

**7A LOOP RANGE EXTENSION CIRCUIT**  
**(SD-97758-01) TESTS**  
**NO. 2/2B ELECTRONIC SWITCHING SYSTEM**

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**1. GENERAL**

**1.01** This section describes the method of testing the loop range extension (LRE) circuit (SD-97758-01) used in the No. 2/2B Electronic Switching System (ESS). In this document, references to No. 2 ESS also apply to No. 2B ESS unless otherwise noted.

**1.02** This section is being reissued to incorporate validation comments. Since this reissue is a general revision, revision arrows used to denote significant changes have been omitted.

**1.03** The LRE circuit is used to increase the range of the central office to 2800 ohms loop resistance. The LRE circuit provides both voice amplification and increased battery voltage for operation of such lines. The necessity to use an LRE is automatically determined by using translations and a measurement of the subscriber loop resistance by the LRE unit.

**1.04** The following tests may be performed:

**A. Tip and Ring Reversal Test:** This test checks for a tip and ring reversal of the connection to the LRE. Battery should be present on the ring and ground on the tip. A reversal causes the LRE to be inoperative.

**B. Battery Voltage Increase:** This test checks the ability of the LRE to provide increased battery voltage of -78 Vdc.

**C. Frequency Amplification and Bypass State:** This test checks the LRE unit for the proper voice frequency amplification of 6 dB in the active state and that minimum loss is present when the circuit is in the bypass state. The 3-dB state cannot be tested because of the fixed termination provided by the trunk test panel.

**1.05** Part 5 should be referenced for necessary TTY messages to remove or restore an LRE unit.

**1.06** The LRE tests are performed on a periodic basis in accordance with equipment test list procedures or when a malfunction of the circuit is suspected.

**1.07** The tests are performed from the trunk test panel (TTP). For more detailed information about the operation of the TTP, refer to Section 232-130-301, Trunk Test Panel—Method of Operation.

**1.08** The keys on the TTP may be either locking or nonlocking. To differentiate between the two types of keys, the use of a locking type key is identified by the words "operate" and "release"; and the use of a nonlocking type key is identified by the word "depress" in the ACTION column.

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Bell System except under written agreement

**Note:** Nonlocking keys require a depression of at least one-half second to ensure system recognition.

**1.09 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 a series of lettered steps should be made is given in the ACTION column. 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**

**Note:** The following test equipment may be needed to perform these tests. Equivalent apparatus may be substituted. This test equipment is not required if the TTP is already equipped with this equipment.

**2.01** Transmission measuring set (TMS), 23D

**2.02** Variable frequency oscillator (VFO), KS-19353-L4

**2.03** Two 2P4A cord assemblies consisting of a P2B cord, 3 feet long with two 310 plugs.

**3. PREPARATION**

**3.01** Refer to the office records to obtain the network number (NN), concentrator group (CG), concentrator (C), B link (B), and grid (G) of the LRE circuit to be tested.

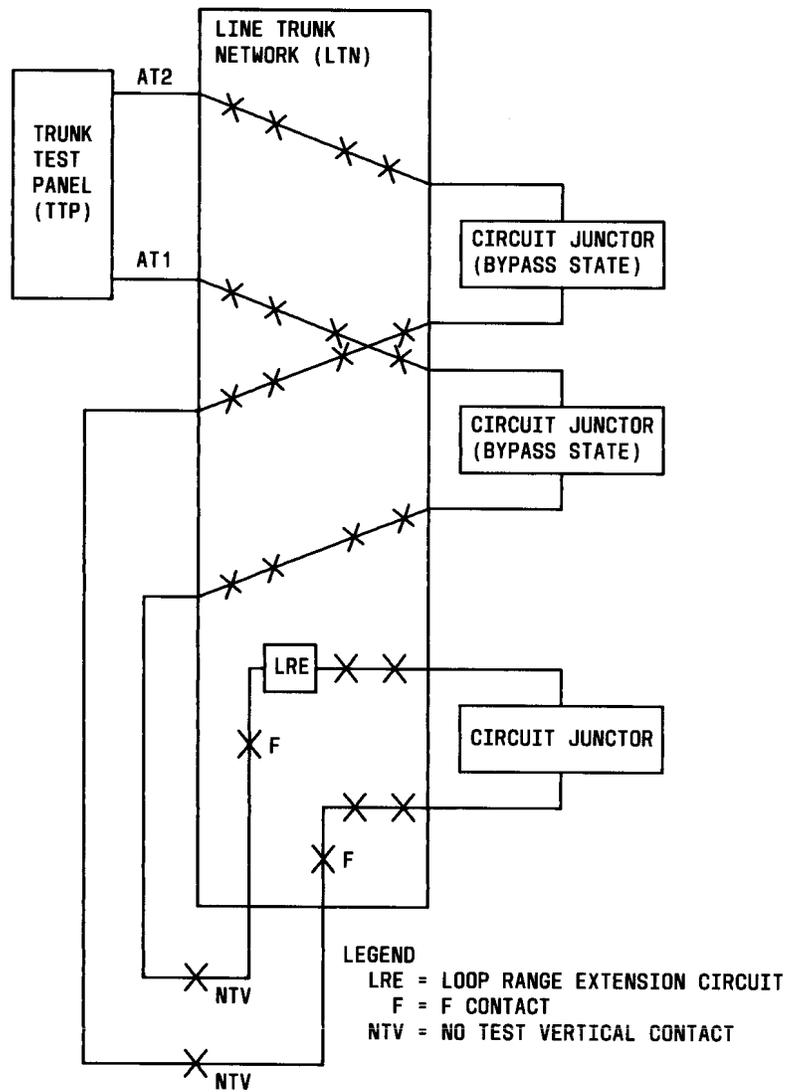
**3.02** The following is a step-by-step procedure to make the circuit traffic busy and connect it to the TTP.

**Note:** Both sides of the LRE unit to be tested are connected to the TTP. The connection must be initiated on access trunk 1 (AT1), and AT2 must be idle. AT1 controls the peripheral decoder (PD) point of the LRE unit, and AT2 controls the peripheral decoder points of the circuit junctor that connects the LRE through to the TTP (Fig. 1).

STEP	ACTION	VERIFICATION
<b>All Tests</b>		
1	At telephone set on TTP— Operate access trunk 1 key.	
2	Lift handset off-hook, or operate TRFR key at test and control unit if using headset.	Access trunk 1 key lamp lighted. Dial tone received. At ACCESS TRUNK 1 CONTROL— SUPV lamp lighted. TRFR lamp lighted if TRFR key is operated.
3	At TOUCH-TONE® dial— Dial 4 + NN + CG + C + B + G + ST.	At ACCESS TRUNK 1 CONTROL— EQPT ST lamp lighted. Steady—circuit idle. 60 ipm—circuit traffic busy. 120 ipm—circuit maintenance busy.  At ACCESS TRUNK 2 CONTROL— SUPV lamp lighted. At MISC TEST CONTROL— P&E lamp lighted if connection was successful. At TRANSMISSION MEASURING CONTROL— RET lamp lighted.

**Note:** If the EQPT ST lamp is flashing at 60 ipm and the P&E lamp is not lighted, the

STEP	ACTION	VERIFICATION
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**Fig. 1—Test Configuration Using Trunk Test Panel to Test a Loop Range Extension Circuit**

TTP is not connected to the LRE unit to be tested.

- 4 If P&E lamp is not lighted—  
Place handset on-hook or release TRFR key.  
Then operate RLS key.
- 5 Repeat Steps 2 and 3 until connection is successful.

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**4. METHOD**

**4.01** If the verification procedure fails or if a malfunctioning circuit is indicated during any part of these tests, proceed as follows.

- (1) Discontinue the test.
- (2) Remove the mate unit of the pair from service. (See paragraphs 5.01 and 5.02.)

The mate unit may be tested using the same procedures.

- (3) Replace the circuit pack.
- (4) Repeat the failing test and if successful, continue the test. See paragraph 5.03 for restoral of the pair of circuits to service.

**A. Tip and Ring Reversal Test**

<b>STEP</b>	<b>ACTION</b>	<b>VERIFICATION</b>
6	At ACCESS TRUNK 1 CONTROL— Depress VM key.	VM lamp lighted. At VOLTMETER CONTROL— 100K lamp lighted.
7	At VOLTMETER CONTROL— Depress METVM key.	METVM lamp lighted. 100K lamp extinguished.
8	At PERIPHERAL DECODER POINTS— Set PD GROUP switch to 0-5 position.	
9	At PERIPHERAL DECODER POINTS— Operate 0 and 1 keys.	At PERIPHERAL DECODER POINTS— 0 and 1 lamps lighted.
10	Depress AT2 key.	Circuit junctor is placed in the local talk state while the LRE is in the idle state. (See Fig. 1 for circuit connections.)
11	At TRANSMISSION MEASURING CONTROL— Depress and hold RET key.	At VOLTMETER CONTROL— Meter indicates between 42.75V and 52.5V.
12	Release RET key.	Voltmeter will indicate a reading which should be ignored at this step.
13	At VOLTMETER CONTROL— Depress FEMF key.	METVM lamp extinguished. FEMF lamp lighted.
14	Operate TR REV key. Operate and hold the RET key.	TR REV lamp lighted. At VOLTMETER CONTROL— Meter indicates 0.0V.
15	Release TR REV and RET keys.	TR REV lamp extinguished.
16a	At PERIPHERAL DECODER POINTS— Release 0 and 1 keys. Depress AT2 key.	At PERIPHERAL DECODER POINTS— 0 and 1 lamps extinguished. Circuit junctor is placed in the bypass state. LRE unit in bypass state.

STEP	ACTION	VERIFICATION
16b	Skip Steps 17 and 18 if additional tests are to be performed; otherwise, do these steps as outlined.	
17	Place handset on-hook or depress the TRFR key.	
18	At ACCESS TRUNK 1 CONTROL— Depress RLS key.	At ACCESS TRUNK 1 CONTROL— VM and SUPV lamps extinguished. At MISC TEST CONTROL— P&E lamp extinguished.
<b>B. Battery Voltage Increase</b>		
STEP	ACTION	VERIFICATION
6	At ACCESS TRUNK 1 CONTROL— Depress VM key.	At ACCESS TRUNK 1 CONTROL— VM lamp lighted. At VOLTMETER CONTROL— 100K lamp lighted.
7	At VOLTMETER CONTROL— Depress MET VM key.	MET VM lamp lighted. 100K lamp extinguished.
8	At PERIPHERAL DECODER POINTS— Set PD GROUP switch to 0-5 position.	
9	At PERIPHERAL DECODER POINTS— Operate 0 and 1 keys.	At PERIPHERAL DECODER POINTS— 0 and 1 lamps lighted.
10	Depress AT2 key.	Circuit junctor is placed in the local talk state while the LRE unit is in the idle state (see Fig. 1 for circuit connections). If VOLTMETER indicates a reading, it should be ignored at this step.
11	At TRANSMISSION MEASURING CONTROL— Depress and hold RET key.	At VOLTMETER CONTROL— Meter indicates between 42.75 and 52.5 volts. (This measures the circuit junctor voltage with the LRE circuit in the bypass state.)
12	Release RET key.	
13	At PERIPHERAL DECODER POINTS— Release the 1 key.	At PERIPHERAL DECODER POINTS— 1 lamp extinguished.
14a	Depress AT1 key.	LRE unit under test is in the active state. At VOLTMETER CONTROL— Meter indicates between 63.0 and 67.0 volts. (Due to line termination, actual -78V reading will not be obtained.)

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<b>STEP</b>	<b>ACTION</b>	<b>VERIFICATION</b>
14b	Depress FEMF key.	
15	At TRANSMISSION MEASURING CONTROL— Depress and hold RET key.	At VOLTMETER CONTROL— Meter indicates momentarily higher value and then drops to voltage measured in Step 11 above. (Depressing the RET key removes the line termination which causes the LRE to return to the bypass state.)
16	Release RET key.	
17	At PERIPHERAL DECODER POINTS— Release 0 key.	At PERIPHERAL DECODER POINTS— 0 lamp extinguished.
18a	Depress AT1 and AT2 keys. Also, depress 100K key.	LRE unit and circuit junctors connected to TTP are placed in bypass state.
18b	Skip Steps 19 and 20 if additional tests are to be performed; otherwise, do these steps as outlined.	
19	Place handset on-hook or depress the TRFR key.	
20	At ACCESS TRUNK 1 CONTROL and ACCESS TRUNK 2 CONTROL— Depress RLS keys.	At ACCESS TRUNK 1 CONTROL— VM lamp extinguished. SUPV lamp extinguished. At ACCESS TRUNK 2 CONTROL— SUPV lamp extinguished. At MISC TEST CONTROL— P&E lamp extinguished.

**C. Voice Frequency Amplification and Bypass**

<b>STEP</b>	<b>ACTION</b>	<b>VERIFICATION</b>
6b	If TTP is equipped with a VFO and TMS— Set SEND switch to VFO position; set MEASURE switch to MEAS 2 position; set TEST SET switch to TMS position.	
7c	If the TTP is not equipped with a VFO and TMS— Connect the 23D TMS to the TM2 jack using the appropriate cable and plugs. Set INPUT switch to 900 position; set DIAL MEAS EXT switch to MEAS position; the ADD DBM switch will be set as applicable.	
8c	Connect the KS-19353 L4 VFO to the TM1 jack using the appropriate cable and plugs. Set OUTPUT LEVEL DBM switches to	

STEP	ACTION	VERIFICATION
	0 positions; set the FUNCTION switch to 900 position; set POWER switch to ON position.	
9	Set VFO to 1000 Hz; set OUTPUT LEVEL at 0 dBm.	
10	At ACCESS TRUNK 1 and 2 CONTROL— Depress XMSN keys.	XMSN lamps lighted.
11	At PERIPHERAL DECODER POINTS— Set PD GROUP switch to 0-5 position.	
12	At PERIPHERAL DECODER POINTS— Operate 0 and 1 keys.	At PERIPHERAL DECODER POINTS— 0 and 1 lamps lighted.
13	Depress AT2 key.	Circuit junctor is placed in the talk state while the LRE is in the idle state (see Fig. 1 for circuit connections).
14	At TTP or portable instruments— Set ADD DBM switch on TMS to -5 position. Adjust output vernier of VFO for an indication of -6 dB at TMS.	At TMS— Meter indicates -6 ±1 dB.
15	At PERIPHERAL DECODER POINTS— Release 1 key.	At PERIPHERAL DECODER POINTS— 1 lamp extinguished.
16	Depress AT1 key.	LRE unit under test is in the active state. At TMS— Meter indicates 4.25 to 6.0 dB higher than in Step 14.
		<b>Note:</b> The difference in the reading is the gain of the LRE unit.
17	At PERIPHERAL DECODER POINTS— Release 0 key.	At PERIPHERAL DECODER POINTS— 0 lamp extinguished.
18	Depress AT1 key.	LRE unit in bypass state.
19	At TMS— Set ADD DBM switch to -5 position.	At TMS— Meter indicates -6 ±1 dB.
20	At TRANSMISSION MEASURING CONTROL— Operate REV TST key.	At TMS— REV TST lamp lighted. Meter indicates -6 ±1 dB.
21	At PERIPHERAL DECODER POINTS— Operate 0 key.	At PERIPHERAL DECODER POINTS— 0 lamp lighted. LRE unit under test is in the active state.

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<b>STEP</b>	<b>ACTION</b>	<b>VERIFICATION</b>
22	Depress the AT1 key.	At TMS— Meter indicates 4.25 to 6.0 dB higher than in Step 19.  <b>Note:</b> The difference between the reading, taken in Step 19, is the difference of gain in the opposite direction of transmission.
23	At PERIPHERAL DECODER POINTS— Release 0 key.	At PERIPHERAL DECODER POINTS— 0 lamp extinguished.
24	Depress AT2 key.	LRE unit and circuit junctor connected to tip are placed in bypass state. At TMS— Meter indicates -6 ±1 dB.
25	Place handset on-hook or depress the TRFR key.	
26	At ACCESS TRUNK 1 and ACCESS TRUNK 2 CONTROL— Depress RLS key.	At ACCESS TRUNK 1 and 2 CONTROL— XMSN lamp extinguished. SUPV lamp extinguished. At MISC TEST CONTROL— P&E lamp extinguished. At TTY— M DGN ATP message is printed.
27c	Remove all external equipment at TTP.	

**5. REMOVAL OR RESTORAL OF AN LRE PLUG-IN UNIT**

**5.01** This operation is necessary because there are two circuits on a plug-in unit. The mate circuit to the one in question must be made busy before removal and diagnosed after restoral.

**5.02** At the TTY, type the following input message to remove both circuits from service:

M RE:RMV:bc defgh!

bc = Network number (0-15)

d = Concentrator group (0-7)

e = Concentrator (0-7)

f = B-link (0-1)

g = Grid (0-7)

h = "Blank" for a single circuit

h = 2 for both amplifiers on the same plug-in unit.

The TTY response should be as follows:

MR RE MB

The circuit(s) are now maintenance busy and the LRE plug-in unit may be removed.

**5.03** After the LRE plug-in unit has been replaced, at the TTY, type in the following input message:

M RE:RST:bc defgh!

bc = Network number (0-15)

d = Concentrator group (0-7)

e = Concentrator (0-7)

f = B-link (0-1)

g = Grid (0-7)

h = "Blank" for a single circuit

= 2 for both amplifiers on the same plug-in unit.

The teletypewriter response should be as follows:

MR RE RST

If the preceding TTY output message is not received, the No. 2/2B ESS Output Manual OM-2H200 should be consulted for further action.