

3.0 REFERENCES

NIL

4.0 DEFINITIONS

Not Applicable

5.0 PROCEDURE

5.0 PROCEDURE - Introduction & Installation

THE LUCAS / GIRLING.

PULSE TRACK CIRCUIT EQUIPMENT TYPE S W 50.

INTRODUCTION.

It is common knowledge amongst Railway Signal Engineers that improved operation of track circuits is obtained as the operating voltage between the rails is increased. This has been confirmed both by laboritory tests and on full scale railroad trials.

In any track circuit where a potential exists between two adjacent parallel railway lines, there is a leakage current across the sleepers, ballast, etc. and this represents a loss of electrical power. For reasons of economy therefore track circuit voltages are usually low, e.g. 1.5 volts. Since power loss is proportional to the square of the rail to rail voltage, it will be appreciated that straight forward increase in potential by a factor of say 30 will increase the power consumption by a factor of 900, clearly impractical.

A solution to this problem is to apply a short duration puls to the rail instead of D.C. These pulses can have a high peak valu (thereby effectively breaking down the rail to wheel insulating barrier) and yet conserve mean power consumption by having relativ long pauses between pulses when no voltage is applied to the rail. The penalty of such a system is that the presence or absence of a train can only be detected each time a pulse is delivered to the rails, and not in between. This virtually introduces a random time lag into the system. However, by keeping the pulse repetition rate exceeding 12 pulses per secong, this random lag becomes of negligi importance.

The SW. 50 type equipment is used for three different appli ions and is basically designed for low ballast resistances.

(a) To automatically operate the continental type crossing barriers, where a very high safety condition must be met.

(b) To work on little used branch lines where a very high degre of corresion exists due to absence of traffic and the D.C. track circuits fail to function correctly.

(c) In sidings where the section of track may be occupied or unoccupied for very long times and an accurate monitoring of the state of these sidings is of the utmost importance.

FEATURES OF THE S W 50 EQUIPMENT.

1) The pulses break down insulating films on the rails. Such films cause faulty operation of the low voltage D.C. system.

2) A feedback control system in the transmitter gives the following characteristics :-

(a) a constant output pulse amplitude in spite of battery voltage variations and

(b) a decrease in power consumption under light loading (high ballast) conditions.

3) The transmitter pulse output voltage remains almost constant up to load currents of 22A. Thus transmitter volts are not lost as the ballast reduces down to 2.5 ohms. For lower resistances the pulse output is current limited. This is an ideal characteristic since :-

(1) The constant pulse voltage region gives little variation of relay voltage due to ballast variations, and

(2) The pulse voltage amplitude reduces rapidly at lower resistances associated with train shunting.

The constant voltage amplitude will give reproducible pick up and drop away relay characteristics. Also, the relay voltage can be set just above the pick up value to give fast drop away and slow pick up. However, on long track circuits at low ballast, a larger variation of relay voltage occurs due to changes in the L/R time constant of the railway line caused by ballast resistance variations.

4) Under . train shunt conditions full pulse voltage is instantly available to breakdown insulating films.

5) A special turn off circuit causes the pulse to shorten (from 0.45 ms. to 0.08ms.) under heavy loading conditions i.e. train on track. This ensures that the transistor output state operates well within its power rating. Additional benefits are low internal heat dissipation in the equipment and a reduction in power consumption.

6) Since the pulse system is energised by a D.C. input, standby operation can be obtained using a battery under trickle charge from a mains rectifier set. If standby opera ion is not required, the system is designed to work from full wave rectified A.C. directly. No damage results from accidental connection of a reverse battery polarity to the transmitter input.

3.

7) ~~Since the pulse system is energised by an impulse only standby~~ The istallation and relay adjustment is very simple since,
(a) there are no controls on the transmitter, and

(b) the relay voltage adjustment is made at the receiver where the relay voltage can be observed directly.

8) The pulse repitition frequency of 14 pulses per second is sufficiently high to ensure that the smoothing time constant required by the pulse system introduces a negligable additional delay to the relay pull and drop away time.

9) The receiver is fail safe since pulses from the track are the only energy source to which the receiver is connected.

10) A special feature prevents the receiver from loading the leading edge of the pulse and so attenuating it.

11) The relay voltage adjustment on the receiver consists of 5 terminals which are interconnected on site for the required voltage. Altogether sixteen different conditions are available to give 10% increments in relay voltage.

12) Transformer coupling in the receiver ensures that a D.C. current from rail has no effect on the relay. A voltage barrier characteristic can be included in the receiver so that an input voltage must exceed a specified value (e.g. 4 V) before it can energise the transformer.

13) Neither the transmitter nor the receiver includes andy heavy or bulky components so that the equipment is relatively small size and portable.

14) There are no valves and no moving parts in either the transmitter or the receiver.

4.

NOTE ON THE METHOD OF "ON SITE" INSTALLATION PROCEDURE

FOR SW. 50 EQUIPMENT.

FEED END.

a) Connect the transmitter "RAILS" terminals to the rails, noting which rail is positive and which is negative.

The connecting leads should be short and of low resistance.

b) Connect the battery to the 12 volt "input" terminals observing polarity. A warbling sound will be emitted. The input voltage must be between 10-16 volts.

N.B. A germanium diode is included in the internal power supply lead so that no damage occurs due to inadvertant connection of the battery with incorrect polarity. However, damage could result from connecting the battery to the transmitter "Rails" terminals and also by connecting either of the rail terminals to the positive input terminal.

RELAY END.

c) Connect the 1.000 ohm relay to the receiver "Relay" terminals.

d) Connect the receiver "Rails" terminals to the rails. The positive receiver terminal must be connected to the same rail as the transmitter positive terminal. If the polarity is incorrect the relay voltage will be zero.

e) Connect the voltmeter (0-100 v range) to the receiver rail terminals with the capacitor and diode connected as shown on Fig 5. The voltage shown on the meter should be greater than 40 volts.

f) Remove capacitor and diode from voltmeter, connect the voltmeter to the relay terminals. To energise the relay, increase the voltage by shorting out the appropriate terminals marked A-E on the receiver. The resistance across the terminals are :-

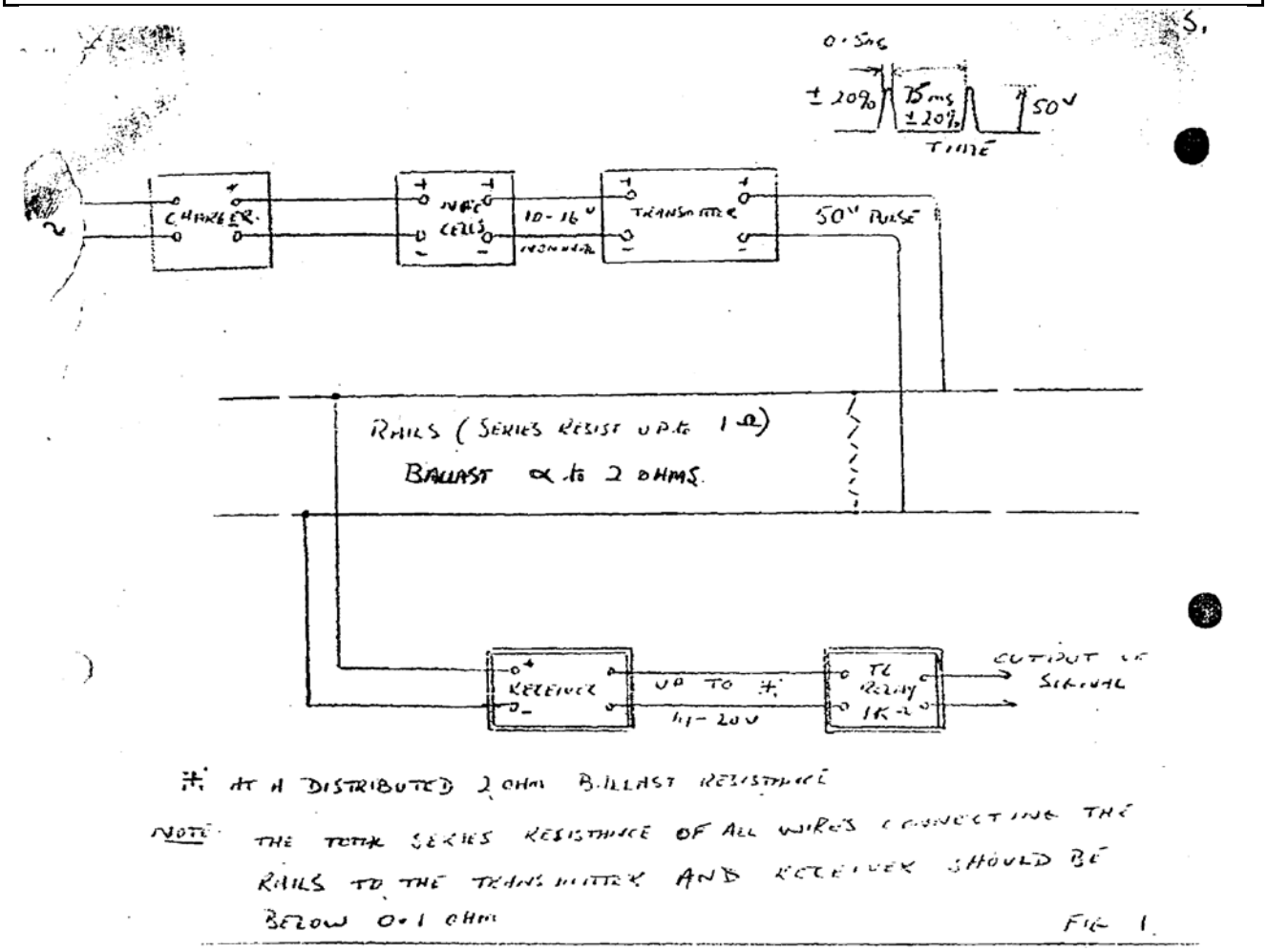
A-B	2.2 ohms
B-C	4.7 ohms
C-D	10 ohms
D-E	20 ohms

Using a relay with a maximum drop out of 3-4 volts and a minimum of 4.5 ~~2~~ 5.5 volts, a suitable setting would be about 8 volts.

Once the relay has been energised it can be de-energised by shorting out the "Rails" terminals.

g) Another test that can be carried out is to connect the decade resistance box across the rail terminals, this is to simulate the train "axle resistance". By reducing the resistance carefully until the relay drops out, the maximum "axle resistance" to operate the equipment can be determined. For the above conditions this is typically 1.0 - 1.5 ohms.

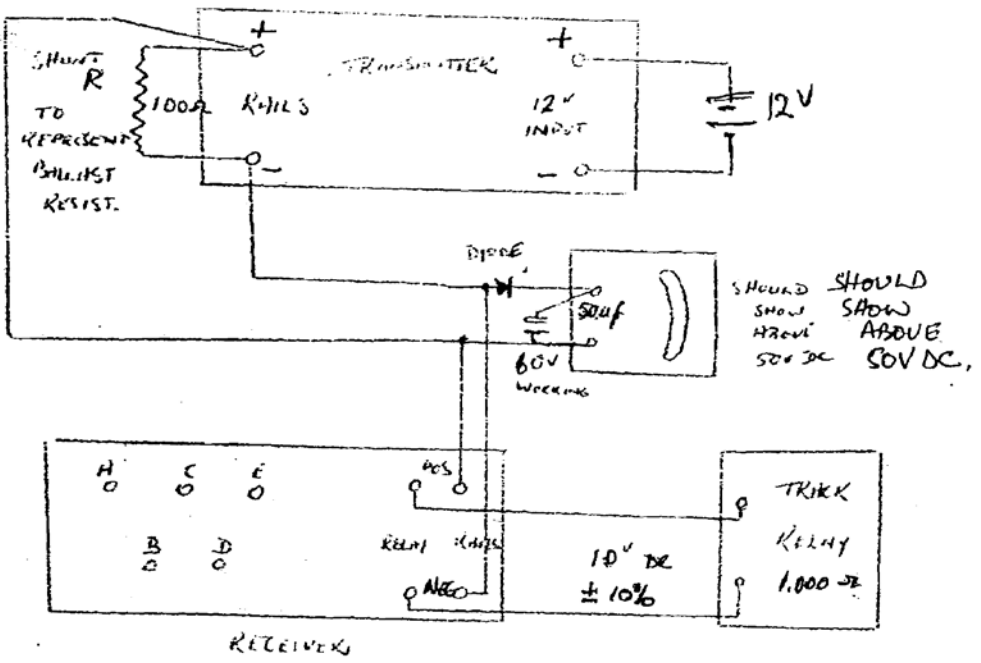
After reducing the resistance to zero increase it again, until the relay pick-up value is also determined. This could be about 2.0 - 2.5 ohms.



* AT A DISTRIBUTED 2 OHM BALLAST RESISTANCE

NOTE: THE TOTAL SERIES RESISTANCE OF ALL WIRES CONNECTING THE RAILS TO THE TRANSMITTER AND RECEIVER SHOULD BE BELOW 0·1 OHM

FIG 1.



6.0 PROCEDURE - MAINTENANCE AND REPAIR

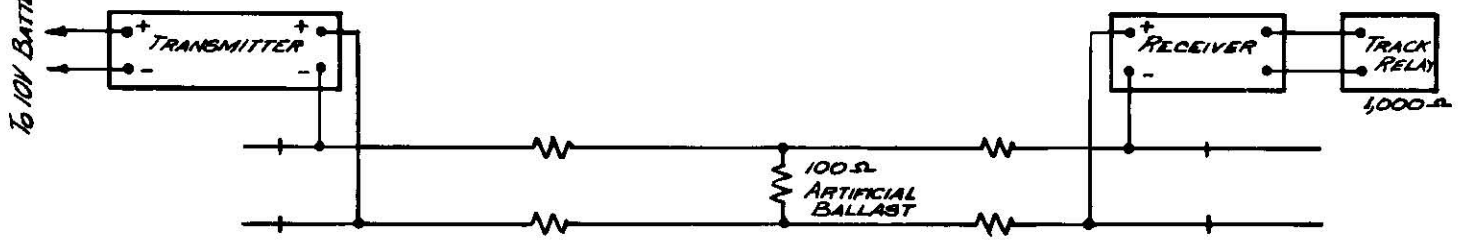
6.1 Signal drawings appended to this document detail Typical Pulse Track Circuits and Repair Method

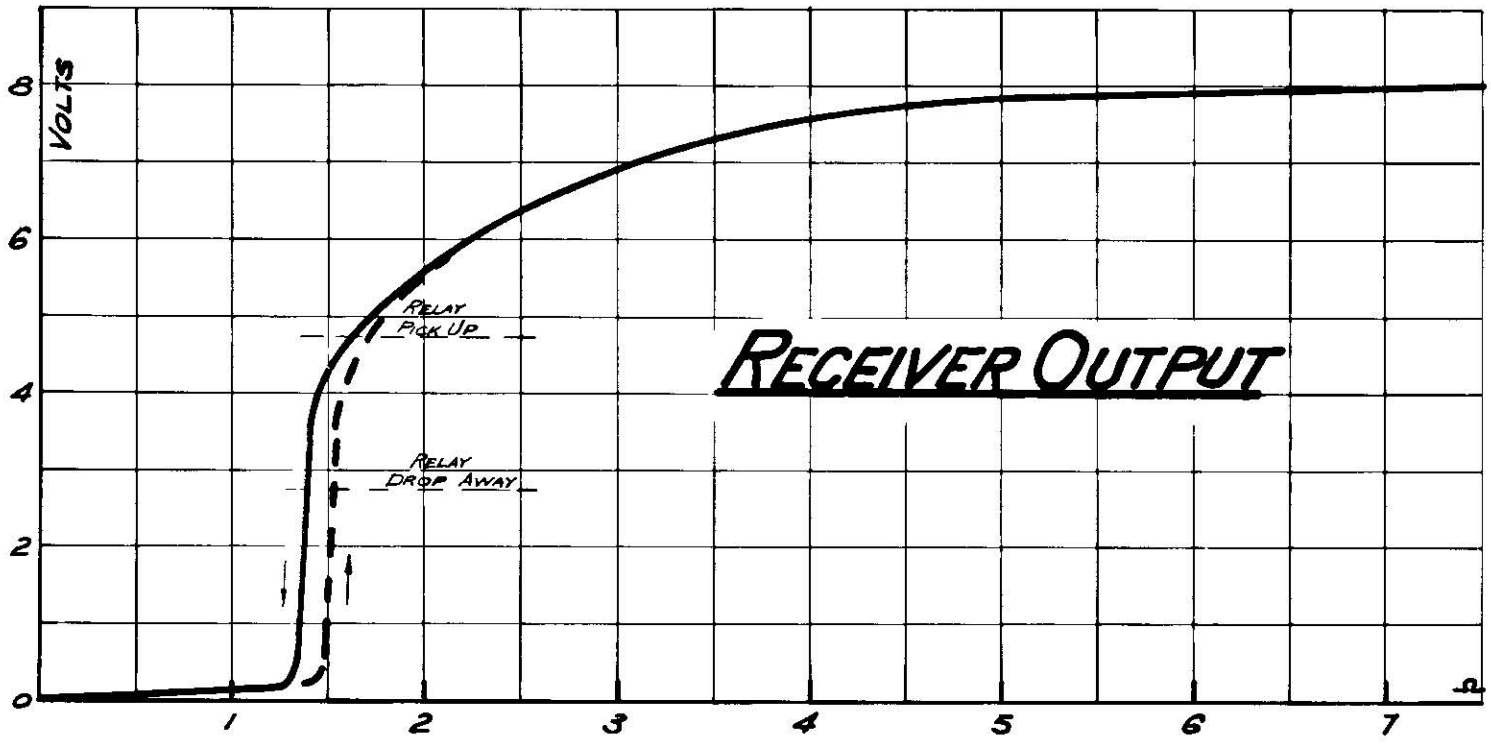
Drawing Number & Details:

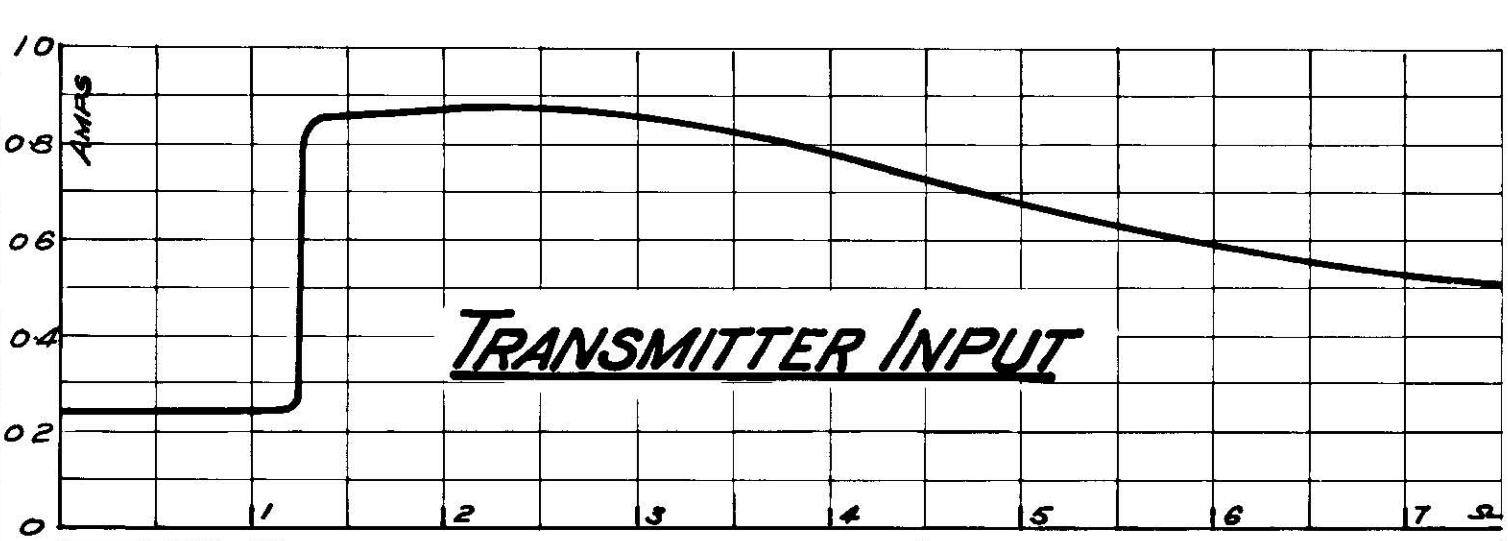
F6059 - SW50 Characteristics
E68/143 - Girling Track Circuit System, Type SW50 Mark II - Repair Method
D68/105 - Receiver board sub-assembly
D68/106 - Converter board sub-assembly
D68/107 - Transmitter box assembly
D68/108 - Receiver box assembly
D68/109 - Pulse generator board sub assembly

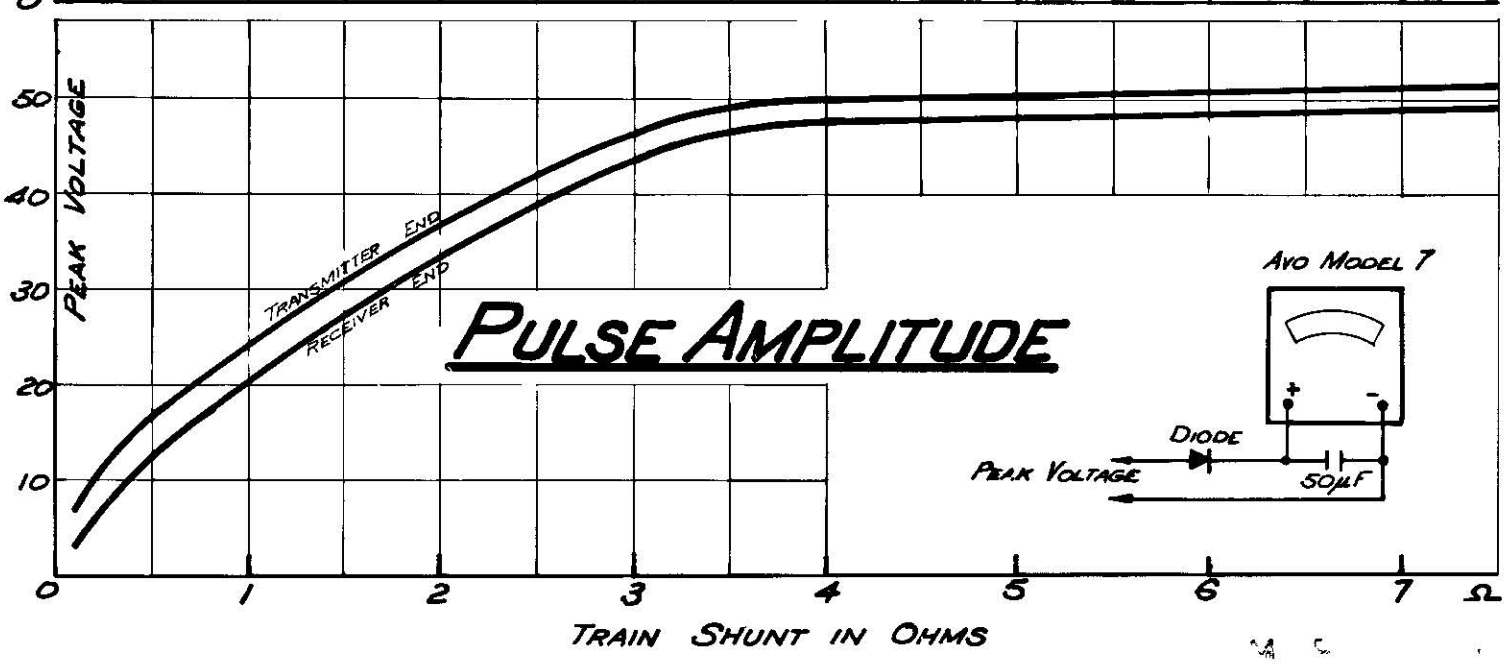
7.0 DOCUMENTATION

Complete Service Sheet SHRI-004-WFST-10 during workshop maintenance and repair of SW50 Pulse equipment.









F6059

4						
3						
2						
1						

DRAWN 12 9 67

SAR - LUCAS/GIRLING
TRACK CIRCUIT EQUIPMENT
TYPE SW50
CHARACTERISTICS

DRAWN	TRACED	CHECKED	PASSED
D.J.B.			

S & T Engineer

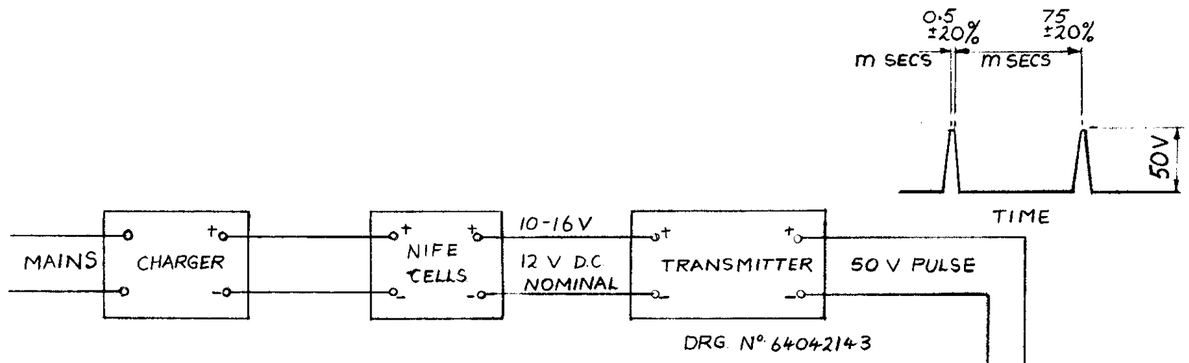
F6059

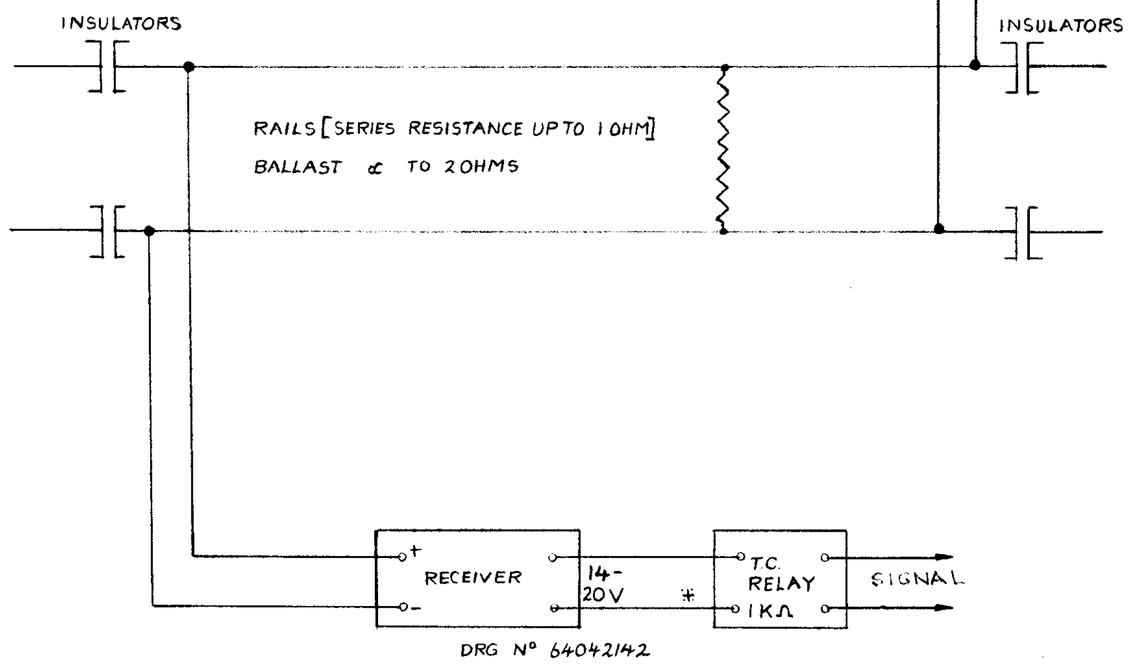
200—9 66 4865

ISSUE DATE:
ISSUED BY:
(Uncontrolled unless numbered & signed in red)

SteamRanger Heritage Railway
Signal & Telegraph Branch

		DRG N°. 06442050		
PART N°	ISS. N°	DESCRIPTION	QUANTITY LH	QUANTITY RH
64042218		RECEIVING BOX ASSY		1
64042219		TRANSMITTER BOX ASSY		1





* AT A DISTRIBUTED 2 OHM BALLAST RESISTANCE

NOTE:-

1. THE TOTAL SERIES RESISTANCE OF ALL WIRES CONNECTING THE TRANSMITTER AND RECEIVER TO THE RAILS SHOULD BE LESS THAN 0·1 OHM.
2. IF ANY UNITS FAIL AND ARE REPAIRED THE FOLLOWING TESTS MUST BE CARRIED OUT:-
   (a) CONNECT A 12 VOLT SUPPLY TO THE TRANSMITTER INPUT TERMINALS AND A 2 OHM 3 WATT RESISTOR TO THE "RAILS" TERMINALS.
   (b) CONNECT AN OSCILLOSCOPE ACROSS THE 2 OHM RESISTOR AND MEASURE THE MAXIMUM HEIGHT OF THE PULSE (42-46 V).
   (c) CONNECT A 10 OHM 3 WATT RESISTOR ACROSS THE "RAILS" TERMINALS AND MEASURE THE PULSE WIDTH AT A HEIGHT OF 40 V (0·46 MILLISECONDS MINIMUM) AND PULSE REPETITION TIME (60-90 MILLISECONDS)
   (D) CONNECT A DECADE RESISTANCE BOX ACROSS THE "RAIL" TERMINALS SET TO 8 OHM AND CHECK THAT PULSE WIDTH IS RELATIVELY UNCHANGED.
   (E) REDUCE THE DECADE BOX IN 0·1 OHM STEPS UNTIL A "TURN OFF" CONDITION IS OBSERVED, (IE. A SUDDEN FALL IN INPUT CURRENT OR A REDUCTION IN PULSE WIDTH TO 60-80 MICROSECONDS) TURN OF SHOULD BE 1·7 - 1·2 OHMS.

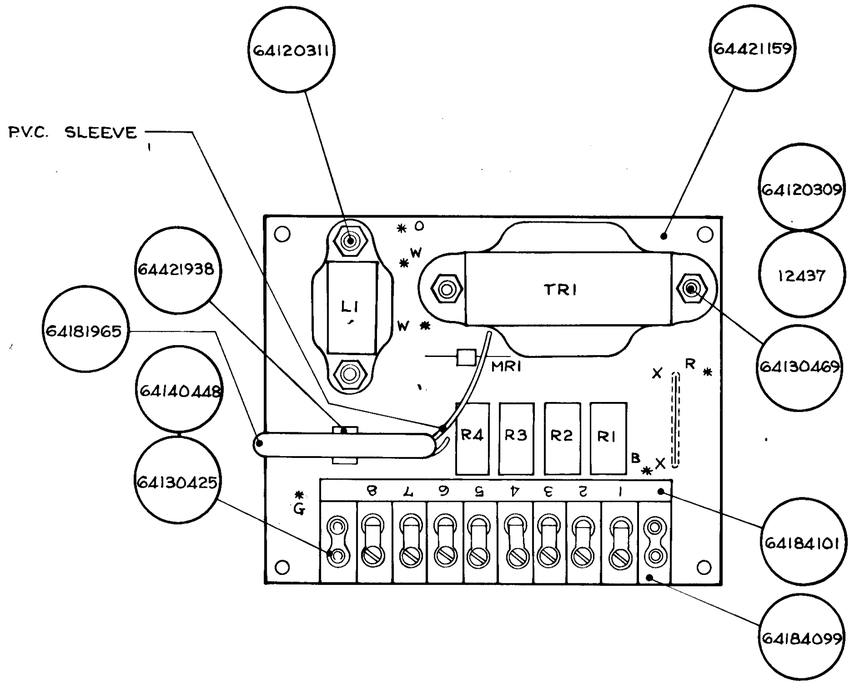
N.B.
IF THE PULSE HEIGHT OR VALUE OF "TURN OFF" RESISTANCE FALL OUTSIDE THE GIVEN LIMITS THE VALUE OF R7 MUST BE SELECTED TO GIVE THESE LIMITS.

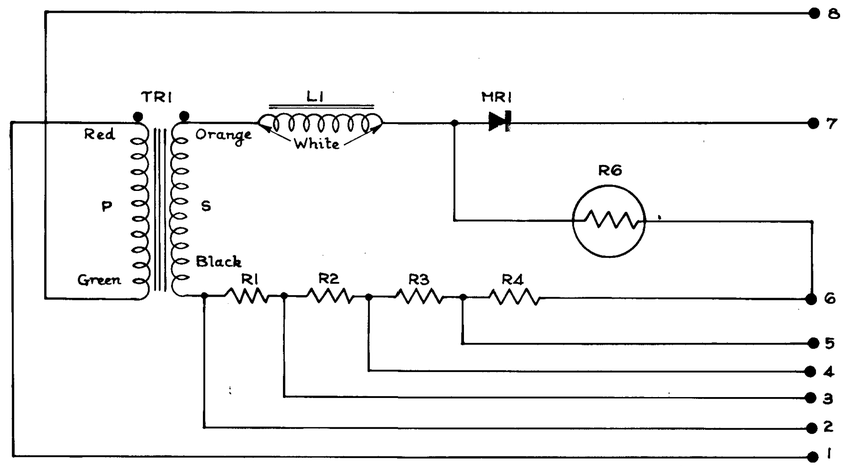
SOUTH AUSTRALIAN RAILWAYS

GIRLING
TRACK CIRCUIT SYSTEM
TYPE SW50. MARK 2.

SCALE	SET ENGINEER	DRAWN	CHECKED
19-7-68		TRACED BRY.	PASSED

E 68 143





COLOUR CODE

B – BLACK
O – ORANGE
W – WHITE
R – RED
G – GREEN

NOTE I
A Link must short XX connections.

NOTE II
MR1 leads to be looped and free from strain.

NOTE III
All components must be fitted as close as possible to the circuit board.

NOTE IV
Choke & transformer must have the insulating film removed from Lewmex wires before soldering.

DRAWING No. 64421158

Circuit Ref.	Part No.	Qty.	Description	Type	Value
	64421159	1	Circuit Board		
R1	64181491	1	Resistor	RWW/P1	2.2 OHM
R2	64181494	1	Resistor	RWW/P1	4.7 OHM
R3	64181492	1	Resistor	RWW/P1	10 OHM
R4	64181493	1	Resistor	RWW/P1	20 OHM
L1	64421162	1	Choke		
TR1	64421161	1	Transformer		
MR1	64181966	1	Diode	DA 2068	
	64184099	1	Terminal Strip		
	64184101	1	Marker Strip		
	64130425	6	Screw		
	64120309	2	Nut		
	64140080	2	Shakeproof Washer		
	64130469	2	Screw		
	64140448	6	Shakeproof Washer		
	64120311	2	Nut		
	64181965	1	Ceramsil	P502/5	
	64421938	1	Clip - Jermyn	A1120	

SOUTH AUSTRALIAN RAILWAYS

RECEIVER BOARD SUB ASSEMBLY

GIRLING PTTC SW50 MARK II

SCALE:

20 - 10 - 76

SIGNAL & TELEG. ENGINEER

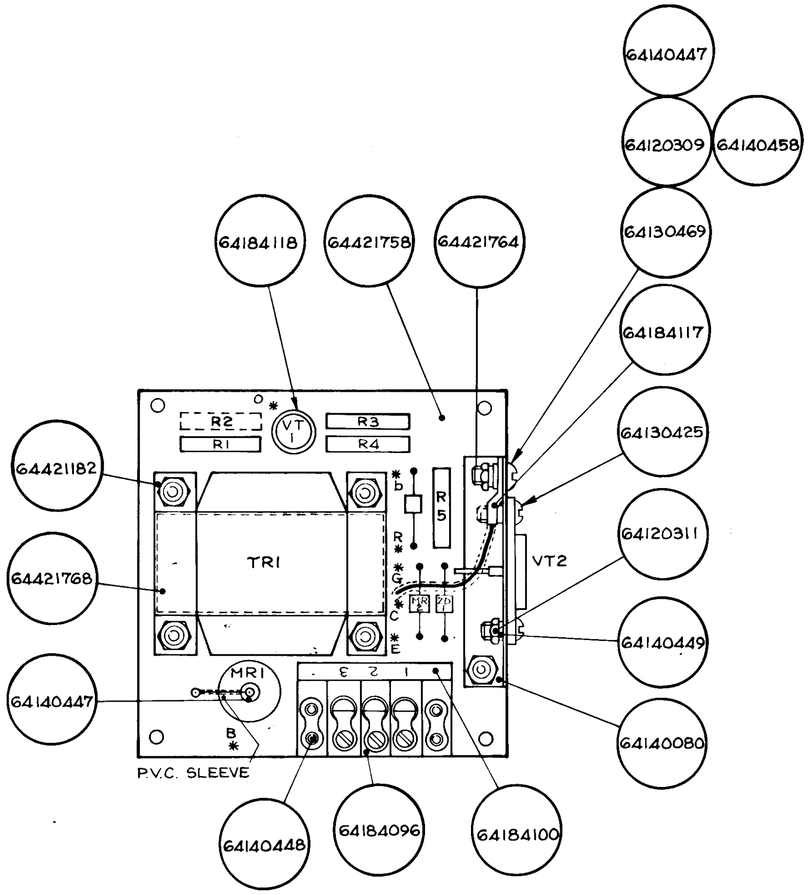
DRAWN LUCAS GIRLING

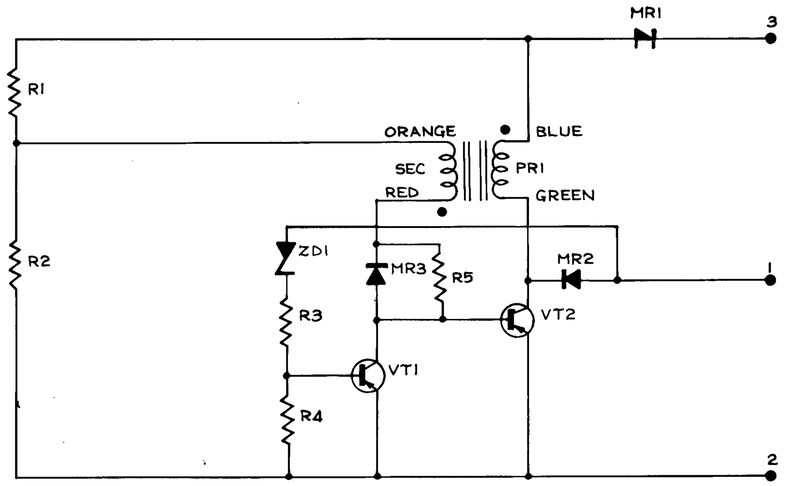
CHECKED

TRACED L.A.W.

PASSED

D 68105





FROM RANGE OF RESISTORS INDICATED THUS + ELECTRONICS DEPT. TO SELECT ONE FOR CIRCUIT REF. R2 ON FINAL ASSEMBLY.

C.T.C. REF.	PART No.	QTY.	DESCRIPTION	TYPE	VALUE
	64421758	1	CIRCUIT BOARD		
R1	64181508	1	RESISTOR	4AP2	1K OHM
+	64181781		RESISTOR	4AP2	100 OHM
+	64181780		RESISTOR	4AP2	82 OHM
+	64181538		RESISTOR	4AP2	68 OHM
+	64181539		RESISTOR	4AP2	56 OHM
+	64181503		RESISTOR	4AP2	47 OHM
+	64181502		RESISTOR	4AP2	39 OHM
+	64181501		RESISTOR	4AP2	33 OHM
+	64181500		RESISTOR	4AP2	27 OHM
+	64181499		RESISTOR	4AP2	22 OHM
+	64181498		RESISTOR	4AP2	18 OHM
+	64181497		RESISTOR	4AP2	15 OHM
+	64181496		RESISTOR	4AP2	12 OHM
+	64181495		RESISTOR	4AP2	10 OHM
R3	64181504	1	RESISTOR	4AP2	330 OHM
R4	64181781	1	RESISTOR	4AP2	100 OHM
R5	64181781	1	RESISTOR	4AP2	100 OHM
VT1	64186022	1	TRANSISTOR	ACY 19	
VT2	64186005	1	TRANSISTOR	OC 28	
MR1	64186372	1	DIODE	GEX 541	
MR2	64186373	1	DIODE	DD 003	
MR3	64186524	1	DIODE	DD 000	
ZD1	64186375	1	ZENER DIODE	238 5600CF	
TR1	64421184	1	TRANSFORMER		
	64184118	1	TRANSIPAD		
	64421182	2	BRACKETS		
	64421764	1	HEAT SINK		
	64184096	1	TERMINAL STRIP		
	64184100	1	MARKER STRIP		
	64184117	1	HYLUG		
	64130469	7	SCREWS		
	64140080	6	SHAKEPROOF W'SH'RS		
	64120309	7	NUTS		
	64130425	6	SCREWS		
	64140448	4	SHAKEPROOF W'SH'RS		
	64120311	2	NUTS		
	64140458	1	PLAIN WASHER		
	64140449	2	SHAKEPROOF W'SH'RS		
	64140447	2	SHAKEPROOF W'SH'RS		
	64421768	1	RESILIENT PAD		

DRAWING No. 64421757

NOTE 1
RESISTOR R2 TO BE SELECTED AND FITTED ON FINAL TEST.

NOTE 2
ZD1, MR2 & 3 TO HAVE LEADS LOOPED AND FREE FROM STRAIN.

NOTE 3
WIRING FROM VT2 TO LETTERS E, B & C ON CIRCUIT BOARD TO BE 40/.0076 USING CONVENTIONAL TRANSISTOR COLOUR CODE.

NOTE 4
ALL COMPONENTS MUST BE MOUNTED AS CLOSE AS POSSIBLE TO THE CIRCUIT BOARD.

NOTE 5
TR1 TRANSFORMER MUST HAVE THE INSULATING FILM REMOVED FROM LEWMEX WIRES BEFORE SOLDERING.

NOTE 6
HYLUG 64184117 MUST BE CRIMPED TO WIRE LEAD AND NOT SOLDERED.

COLOUR CODE

O - ORANGE
B - BLUE
R - RED
G - GREEN

Plan Retraced From Drg. Dated 26-7-68.

SOUTH AUSTRALIAN RAILWAYS

CONVERTER BOARD SUB ASSEMBLY

GIRLING PTTC SW 50 MARK II

SCALE:

15 - 10 - 76

SIGNAL & TELEG. ENGINEER

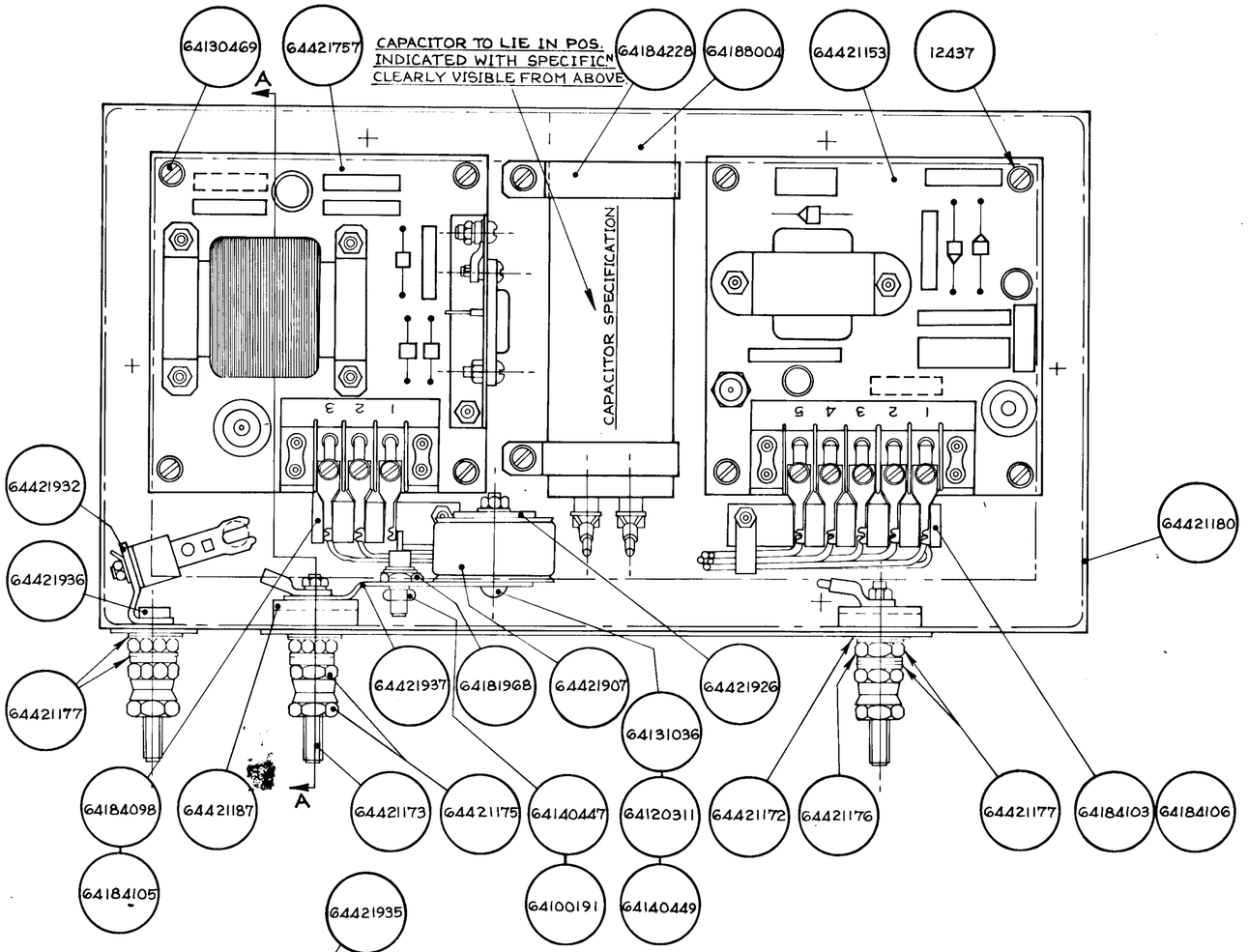
DRAWN LUCAS GIRLING

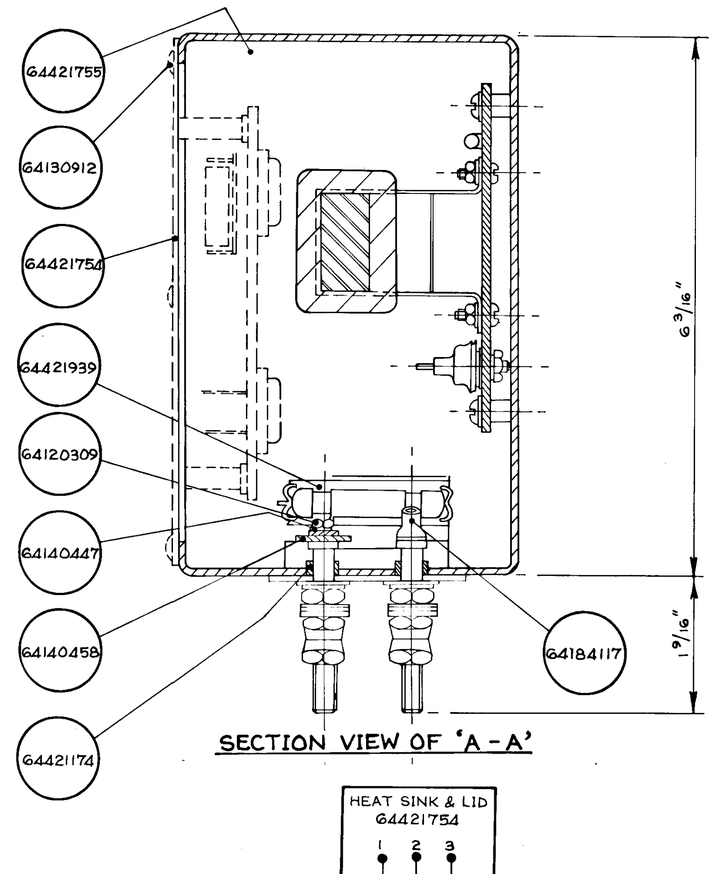
CHECKED

TRACED L.A.W.

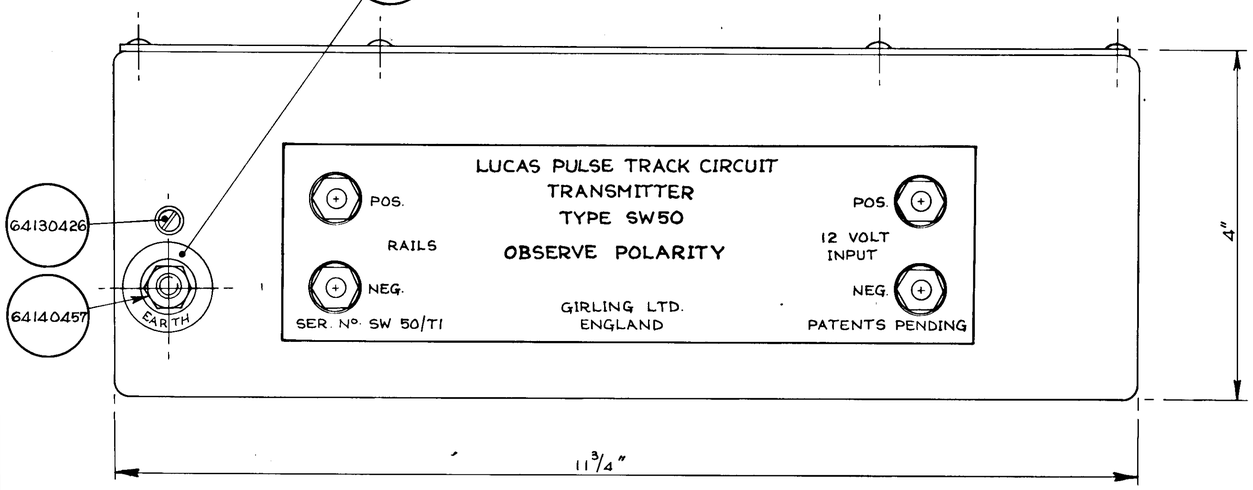
PASSED

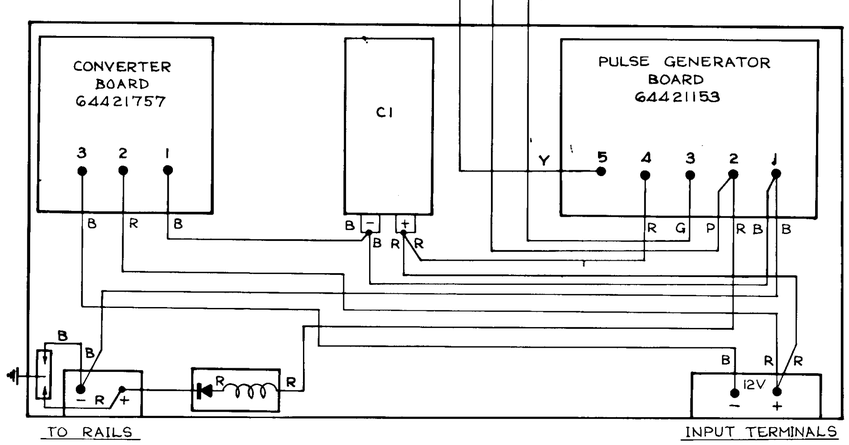
D 68 106





SECTION VIEW OF 'A-A'





PART No.	ISS No	DESCRIPTION	QUANTITY L.H.	QUANTITY R.H.
64421755		SUB ASSEMBLY TRANSMITTER BOX		1
64421754		SUB. ASSY. TRANSMITTER LID		1
64421757		CONVERTER CIRCUIT BOARD S/ASSY.		1
64421153		PULSE CIRCUIT BOARD S/ASSY.		1
64421180		TRANSMITTER BOX LABEL		1
64421173		TERMINAL		4
64421187		TERM. BLOCK		2
64421175		BINDING NUT		10
64421176		LOCK NUT		5
64421177		TERM. WASHER		20
64421172		INSULATING WASHER		4
64184117		HYLUG		7
64421174		INSULATING BUSH		4
64188004		CAPACITOR		1
64184228		BRACKET		2
64184103		FANNING STRIP		1
64184098		FANNING STRIP		1
64184105		CABLE CLAMP		1
64130469		2BA SCREW		10
64140080		SHAKEPROOF WASHER		10
64120309		2BA NUT		4
64140447		SHAKEPROOF WASHER		5
64140458		PLAIN WASHER		4
64130912		4BA SCREW		6
64184106		CABLE CLAMP		1
64181968		DIODE TYPE EMG 74 DD4		1
64421937		BRACKET		1
64421939		GAS DISCHARGE UNIT (S5A)		1
64421932		BRACKET - S/A		1
64421936		TERMINAL		1
64421935		LABEL		1
64130426		SCREW		1
64140457		WASHER		1
64131036		SCREW		1
64100191		NUT		1
64421907		COIL		1
64421926		COIL WASHER		1
64120311		NUT		1
64140449		SHAKEPROOF WASHER		1

DRG. No. 64042219

NOTE:

(1) ALL WIRING TO BE 40/.0076.

(2) REMOVE PAINT LOCALLY FROM INSIDE OF BOX BEFORE FITTING BRACKET 64421932 TO ENSURE ELECTRICAL CONTACT.

(3) LEADS TO GAS DISCHARGE TUBE TO BE SOLDERED TO CARRY TERMINALS. TERMINAL NUTS TO BE LOCKED IN POSITION WITH SHELLAC.

HYLUGS 64184117 MUST BE CRIMPED TO WIRING LEADS AND NOT SOLDERED.

COLOUR CODE

Y - YELLOW B - BLACK
G - GREEN R - RED
P - PURPLE

INTER-UNIT WIRING DIAGRAM

This plan is retraced from Drg. dated 25.7.68.

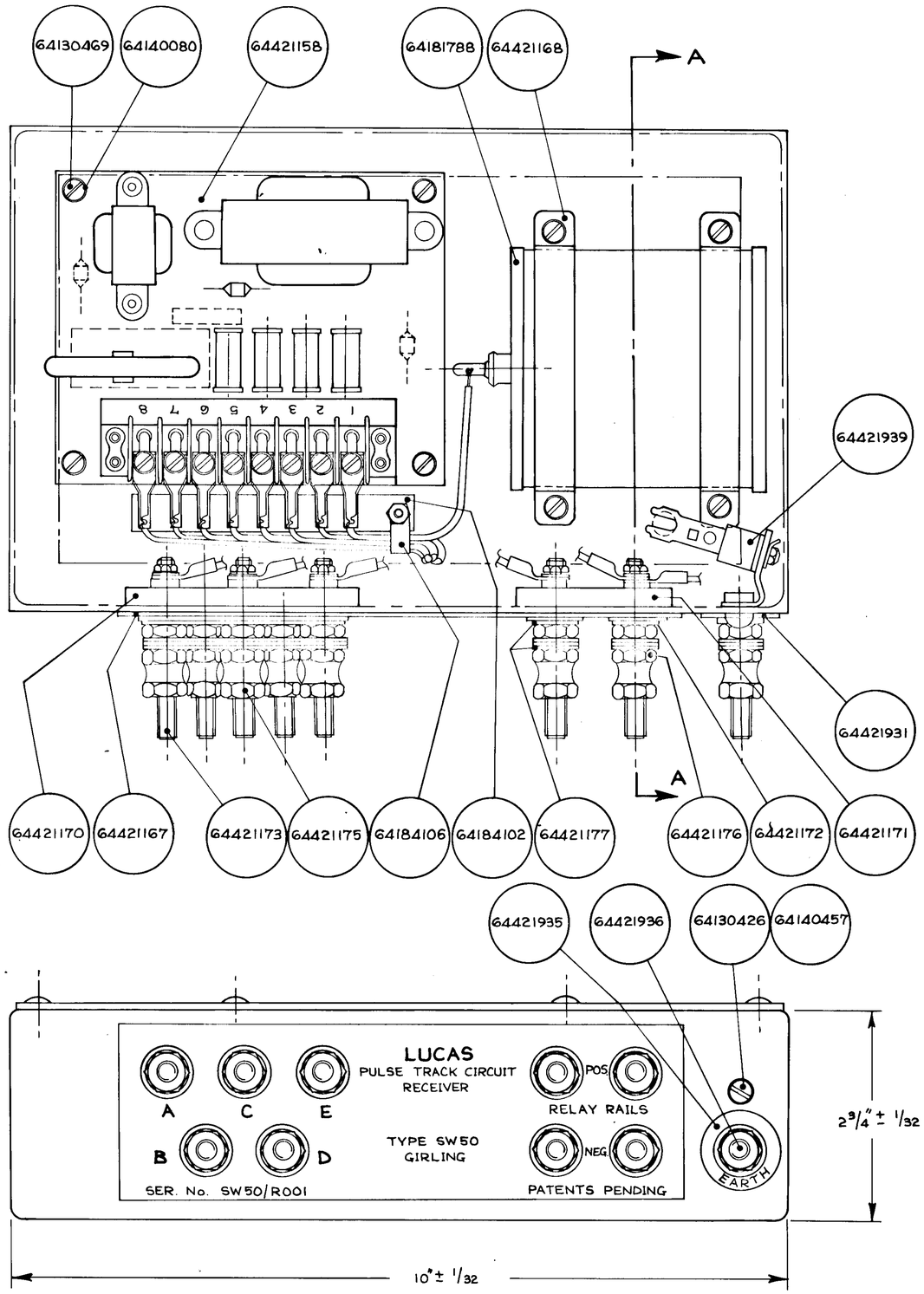
SOUTH AUSTRALIAN RAILWAYS

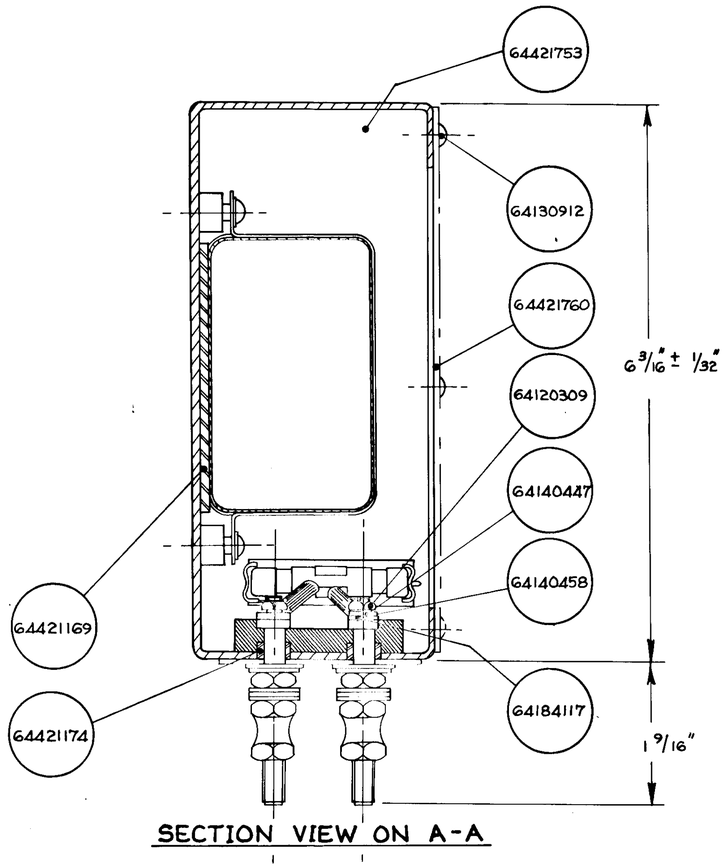
TRANSMITTER BOX ASSY.

GIRLING PTTC SW50 MARK II

SCALE: FULL SIZE	SIGNAL & TELEG. ENGINEER	DRAWN LUCAS GIRLING	CHECKED
28 - 10 - 76		TRACED L.A.W.	PASSED

D 68 107





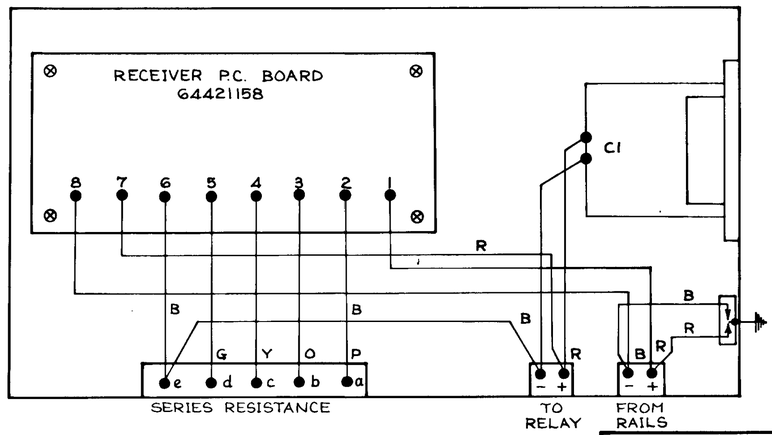
SECTION VIEW ON A-A

PART No.	ISS.No	DESCRIPTION	QUAN.
64421753		RECEIVER BOX 5/A	1
64421760		RECEIVER BOX LID	1
64421158		RECEIVER CIRCUIT BOARD ASSEMBLY	1
64181788		CAPACITOR	1
64421168		CAPACITOR CLAMP	2
64421169		RESILIENCE PAD	1
64421170		TERMINAL BLOCK	1
64421171		TERMINAL BLOCK	1
64421167		LABEL	1
64421173		TERMINAL	9
64421174		INSULATOR BUSH	9
64421175		BINDING NUT	20
64421176		LOCK NUT	10
64421177		TERMINAL WASHER	40
64421172		INSULATING WASHER	9
64184117		HYLUG	11
64184102		FANNING STRIP	1
64184106		CABLE CLAMP	1
64120309		2 B.A. NUT	9
64140447		SHAKEPROOF WASHER	9
64140458		PLAIN WASHER	9
64130469		2 B.A. SCREW	8
64140080		SHAKEPROOF WASHER	8
64421939		SUB-ASSY GAS (53A) GAS DISCHARGE TURE+CLIP	1
64130912		4 B.A. SCREW	6
64421931		5/A BRACKET	1
64421936		TERMINAL	1
64421935		LABEL	1
64130426		SCREW	1
64140457		WASHER	1

DRAWING No. 64042218

NOTE:

1. ALL WIRING TO BE 40/.0076.
2. REMOVE PAINT LOCALLY FROM INSIDE OF BOX BEFORE FITTING BRACKET 64421931 TO ENSURE ELECTRICAL CONTACT.
3. LEADS TO GAS DISCHARGE TUBE TO BE SOLDERED TO CARRIER TERMINALS. TERMINAL NUTS TO BE LOCKED IN POSITION WITH SHELLAC.
4. HYLUGS 64184117 MUST BE CRIMPED TO WIRING AND NOT SOLDERED.



INTER-UNIT WIRING DIAGRAM

COLOUR CODE:

B – BLACK
R – RED
O – ORANGE
Y – YELLOW
G – GREEN
P – PURPLE

SOUTH AUSTRALIAN RAILWAYS

RECEIVER BOX ASSEMBLY

GIRLING PTTC SW50 MK. II

SCALE: FULL SIZE

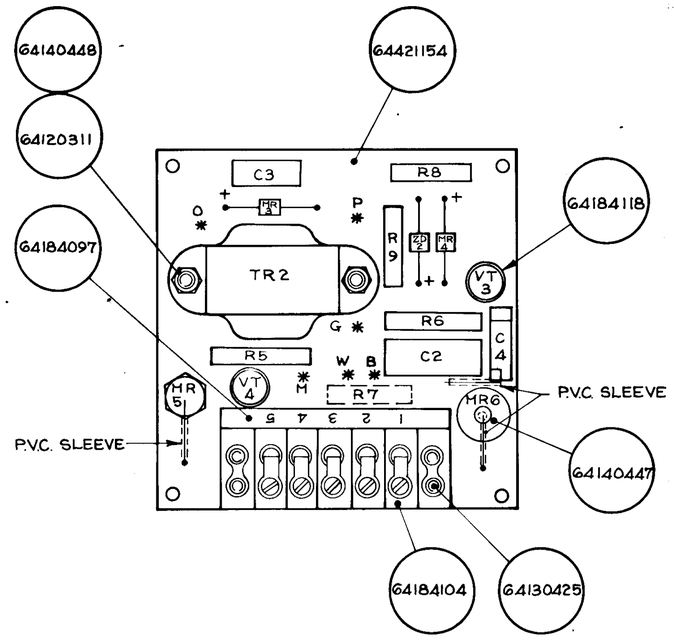
13 - 10 - 76

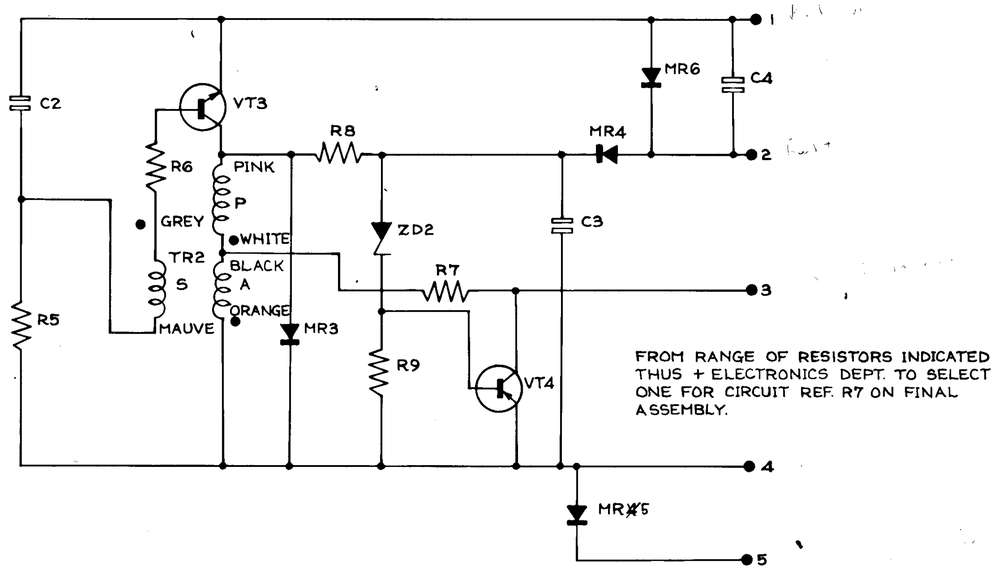
SIGNAL & TELEG. ENGINEER

DRAWN LUCAS GIRLING | CHECKED | TRACED L.A.W. | PASSED

D 68 108

Plan Retraced From Drg. Dated 26.7.68.





FROM RANGE OF RESISTORS INDICATED THUS + ELECTRONICS DEPT. TO SELECT ONE FOR CIRCUIT REF. R7 ON FINAL ASSEMBLY.

CIRCUIT REF.		PART No.	Q'TY.	DESCRIPTION	TYPE	VALUE
		64421154	1	CIRCUIT BOARD		
R5		64181506	1	RESISTOR	2H53	330K OHM
R6		64181507	1	RESISTOR	2H53	330 OHM
R8		64181505	1	RESISTOR	4AP2	820 OHM
R9		64181504	1	RESISTOR	4AP2	330 OHM
C2		64188002	1	CAPACITOR	MK5	2.2 M.F.D.
C3		64188001	1	CAPACITOR	MK5	0.22 M.F.D.
VT3		64186175	1	TRANSISTOR	DT 1121	
VT4		64186022	1	TRANSISTOR	ACY 19	
		64184118	2	TRANSIPAD		
MR 3 & 4		64186373	2	DIODE	DD003	
MR5		64186377	1	DIODE	DD 4520A	
MR6		64186372	1	DIODE	GEX 541	
ZD2		64186376	1	ZENER DIODE	BZC 2018	
TR2		64421185	1	TRANSFORMER		
		64184104	1	TERMINAL STRIP		
		64184097	1	MARKER STRIP		
C4		64181967	1	CAPACITOR	C280AE A470K	0.5 M.F.D.
		64120311	2	NUTS		
		64130425	6	SCREWS		
		64140448	6	SHAKEPROOF WASHERS		
		64140447	1	SHAKEPROOF WASHER		
	+	64181495		RESISTOR	4AP2	10 OHM
	+	64181496		RESISTOR	4AP2	12 OHM
	+	64181497		RESISTOR	4AP2	15 OHM
	+	64181498		RESISTOR	4AP2	18 OHM
	+	64181499		RESISTOR	4AP2	22 OHM
	+	64181500		RESISTOR	4AP2	27 OHM
	+	64181501		RESISTOR	4AP2	33 OHM
	+	64181502		RESISTOR	4AP2	39 OHM
	+	64181503		RESISTOR	4AP2	47 OHM
2	+	64181539		RESISTOR	4AP2	56 OHM
2	+	64181538		RESISTOR	4AP2	68 OHM
A 1910	+	64181780		RESISTOR	4AP2	82 OHM
A 1910	+	64181781		RESISTOR	4AP2	100 OHM

A 1910

DRAWING No. 64421153

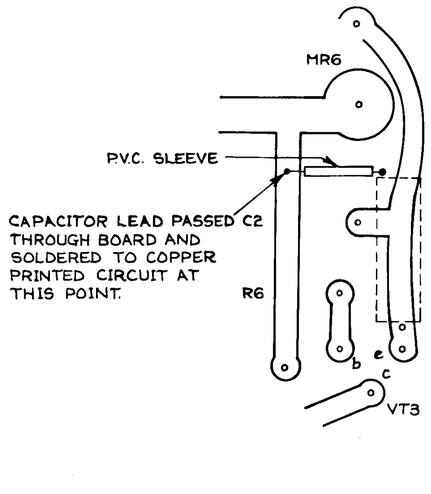
NOTES :-

1. RESISTOR R7 TO BE SELECTED & FITTED ON FINAL TEST.
2. MR3, MR4, & ZD2 LEADS TO BE LOOPED & FREE FROM STRAIN.
3. ALL COMPONENTS TO BE MOUNTED AS CLOSE AS POSSIBLE TO THE CIRCUIT BOARD.
4. TR2 TRANSFORMER MUST HAVE THE INSULATING FILM REMOVED FROM LEWMEX WIRES BEFORE SOLDERING.

KEY TO COLOUR CODE :-

B —— BLACK
M —— MAUVE
O —— ORANGE
G —— GREY
W —— WHITE
P —— PINK

DETAIL OF CONNECTION FOR CAPACITOR C4



5945-0800

SOUTH AUSTRALIAN RAILWAYS

PULSE GENERATOR BOARD
SUB ASSEMBLY

GIRLING PTTC SW50 MARK II

SCALE:

4 - 10 - 76

SIGNAL & TELEG. ENGINEER

DRAWN LUCAS GIRLING

CHECKED

TRACED L.A.W.

PASSED

Plan Retraced From Drawing Dated 25-7-68.

D68109