

LINE INSULATION TEST CIRCUIT (SD-2H142)
TESTS AND ADJUSTMENTS
NO. 2/2B ELECTRONIC SWITCHING SYSTEM

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1. GENERAL

1.01 This section describes a method of testing and adjusting the SD-2H142 line insulation test (LIT) circuit (Fig. 1) used in the No. 2/2B Electronic Switching System (ESS).

1.02 This section is reissued to include a new procedure for changing terminal equipment number or originating equipment number assignments for the LIT circuit. The Equipment Test List is affected by this change. Revision arrows are used to indicate the more significant changes.

1.03 ♦The terminal equipment number (TEN) or originating equipment (OE) number assigned to the line insulation test (LIT) circuit should be changed at 6-month intervals. Rotation of the LIT circuit assignment distributes the test call load more evenly. The new assignment may be in any frame, but it should not be associated with the same first stage as the previous assignment.♦

1.04 Whenever the term TOUCH-TONE® telephone service is used, it refers to the equipment required to provide this service to the customer.

1.05 New (conventional) service order codes were adopted for use with the EF-2 and 2B-EF-2 generic programs. However, the translations can be configured with the old (No. 2 ESS unique) service order codes as an option. These old codes are common to all previous No. 2/2B ESS generic programs. The EF-2 and 2B-EF-2 generic programs can be arranged to recognize either option. In this section, the term "conventional (new)" or "No. 2 ESS unique (old)" is used to identify the service order code for the keywords in each TTY input message given.

1.06 The LIT circuit is used to test subscriber lines for insulation defects. These defects cause leakage currents to flow which, if permitted to persist, result in false originations and permanent signals and also degrade voice transmission.

1.07 The LIT circuit tests and adjustments are ♦to be performed at 6-month intervals♦ or when malfunction of the circuit is suspected. Malfunction of the LIT circuit is suspected when either an abnormal number of LIT failures occurs or the TTY printout M LI ABT indicates abortion of automatic line insulation test (ALIT) program exercises due to trouble. (The ALIT program runs periodic checks of the LIT circuit to assure measurement accuracy.)

1.08 The tests covered are as follows:

A. Access Trunk Control Test: This test checks the test circuit state changes from the trunk test panel (TTP).

B. Detector Gain Test and Adjustment: This test checks that, with proper gain adjustment, ferros 0, 1, and 2 will change states when the correct level of current is detected.

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C. Self Checking of Line Insulation

Test Circuit: This test checks that the line insulation test circuit can signal the appropriate ferrod sensor (scan point) in the unit by properly converting a small direct current to a binary code.

D. Changing TEN or OE Assignment:

Changing the TEN or OE of the LIT circuit is necessary in order to reduce wear and tear on the switching network.

1.09 For more information on TTP operation, refer to Section 232-130-301, Trunk Test Panel—Method of Operation.

1.10 The keys on the TTP may be either a locking or a nonlocking type. In order to differentiate between the two types of keys, the use of a locking type key shall be identified by the words “operate” and “release” and the use of the nonlocking type key shall be identified by the word “depress” in the ACTION column.

Note: Nonlocking keys require a depression of at least one-half second during periods of light traffic and at least one second during periods of very heavy traffic to ensure system recognition.

1.11 Lettered Steps: A letter, a, b, c, etc, added to a step number in Part 3 or 4 of this section indicates an action which may or may not be required depending on local conditions. The condition under which a lettered step or series of lettered steps should be made is given in the ACTION column, and all steps governed by the same condition are designated by the same letter within a test. Where a condition does not apply, all steps designated by that letter should be omitted.

2. APPARATUS

2.01 The following apparatus is required to perform these tests. Equivalent apparatus may be substituted.

- (a) KS-14510 L1 volt-ohm-milliammeter (VOM).
- (b) One pair of KS-14510 L3 test leads equipped with an alligator clip at one end and a connector at the other end. Insulate alligator clips with a 108 cord tip (insulating tubing).

(c) Two 1W13A cord assemblies with a 360A tool (adapter) on each end of each cord assembly and two number 30 Mueller Mini-Gator clips (insulated by a 32 Mueller insulating sleeving) for each cord assembly.

(d) Blocking and insulating tools (508A) as required.

3. PREPARATION

3.01 For proper operation of the line insulation test circuit, ensure that the voltage working limits are within the limits given in SD-2H142. When replacing circuit packs in the unit, the associated power removal switch must be operated to remove dangerous voltages and to remove power from the plug-in circuit packs and the CT and M1 relays. To remove power from the remaining relays, the corresponding PD PWR OFF key must be turned to the vertical position.

3.02 Before beginning tests, ensure that all relays are in the released state and that the LIT circuit is not traffic busy.

3.03 Refer to the office records to obtain the following information about the circuit to be tested:

- (a) Trunk group number (TGN)
- (b) Member number (MEMN)
- (c) Supervisory scan point number (SPN).

3.04 Verify the scan point numbers obtained from the office records as follows:

At the maintenance TTY, type in:

A VY:TRK:aaa bbb!

aaa = TGN

bbb = MEMN

The system response for offices using No. 2 ESS unique (old) code is as follows:

AR VY TRK aaa bbb
TEN nn gcsl

.
 DSP ss rrb
 .
 .
 .
 END

.
 END

ss = scanner number

rr = scanner row

bb = bit in row

The system response for offices using conventional (new) code is as follows:

AR VY TRK aaa bbb
 OE nn gcsi
 .
 .
 .
 DSP ss rrb
 .
 .

The bb bit represents the first ferrod sensor (0) in the scanner row that is associated with the specific circuit. All other ferrod sensors assigned to the same circuit follow in consecutive order (0, 1, 2, etc). Refer to the output message manual (OM-2H200) for explanation of other data fields, if required.

3.05 The following is a step-by-step procedure to make the circuit traffic busy and connect it to the TTP.

STEP	ACTION	VERIFICATION
All Tests		
1	At telephone set on TTP— Operate access trunk 1 key.	
2	Lift handset off-hook, or operate TRFR key at TEL CKT on TTP if using headset.	At telephone set— Access trunk 1 lamp lighted. At ACCESS TRUNK 1 CONTROL— SUPV lamp lighted. At TEL CKT— Dial tone received or TRFR key lamp lighted.
3	At TOUCH-TONE dial— Dial 1 + TGN + MEMN + ST.	At ACCESS TRUNK 1 CONTROL— EQPT ST lamp lighted steadily or flashing at a rate of 120 interruptions per minute. At MISC TEST CONTROL— P&E lamp lighted if connection was successful.
		Note: If the EQPT ST lamp is flashing and the P&E lamp is not lighted steadily, the TTP is not connected to the circuit to be tested.
4a	If the P&E is not lighted steadily— At ACCESS TRUNK 1 CONTROL— Depress RLS key.	
5a	Repeat Steps 3 and 4a until connection is successful.	

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STEP	ACTION	VERIFICATION
6	At telephone set— Place handset on-hook, or release TRFR key at test and control unit.	At telephone set— ACCESS TRUNK 1 lamp extinguished. At TEL CKT— TRFR lamp extinguished.
4. METHOD		(2) Troubleshoot the circuit which failed.
4.01	If a verification procedure fails or if a malfunctioning circuit is indicated during any part of the tests, proceed as follows:	(3) Replace faulty circuit components using standard repair procedures.
	(1) Discontinue the test.	(4) Repeat the test that failed. If verification is successful continue the test.

STEP	ACTION	VERIFICATION
A. Access Trunk Control Test		
7	At ACCESS TRUNK 1 CONTROL— Depress VM key.	At ACCESS TRUNK 1 CONTROL— VM key lamp lighted. At VOLTMETER CONTROL— 100K lamp lighted. At VOLTMETER— Meter indicates 0.
8	At VOLTMETER CONTROL— Operate VM REV key.	At VOLTMETER— Meter indicates between 95 and 105 volts on the 120-volt scale. At VOLTMETER CONTROL— VM REV key lamp lighted.
9	Release VM REV key.	At VOLTMETER CONTROL— VM REV lamp extinguished. At VOLTMETER— Meter indicates 0.
10	At STATE CHANGE CONTROL— Set PD GROUP switch to 0-5 position.	
11	At PERIPHERAL DECODER POINTS— Operate 0, 1, 2, 3, 4, and 5 keys.	At PERIPHERAL DECODER POINTS— 0, 1, 2, 3, 4, and 5 lamps lighted.
12	Depress AT 1 key.	At circuit under test— Relays A, B, C, D, E, and F operated.
13	At PERIPHERAL DECODER POINTS— Release 5 key.	At PERIPHERAL DECODER POINTS— 5 lamp extinguished.
14	Depress AT 1 key.	At circuit under test— Relay F released. Relays A, B, C, D, and E remain operated.

STEP	ACTION	VERIFICATION
15	At PERIPHERAL DECODER POINTS— Release 4 key.	At PERIPHERAL DECODER POINTS— 4 lamp extinguished.
16	Depress AT 1 key.	At circuit under test— Relay E released. Relays A, B, C, and D remain operated.
17	At PERIPHERAL DECODER POINTS— Release 3 key.	At PERIPHERAL DECODER POINTS— 3 lamp extinguished.
18	Depress AT 1 key.	At circuit under test— Relay D released. Relay A, B, and C remain operated.
19	At PERIPHERAL DECODER POINTS— Release 2 key.	At PERIPHERAL DECODER POINTS— 2 lamp extinguished.
20	Depress AT 1 key.	At circuit under test— Relay C released. Relays A and B remain operated.
21	At PERIPHERAL DECODER POINTS— Release 1 key.	At PERIPHERAL DECODER POINTS— 1 lamp extinguished.
22	Depress AT 1 key.	At circuit under test— Relay B released. Relay A remains operated.
23	At PERIPHERAL DECODER POINTS— Release 0 key.	At PERIPHERAL DECODER POINTS— 0 lamp extinguished.
24	Depress AT 1 key.	At circuit under test— Relay A released.
25	At STATE CHANGE CONTROL— Set PD GROUP switch to 6-11 position.	
26	At PERIPHERAL DECODER POINTS— Operate 6 key.	At PERIPHERAL DECODER POINTS— 6 lamp lighted.
27	Depress AT 1 key.	At circuit under test— Relay G operated.
28	At PERIPHERAL DECODER POINTS— Release 6 key.	At PERIPHERAL DECODER POINTS— 6 lamp extinguished.
29	Depress AT 1 key.	At circuit under test— Relay G released.
30	At PERIPHERAL DECODER POINTS— Operate 7 and 8 keys.	At PERIPHERAL DECODER POINTS— 7 and 8 lamps lighted.

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STEP	ACTION	VERIFICATION
31	Depress AT 1 key.	At VOLTMETER— Meter indicates between 28 and 38 volts on 120-volt scale. At circuit under test— Relays H and J operated.
32	At PERIPHERAL DECODER POINTS— Release 7 key.	At PERIPHERAL DECODER POINTS— 7 lamp extinguished.
33	Depress AT 1 key.	At VOLTMETER— Meter indicates between 40 and 50 volts on 120-volt scale. At circuit under test— Relay H released. Relay J remains operated.
34	At PERIPHERAL DECODER POINTS— Operate 9 key.	At PERIPHERAL DECODER POINTS— 9 lamp lighted.
35	Depress AT 1 key.	At VOLTMETER— Meter indicates between 15 and 25 volts on the 120-volt scale. At circuit under test— Relay K operated. Relay J remains operated.
36	At PERIPHERAL DECODER POINTS— Release 8 and 9 keys.	At PERIPHERAL DECODER POINTS— 8 and 9 lamps extinguished.
37	Depress AT 1 key.	At VOLTMETER— Meter indicates 0. At circuit under test— Relays J and K released.
38	At VOLTMETER CONTROL— Operate FEMF key.	At VOLTMETER CONTROL— FEMF lamp lighted. 100K lamp extinguished. VOLTMETER indicates 0.
39	At PERIPHERAL DECODER POINTS— Operate 11 key.	At PERIPHERAL DECODER POINTS— 11 lamp lighted.
40	Depress AT 1 key.	At VOLTMETER— Meter indicates between 42.75 and 52.50 volts on the 120-volt scale. At circuit under test— Relays M, M1, and CT operated.
41	At PERIPHERAL DECODER POINTS— Release 11 key.	At PERIPHERAL DECODER POINTS— 11 lamp extinguished.

STEP	ACTION	VERIFICATION
42	Depress AT 1 key.	At VOLTMETER— Meter indicates 0. At circuit under test— Relays M, M1, and CT released.
43	At VOLTMETER CONTROL— Operate 1K key.	At VOLTMETER CONTROL— 1K lamp lighted. FEMF lamp extinguished.
44	Operate GRD key.	GRD lamp lighted. VOLTMETER indicates 0.
45	At PERIPHERAL DECODER POINTS— Operate 10 key.	At PERIPHERAL DECODER POINTS— 10 lamp lighted.
46b	If LIT circuit has Y option, then at VOLTMETER CONTROL— Operate TR REV key.	
47	Depress AT 1 key.	At VOLTMETER— Meter indicates between 6 and 8 volts on the 24-volt scale. At circuit under test— Relay L operated.
48	At PERIPHERAL DECODER POINTS— Release 10 key.	At PERIPHERAL DECODER POINTS— 10 lamp extinguished.
49	Depress AT 1 key.	At VOLTMETER— Meter indicates 0. At circuit under test— Relay L released.
50c	If detector gain test and adjustment is desired, proceed to Step 7 of Test B.	
51d	If no further tests are desired, then at ACCESS TRUNK 1 CONTROL— Operate RLS key.	At ACCESS TRUNK 1 CONTROL— VM lamp extinguished. SUPV lamp extinguished. RLS lamp extinguished. EQPT ST lamp extinguished. At MISC TEST CONTROL— P&E lamp extinguished.
52d	At telephone set on TTP— Operate green release key.	

B. Detector Gain Test and Adjustment

- 7 At line insulation test circuit—
Check that both the -48 volt and +24 volt

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STEP	ACTION	VERIFICATION
	supplies are operating properly within their assigned limits. (Refer to SD-2H142.)	
8	At STATE CHANGE CONTROL— Set PD GROUP switch to 0-5 position.	
9	At PERIPHERAL DECODER POINTS— Operate 5 key.	At PERIPHERAL DECODER POINTS— 5 lamp lighted.
10	Depress AT 1 key.	At circuit under test— Relay F operated.
11	Insert a piece of fiber or paper between the fixed and break contact of the F relay.	
12	At PERIPHERAL DECODER POINTS— Release 5 key.	At PERIPHERAL DECODER POINTS— 5 lamp extinguished.
13	Depress AT 1 key.	At circuit under test— Relay F released. This will insulate the contacts of the F relay so as to isolate the oscillator from the rest of the circuit.
14	Connect the positive voltmeter lead to the positive 24-volt power supply and the negative lead to terminal 15 of terminal strip (TS) (C) (Fig. 1). BE EXTREMELY CAUTIOUS NOT TO SHORT THE TERMINALS.	
15	Clip 1W13A cord from test point (TP) 1 [terminal 54 of TS (C)] to a convenient ground point.	
16	Clip 1W13A cord from TP2 [terminal 55 of TS (C)] to terminal 25 of TS (A).	
17	Adjust variable resistor (R40) for a VOM indication of 0 to 0.5 volts.	At VOM— Indication should be less than 0.5 volts.
18	At line insulation test circuit— Move 1W13A cord connection from TS (A) terminal 25 to terminal 26 of TS (A).	
19	Adjust variable resistor (R40) for a VOM indication of greater than 1.0 volt.	At VOM— Indication should be greater than 1.0 volt.

Note: R40 must be adjusted properly before attempting detector unit test. This adjustment should satisfy the voltage requirements for the next two steps.

STEP	ACTION	VERIFICATION
20	At line insulation test circuit— Move 1W13A cord connection from TS (A) terminal 26 to TS (A) terminal 25.	At VOM— Indication should be 0.5 volts or less.
21	At line insulation test circuit— Move 1W13A cord connection from TS (A) terminal 25 to TS (A) terminal 26.	At VOM— Indication should be 1.0 volt or greater.
22e	If voltage reading of Steps 16 through 20 fails verification— Remove power by operating PWR OFF key on SD-2H142 circuit mounting plate.	
23e	Replace circuit pack (CP) A178 and restore power.	
24e	Move 1W13A cord connection from TS (A) terminal 26 to TS (A) terminal 25 and repeat Steps 16 through 21.	
25f	If correct voltmeter readings were obtained in Steps 16 through 21— Disconnect voltmeter leads and remove all blocking tools.	
26c	If self checking of line insulation test circuit is desired, then proceed to Step 7 of Test C.	
27d	If no further tests are desired, then at ACCESS TRUNK 1 CONTROL— Operate RLS key.	At ACCESS TRUNK 1 CONTROL— SUPV lamp extinguished. EQPT ST lamp extinguished. At MISC TEST CONTROL— P&E lamp extinguished.
28d	At telephone set on TTP— Operate green release key.	

C. Self Checking of Line Insulation Test Circuit

Note: Use the TTY printout from paragraph 3.04 to determine the trunk scanner and number of the scanner row associated with the scan points assigned to the outgoing trunk circuit.

- 7 At maintenance TTY—
For No. 2 ESS offices type in:
UBRL TS:RSN:ssrr!

ss = Number of trunk scanner in decimal
(00-11)

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STEP	ACTION	VERIFICATION
	<p>rr = Number of scanner row to be displayed in decimal (0-63).</p> <p>For No. 2B ESS offices type in: MON:TSSN: ssrr;RDT LAMPS!</p> <p>ss = Number of trunk scanner in decimal (0-11 for the 2B-EF-1 generic program) or (00-30 for the 2B-EF-2 generic program) rr = Number of scanner row in decimal (0-63) RDT LAMPS = Direct the result to the DISPLAY BUFFER.</p>	<p>At maintenance center (MC) for No. 2 ESS or at system status panel (SSP) for No. 2B ESS— Scanner row containing specific scan points displayed on DISPLAY BUFFER lamps. Lamps associated with ferrod sensors connected to circuit under test extinguished.</p> <p>Note: To verify the correct ferrods are nonsaturated, compare the number of the DISPLAY BUFFER lamps with the column numbers found in the office records.</p>
8	<p>At STATE CHANGE CONTROL— Set PD GROUP switch to 6-11 position.</p>	
9	<p>At PERIPHERAL DECODER POINTS— Operate 8 key.</p>	<p>At PERIPHERAL DECODER POINTS— 8 lamp lighted.</p>
10	<p>Depress AT 1 key.</p>	<p>At circuit under test— Relay J operated. At DISPLAY BUFFER— Lamps associated with ferrod sensors 0, 1, and 2 remain extinguished.</p>
11	<p>At PERIPHERAL DECODER POINTS— Operate 9 key.</p>	<p>At PERIPHERAL DECODER POINTS— 9 lamp lighted.</p>
12	<p>Depress AT 1 key.</p>	<p>At DISPLAY BUFFER— Lamp associated with ferrod sensor 0 lighted. At circuit under test— Relay K operated.</p>
13	<p>At PERIPHERAL DECODER POINTS— Operate 11 key.</p>	<p>At PERIPHERAL DECODER POINTS— 11 lamp lighted.</p>
14	<p>Depress AT 1 key.</p>	<p>At DISPLAY BUFFER— Lamps associated with ferrod sensor 1 and 2 remain extinguished. Lamp associated with ferrod sensor 0 remains lighted. At circuit under test— Relays M, M1, and CT operated.</p>
15	<p>At PERIPHERAL DECODER POINTS— Operate 7 key.</p>	<p>At PERIPHERAL DECODER POINTS— 7 lamp lighted.</p>

STEP	ACTION	VERIFICATION
16	Depress AT 1 key.	At DISPLAY BUFFER— Lamp associated with ferrod sensor 1 lighted. Lamp associated with ferrod sensor 0 remains lighted. Lamp associated with ferrod sensor 2 remains extinguished. At circuit under test— Relay H operated.
17	At PERIPHERAL DECODER POINTS— Release 9 key.	At PERIPHERAL DECODER POINTS— Lamp 9 extinguished.
18	Depress AT 1 key.	At DISPLAY BUFFER— Lamps associated with ferrod sensors 0 and 1 remain lighted. Lamp associated with ferrod sensor 2 remains extinguished. At circuit under test— Relay K released.
19	Release 7 key.	At PERIPHERAL DECODER POINTS— Lamp 7 extinguished.
20	Depress AT 1 key.	At DISPLAY BUFFER— Lamp associated with ferrod sensor 2 lighted. Lamps associated with ferrod sensors 0 and 1 remain lighted. At circuit under test— Relay H released.
21	Release 8 and 11 keys.	At PERIPHERAL DECODER POINTS— Lamps 8 and 11 extinguished.
22	Depress AT 1 key.	At DISPLAY BUFFER— Lamps associated with ferrod sensors 0, 1, and 2 extinguished. At circuit under test— Relays J, M, M1, and CT released.
23e	If the lamps associated with the ferrod sensors do not light or extinguish as specified— Remove power from circuit pack by operating PWR OFF key on SD-2H142 circuit mounting panel.	
24e	Replace CPA179, restore power, and repeat the detector gain and adjustment test and the self-checking test.	

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STEP	ACTION	VERIFICATION
25	At maintenance TTY— For No. 2 ESS offices type in: UB SY:CLB!	
26	For No. 2B ESS offices type in: STOP:UTIL!	
27	At ACCESS TRUNK 1 CONTROL— Operate RLS key.	At ACCESS TRUNK 1 CONTROL— SUPV lamp extinguished. EQPT ST lamp extinguished. At MISC TEST CONTROL— P&E lamp extinguished.
28	At telephone set on TTP— Operate green release key.	All lamps extinguished. All keys in normal position.

D. Changing TEN or OE Assignment

- 1 From office records, obtain the trunk group number (TGN) and member number (MEMN) of the LIT circuit.
- 2 Remove the LIT circuit from service as follows:
- 2 At maintenance TTY—
Type in:
M SV:RMV ggg mmm!
ggg = trunk group number
mmm = member number in the group.
- 3 From office records, select new TEN or OE for the LIT circuit.

Note: The new TEN or OE should not be associated with the same first stage as the previous assignment.
- 4 To change the TEN or OE of the LIT circuit, proceed as follows:
- 5 At maintenance TTY—
For No. 2 ESS offices type in:

A RC:SVC/
OGP nnn/
OMB nnn/
TEN nn gcsl/
NTE nn gcsl/
END!

STEP	ACTION	VERIFICATION
	For No. 2B ESS offices type in:	
	A RC:SVC/ OGP nnn/ OMB nnn/ OE nn gcsl/ IOE nn gesl/ END!	
	Make the appropriate wiring change for the new TEN or OE assignment.	
6	Enter TEN or OE change into office records.♦	

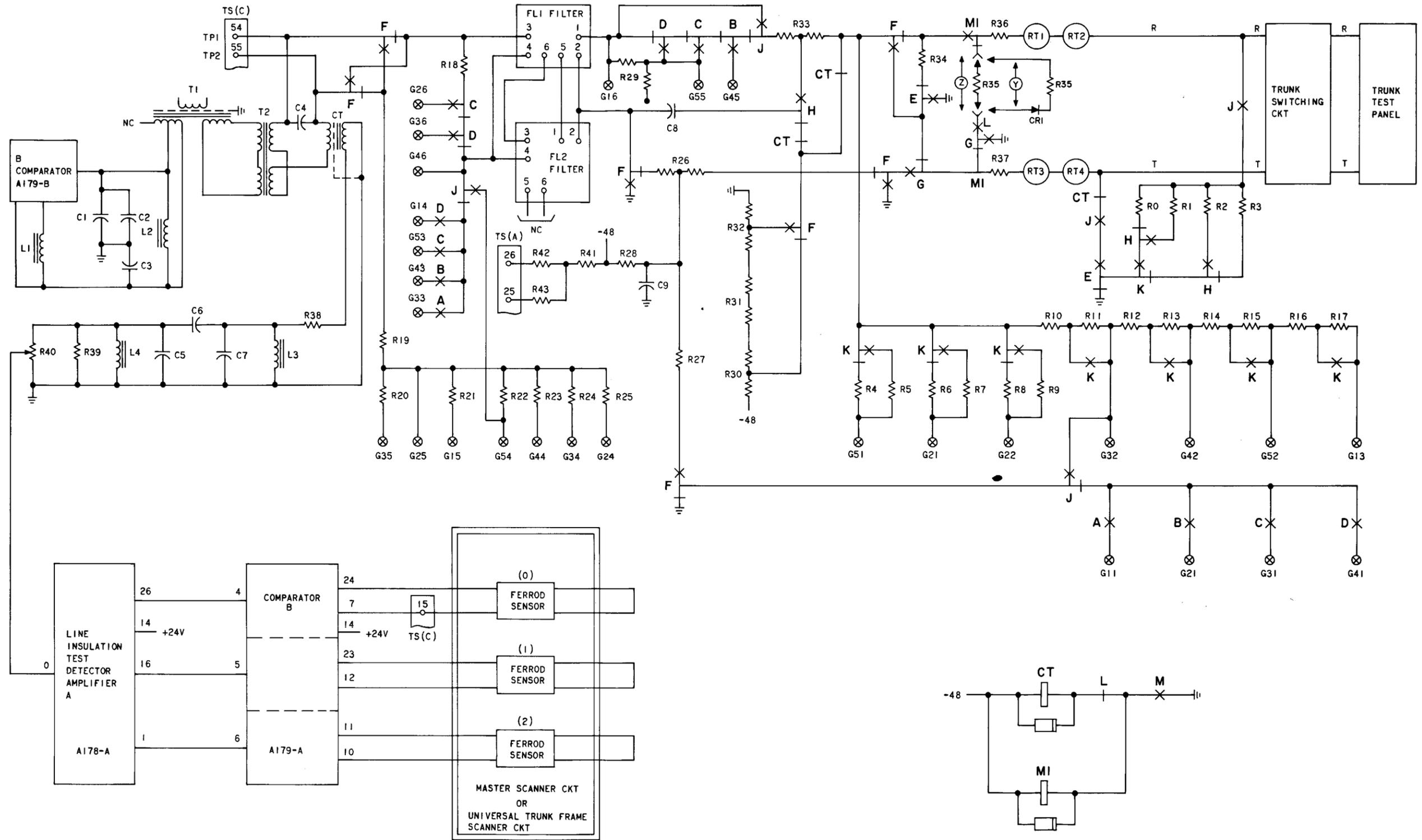


Fig. 1—Line Insulation Test Circuit (SD-2H142-01)