SPECIAL SERVICE LINK LINEUP

PBX TO CENTRAL OFFICE 2-WIRE LINK

USING E6 REPEATERS

CONTENTS PAGE

1. GENERAL

1.01 The E6 repeatered line is used in several types of special service circuits. Each of these special service circuits may consist of one or more of the following links: private branch exchange (PBX) to central office (CO), CO to CO, and CO to station. This section provides the lineup procedure for the PBX to CO 2-wire link.

1.02 This section is reissued to:

(a) Include information on the use of an 830C network at the CO without a network at the PBX

(b) Correct switch designations and settings

(c) Add information on the KS-20501 return loss measuring set (RLMS)

(d) Add information on setting switch S3 of the 54C RLMS.

1.03 The PBX to CO link may include E6 repeaters, repeater disablers, dial long line (DLL) units, tie trunk circuits, and LBO networks on loaded or nonloaded lines. The equipment used in individual links varies widely; therefore, the procedures in this section rely on the circuit layout record (CLR) to provide the necessary details for specific links.

1.04 The CLR provides the following information:

(a) Equipment used at the PBX and the CO.

(b) Initial adjustments or prescription settings of all E6 repeater LBO networks and gain units. Temperature corrections, if required, are included.

(c) Simplex or loop strapping options for E6 repeater disablers.

(d) Diagram of special service circuit showing 1-kHz net loss and echo return loss requirement for each link.

(e) Overall expected measured loss (EML) for the special service circuit.

1.05 Lineup of PBX to CO links begins with initial adjustments of the E6 repeater LBO networks and gain units according to the information on the CLR. Gain is checked with the J99254A (54A) transmission measuring set (TMS) and, if required, final LBO network adjustments are made using the J99254C (54C) RLMS. Where available, the KS-20501 RLMS (Section 103-106-115) may be used as an alternative to the 54C set. It is powered from commercial 60-Hz supply only and needs no auxiliary supply. Where this section specifies using the 500- to 2500-Hz sweep of the 54C set, the echo range of the KS set may be used. Where this section specifies using the 2000- to 3000-Hz sweep, the high range of the KS set may be used. Although the readings of the 54C and the KS sets usually differ a little from each other, the same numerical requirements should be used for the readings of the KS set and the 54C set.

2. APPARATUS

2.01 Table A lists the equipment required for the lineup of various links between the PBX to CO and the location where the equipment is needed.

TABLE A

APPARATUS REQUIRED FOR E6 REPEATER LINK LINEUP

APPARATUS REQUIRED	LOCATION USED		TYPE OF TEST		TYPE OF POWER NEEDED
	CO	PBX	RETURN LOSS	TRANS-MISSION	
Line Extension Cord ED-97023-30	1	—	X	X	—
J99254A, L1 Transmission Measuring Set (54A) with Cords	1	—	—	X	110 to 120 volts, 60 Hz, 48 Vdc, and ground supplied from 54B Test Stand (power obtained from J87241B at PBX)
J99254B Test Stand (54B)	1	—	X	X	
J99254C Return Loss Measuring Set (54C) (RLMS) with Cords	1	1	X	—	
J87241B Power Supply (if 54C Set is used at PBX).	—	1	X	—	110 to 120 volts, 60 Hz
3 Power Cords with P5F Jones Connectors	3	—	X	X	—
KS-20501 Return Loss Measuring Set (RLMS) (Alternative to the 54C set)	1	1	X	—	110 to 120 volts, 60 Hz
4125A or 4125B Network or Termination of 900 ohms or 600 ohms* ±5% in series with 2.16 μF ±20%, 500 wVdc	—	1	X	—	—
4066H Network	—	1	X	—	—
4097B Network	1	—	X	X	—
832A Network	1	—	X	X	—
Circuit Layout Record	1	1	X	X	—
Shorting Plug	—	1	X	—	—

* Termination depends upon PBX impedance.

3. LINK WITH NO NETWORK AT PBX, NONLOADED CABLE, NO NETWORK AT CO, OR 832A NETWORK AT CO

3.01 In this type of link, ▶initial adjustments or prescription settings of the LBO network and gain unit as given on the CLR card are usually satisfactory.◀

4. LINK WITH AN 837C OR 837D NETWORK AT PBX, NONLOADED CABLE, AND 830C NETWORK AT CO

4.01 With this type of link, network adjustments and gain settings are made initially in accordance with the CLR. Gain is checked with the 54A TMS, and final adjustment of the 830C network is accomplished by checking return loss with the 54C RLMS. The 837C or 837D network may or may not require final adjustment by return loss measurement; refer to the CLR, the general section covering the special service circuit, or the responsible engineering department.

STEP	PROCEDURE
1	Consult the CLR to determine gain settings of the 831-type network in the E6 repeater.
2	Set the adjusting screws of the 831-type network in accordance with the CLR. (If the gain is specified in dB, refer to Part 12).
3	Check the gain of the E6 repeater using the procedure in Part 12 of this section.
4	Adjust the 837C or 837D network at the PBX and the 830C network at the CO in accordance with the CLR.
5	Make a final adjustment of the 830C network at the CO and, if required, the 837C or 837D network at the PBX by using the 54C RLMS and the procedure in Part 13.

5. LINK WITH NO NETWORK AT PBX, NONLOADED CABLE, AND 830E ▶OR 830C◀ NETWORK AT CO

5.01 With ▶an 830E network at CO (recommended),◀ network adjustments and gain settings are made initially in accordance with the CLR. Gain is checked with the 54A TMS, and final adjustment of the 830E network is accomplished by checking return loss with the 54C RLMS ▶as follows.◀

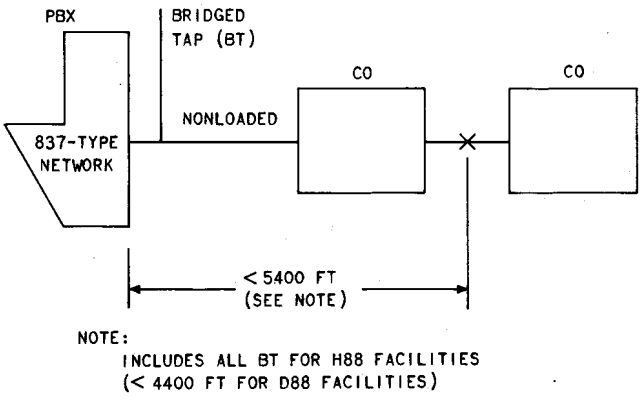
STEP	PROCEDURE
1	Consult the CLR to determine gain settings of the 831-type network in the E6 repeater.
2	Set the adjusting screws of the 831-type network in accordance with the CLR. (If the gain is specified in dB, refer to Part 12.)
3	Check the gain of the E6 repeater by using the procedure in Part 12 of this section.
4	Adjust the 830E network at the CO by using the 54C RLMS and the procedure in Part 13.

5.02 ▶With an 830C network at CO (not recommended), network adjustments and gain settings are made initially in accordance with the CLR. Gain is checked with the 54A TMS, and final adjustment of the 830C network is accomplished by checking return loss with the 54C RLMS as follows:

STEP	PROCEDURE
1	Consult the CLR to determine gain settings of the 831A network in the E6 repeater.
2	Set the adjusting screws of the 831A network in accordance with the CLR. (If the gain is specified in dB, refer to Part 12.)
3	Check the gain of the E6 repeater by using the procedure in Part 12 of this section.
4	Adjust the 830C network at the CO in accordance with the CLR.
5	Make a final adjustment of the 830C network at the CO, using the 54C RLMS and the procedure in Part 13. ***Note:*** Since the 830C network was developed to work in conjunction with an 837C or D network, use of the 830C network without the 837C or D limits the amount of transmission equalization obtainable. The use of an 830C network at the CO without an 837C or D network should not be used where PBX-CO trunks are switched to 4-wire tie trunks on a pad-out basis at the PBX.◀

6. LINK WITH 837A, 837B, 837E, 837F, OR 837G NETWORK AT PBX; SHORT NONLOADED CABLE; AND NO NETWORK AT CO

6.01 This link is shown in the following diagram:



6.02 This layout is suitable only for short nonloaded facilities from a PBX to a CO where the CO to CO facility is a 2-wire loaded facility and the conditions in the above diagram are met.

6.03 With this circuit layout, network adjustments are made initially in accordance with the CLR.

7. LINK WITH NO NETWORK AT PBX, LOADED CABLE, AND 830A OR 830B NETWORK AT CO

7.01 In this type of link, initial adjustments or prescription settings of the LBO network and gain unit as given on the CLR card are usually satisfactory.

8. LINK WITH AN 837A OR 837B NETWORK AT PBX, LOADED CABLE, AND NO NETWORK AT CO

8.01 With this type of circuit, initial adjustments or prescription settings of the LBO network and gain unit as given on the CLR card are usually sufficient.

9. LINK WITH AN 837A, 837B, 837E, 837F, OR 837G NETWORK AT PBX; LOADED CABLE; AND 830A, 830B, OR 830G NETWORK AT CO

9.01 With this type of circuit, initial adjustments or prescription settings of the LBO network and gain unit as given on the CLR card are usually satisfactory.

10. LINK WITH 830F AND 830C NETWORKS AT CO, NONLOADED CABLE, AND 837D NETWORK AT PBX

10.01 The 830F network is used for delay distortion, requires no adjustment, and is placed opposite the 830C network in the E6 repeater. Adjust the 830C network at the CO by using the 54C RLMS and the procedure in Part 13.

11. LINK WITH 830F AND 830E NETWORKS AT CO, NONLOADED CABLE, AND NO NETWORKS AT PBX

11.01 The 830F network is used for delay distortion, requires no adjustment, and is placed opposite the 830E network in the E6 repeater. Adjust the 830E network at the CO by using the 54C RLMS and the procedure in Part 13.

12. ADJUSTMENT OF REPEATER GAIN

12.01 The repeater gains should be set according to the CLR. At the CO, check the gain of the E6 repeater by using the procedure in the following steps:

STEP	PROCEDURE
1	Consult the CLR to determine gain settings of the 831-type network in the E6 repeater. ***Note:*** Under certain circumstances, the gain of a single repeater will be used to supply gain for two adjacent links. The gain on the CLR for those cases will be higher than that ordinarily required. The single repeater would also contain the proper LBO for the adjacent link. If a repeater disabler is used on this link, the enabler relay must be blocked in its operated position.

STEP	PROCEDURE
2	Check the gain of the E6 repeater by using the procedure in the following steps.
3	Place the printed wiring board side of the 831-type network face up. Loosen screws A through K and 1 through 9. All adjustments on the gain network are now made by tightening some of these screws. Contact with the printed wiring board conductors is made under the screwheads. Therefore, the screwheads should be either fully down on or fully clear of the printed wiring board, as required.
4	Set the 54B test stand and 54A TMS near the −48 volt power distribution outlet, which is provided on bays equipped with E6 repeaters.
5	Connect −48 volt power to the 54B test stand and connect the test stand to the 54A TMS, as shown in Fig. 1.

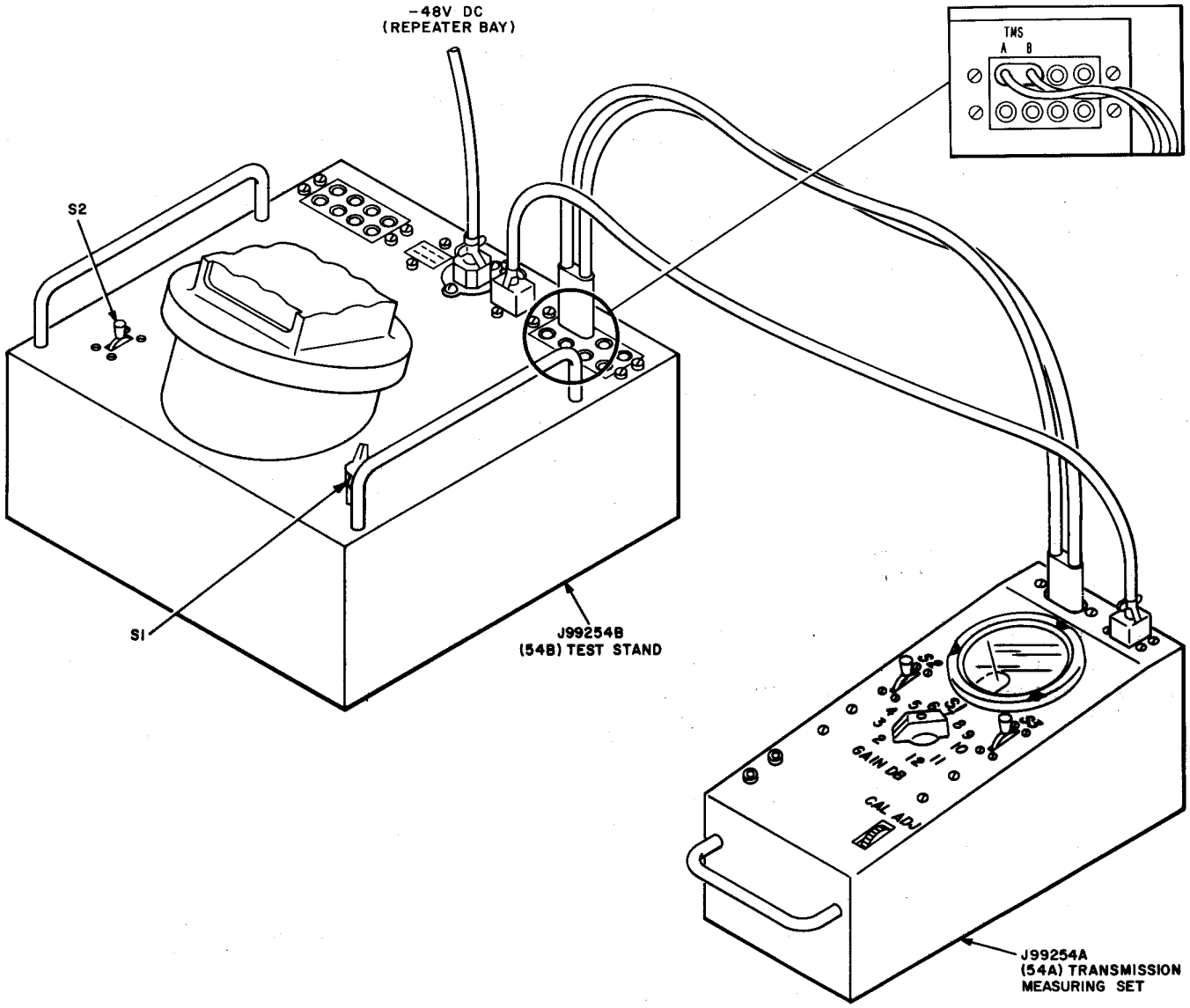


Fig. 1—Converter Gain—Test Equipment Connections

STEP	PROCEDURE

Note: The 54A TMS has neither a switch to apply power nor a pilot light. No warm-up period is necessary. No connection to the cable pairs is required for the gain adjustment of the 831-type network.

6 Carefully insert the repeater into the 54B test stand. Lower (do not drop or force) the repeater into the stand so that the terminals at the back of the repeater fit into the connector of the test stand. Rotate the ▶turret◀ of the 54B test stand so that the 831-type gain unit side of the repeater is easily accessible.

7 All screws on the gain unit side should have been loosened as in Step 3. Consult the CLR for the specified gain adjustment. Refer to Table B to determine the necessary screw settings for this specified gain value.

Example: In the row corresponding to 12-dB gain, screws A, B, C, E, H, and 1, 2, 4, 5, 7, 9, are listed to be turned down. Tighten these firmly, but not excessively, and leave all other screws raised. ▶Screw K is not turned down at this time.◀

Caution: Excessive tightening may strip threads.

Converter Unit Gains

8 On the 54B test stand, set switch S2 to a neutral position and switch S1 to GAIN position.

9 Throw S2 on the 54A TMS to CAL and adjust the knurled knob CAL ADJ to give a 0 dB reading. Then set S2 to MEAS position. The position of other keys and knobs on the 54A set does not affect this reading.

10 Rotate GAIN DB knob S1 to the specified gain. Make certain that screw K on the 831-type network is loosened. Operate S3 to SERIES and rotate gain knob S1 counterclockwise until the meter reads between 0 and +1 dB. The series converter gain equals the sum of the gain knob setting plus the meter reading. Note this value.

11 Throw switch S3 from SERIES to SHUNT. Measure and note this gain.

12 Compare the two measured gain values with the value given for the 831-type network adjustment in Table B.

Example: For 12 dB total gain, the separate converters should measure 7.9 dB gain as shown in Table B. If both series and shunt gain measurements fall within $\pm$0.2 dB of this value and the difference between the two gain readings is less than 0.2 dB, proceed to measure the combined gain as described in Step 15. If not, adjust the gain of either the series or shunt converter or both as in the following steps.

13 Verify that the proper screws are turned down and that all others are clear of the printed wiring board. If no error can be found and the series converter gain measurement deviates by more than $\pm$0.2 dB from the listed value, throw S3 to SERIES. Recalibrate as in Step 9 and then restore S2 to MEAS. Adjust screws A through J on the 831-type network to give the tabulated gain for a single converter to within $\pm$0.1 dB.

Note: Screw A gives the finest gain change; screws B, C, etc, give larger changes in approximately 2:1 steps. Tightening a screw on the series converter lowers the gain; loosening a screw raises the gain.

TABLE B

831-TYPE NETWORK

E6 GAIN-UNIT SETTINGS

TOTAL 1-KHZ GAIN (DB) MEASURED*	SERIES OR SHUNT GAIN† (DB)	SERIES SCREWS DOWN	SHUNT SCREWS DOWN	TOTAL 1-KHZ GAIN (DB) MEASURED*	SERIES OR SHUNT GAIN† (DB)	SERIES SCREWS DOWN	SHUNT SCREWS DOWN	TOTAL 1-KHZ GAIN (DB) MEASURED*	SERIES OR SHUNT GAIN† (DB)	SERIES SCREWS DOWN	SHUNT SCREWS DOWN	TOTAL 1-KHZ GAIN (DB) MEASURED*	SERIES OR SHUNT GAIN† (DB)	SERIES SCREWS DOWN	SHUNT SCREWS DOWN
0.0	0.0	BCDGHJK	123	3.4	1.8+	ADEFGJK	13467	6.8	4.0	CDEJK	1578	10.1	6.3+	DGHK	469
0.1	0.0	ABDGHJK	14	3.5	1.9	BCEFGJK	567	6.9	4.0+	BDEJK	3578	10.2	6.4	BCGHK	12469
0.2	0.1	ADGHJK	134	3.6	2.0	CEFGJK	12567	7.0	4.1	ABCEJK	123578	10.3	6.5	ABGHK	13469
0.3	0.1+	BCGHJK	5	3.7	2.0+	AEFGJK	23567	7.1	4.2	CEJK	24578	10.4	6.5+	AGHK	123469
0.4	0.2	ABGHJK	35	3.8	2.1	ABCDFGJK	24567	7.2	4.3	AEJK	134578	10.5	6.6	BCDEFHK	2569
0.5	0.2+	GHJK	235	3.9	2.1+	CDFGJK	134567	7.3	4.4	ABCDJK	1234578	10.6	6.7	ABDEFHK	3569
0.6	0.3	BCDEFHJK	145	4.0	2.2	ADFGJK	8	7.4	4.5	CDJK	2678	10.7	6.8	DEFHK	4569
0.7	0.3+	CDEFHJK	345	4.1	2.3	ABCFGJK	128	7.5	4.5+	ADJK	13678	10.8	6.9	BCEFHK	124569
0.8	0.4	BDEFHJK	2345	4.2	2.3+	CFGJK	238	7.6	4.6	ABCJK	123678	10.9	7.0	CEFHK	234569
0.9	0.4+	DEFHJK	16	4.3	2.4	AFGJK	148	7.7	4.7	CJK	24678	11.0	7.1	AEFHK	179
1.0	0.5	BCEFHJK	36	4.4	2.5	BCDEGJK	348	7.8	4.7+	AJK	134678	11.1	7.2	BCDFHK	1279
1.1	0.6	ABEFHJK	1236	4.5	2.5+	ABDEGJK	12348	7.9	4.8	ABCDEFGHK	1234678	11.2	7.2+	CDFHK	2379
1.2	0.6+	AEFHJK	246	4.6	2.6	DEGJK	258	8.0	4.8+	CDEFGHK	25678	11.3	7.3	ADFHK	1479
1.3	0.7	BCDFHJK	1346	4.7	2.6+	ACEGJK	1358	8.1	4.9	ADEFGHK	135678	11.4	7.4	ABCFHK	12479
1.4	0.7	ABDFHJK	56	4.8	2.7	BEGJK	458	8.2	5.0	ABCEFGHK	1235678	11.5	7.5	CFHK	23479
1.5	0.7+	ADFHJK	1256	4.9	2.8	ABCDGJK	12458	8.3	5.1	CEFGHK	245678	11.6	7.5+	BFHK	579
1.6	0.8	BCFHJK	2356	5.0	2.8+	CDGJK	23458	8.4	5.1+	AEFGHK	345678	11.7	7.6	ABCDEHK	2579
1.7	0.9	CFHJK	1456	5.1	2.9	ADGJK	168	8.5	5.2	BCDFGHK	12345678	11.8	7.7	CDEHK	13579
1.8	0.9+	AFHJK	3456	5.2	2.9+	BCGJK	368	8.6	5.3	CDFGHK	9	11.9	7.8	BDEHK	4579
1.9	1.0	ABCDEHJK	123456	5.3	3.0	CGJK	12368	8.7	5.4	ADFGHK	129	12.0	7.9	ABCEHK	124579
2.0	1.0	CDEHJK	27	5.4	3.1	AGJK	2468	8.8	5.5	ABCFGHK	239	12.1	8.0	ACEHK	134579
2.1	1.1	BDEHJK	137	5.5	3.2	ABCDEFJK	13468	8.9	5.5+	CFGHK	149	12.2	8.0+	BEHK	1234579
2.2	1.2	ABCEHJK	47	5.6	3.2+	CDEFJK	568	9.0	5.6	AFGHK	349	12.3	8.1	EHK	2679
2.3	1.2	ACEHJK	1247	5.7	3.3	ADEFJK	12568	9.1	5.6+	ABCDEGHK	12349	12.4	8.1+	BCDHK	3679
2.4	1.3	BEHJK	2347	5.8	3.4	ABCEFJK	23568	9.2	5.7	ACDEGHK	159	12.5	8.2	CDHK	23679
2.5	1.3	ABCDHJK	157	5.9	3.5	CEFJK	14568	9.3	5.8	ABDEGHK	1259	12.6	8.2+	BDHK	14679
2.6	1.4	ACDHJK	357	6.0	3.5	AEFJK	34568	9.4	5.9	DEGHK	2359	12.7	8.3	DHK	124679
2.7	1.4+	BDHJK	12357	6.1	3.6	ABCDFJK	234568	9.5	6.0	BCEGHK	1459	12.8	8.4	BCHK	134679
2.8	1.5	DHJK	2457	6.2	3.6+	CDFJK	178	9.6	6.1	CEGHK	12459	12.9	8.5	CHK	5679
2.9	1.5+	ACHJK	13457	6.3	3.7	ADFJK	378	9.7	6.1+	BEGHK	23459	13.0	8.6	BHK	125679
3.0	1.6	BHJK	167	6.4	3.8	ABCFJK	12378	9.8	6.2	ABCDGHK	169	13.1	8.7	HK	135679
3.1	1.7	HJK	367	6.5	3.8+	CFJK	2478	9.9	6.2+	ACDGHK	1269	13.2	8.8	BCDEFGK	1235679
3.2	1.7+	BCDEFGJK	12367	6.6	3.9	BFJK	3478	10.0	6.3	ABDGHK	1369	13.3	8.9	CDEFGK	145679
3.3	1.8	ABDEFGJK	2467	6.7	3.9+	ABCDEJK	123478								

Notes: * Measured total gain is the gain measured with a 54A TMS. Possible variation in measured gain due to component allowances is ± 0.3 dB for gains above 13 dB and in proportion for lower gains.

† Measured series or shunt gain with the K screw UP.

STEP	PROCEDURE
14	If the shunt converter gain measurement deviates by more than ±0.2 dB from the listed value, throw S3 to SHUNT and adjust the measured gain to within ±0.1 dB of the listed value, using screws 1 through 9 on the 831-type network. ***Note:*** Screws 1, 2, etc, are the fine gain adjustment. Loosening a screw on this converter lowers the gain; tightening a screw raises the gain.
15	The gains of the individual converters must agree with each other within 0.2 dB before combined gain can be measured.
16	Tighten screw K on the 831-type network and leave it in this position. (This screw connects series and shunt converter units together in the operating position.)
17	Recalibrate the 54A TMS.
18	Throw ▸S3◂ to SH and SER and measure combined gain. This should check specified gain to within ±0.3 dB. Record the measured gain in pencil in the rectangular recess on the front face of the repeater after the word GAIN.
19	With S3 on SH and SER, operate S1 to LOAD MEAS; the meter reading will decrease slightly. If this decrease is less than 0.4 dB, record both gain measurements on the repeater face. This data will be valuable for future maintenance checks on the repeater.
20	Repeaters that fall off in gain more than 0.4 dB between MEAS and LOAD MEAS are considered defective. Their converters should be returned to the Western Electric Company for repair.

13. ADJUSTMENT OF LINE BUILDING-OUT NETWORKS

13.01 The following procedures apply to the line building-out networks. The 830-type networks are adjusted when installed in the central office E6 repeaters; the 837-type networks are adjusted when installed at the PBX. Where 830A, 830B, 830G, 837A, and 837G networks are used, the prescription settings are usually satisfactory. Touch-up is required only for trouble conditions or where requirements are not met.

13.02 When 837C or 837D and 830C networks are used in a PBX-to-CO link, the two networks should be adjusted in a specific sequence. First, the 830C network should be adjusted to a midvalue or prescription setting. The 837C or 837D network at the PBX should be adjusted before the 830C network at the CO is adjusted.

STEP	PROCEDURE
	A. 830A, 830B, and 830G Networks—Adjustment (For Touch-Up Only)
1	Patch from the TST PWR jack of the 54C RLMS to RLMS TST PWR jacks of the 54B test stand. Patch from the RL jack of the 54B test stand to MEAS RL jack of the 54C RLMS by using a 3P7B cord. These connections are shown in Fig. 2.

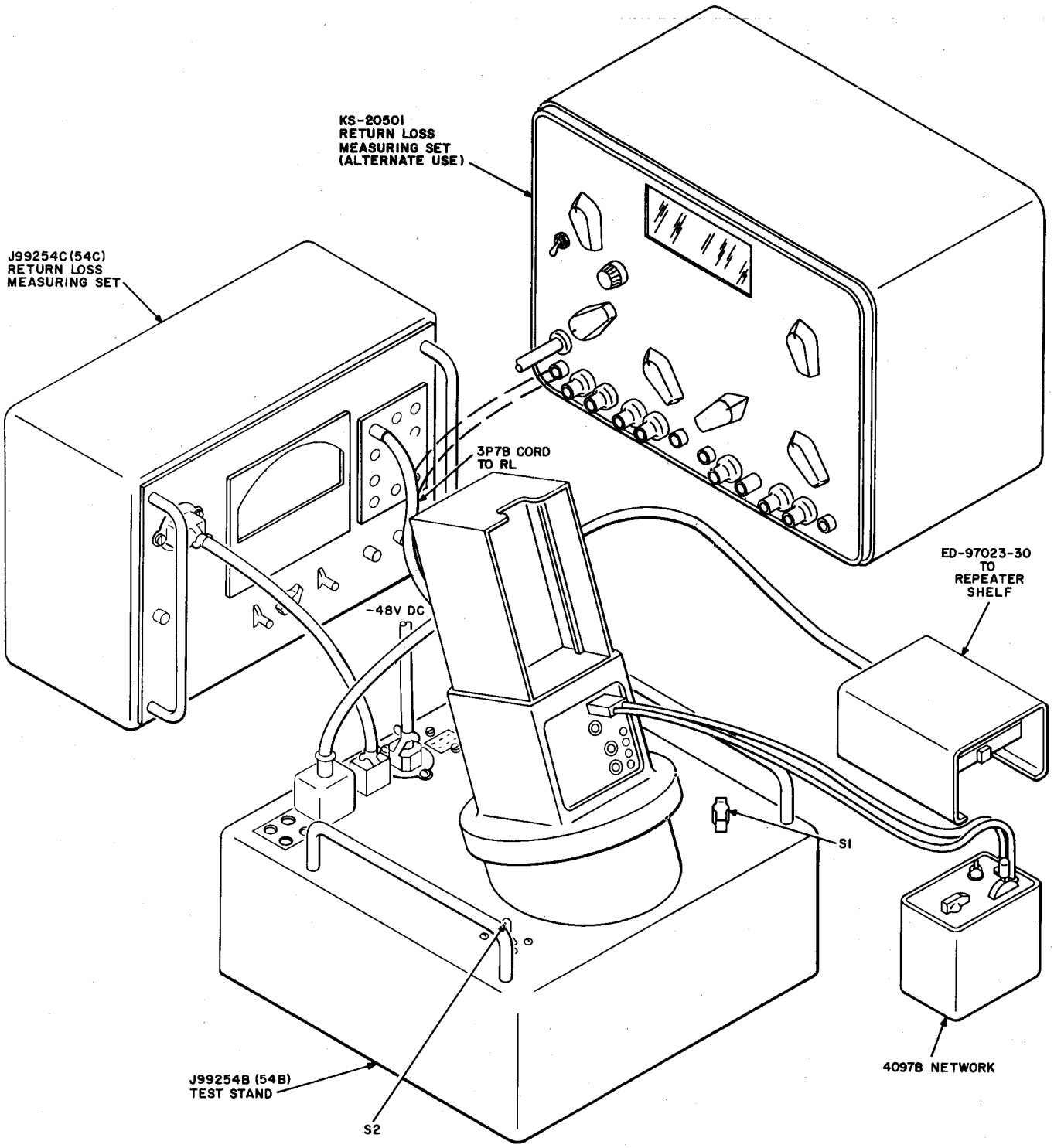


Fig. 2—Return Loss Adjustment of E6 Repeater—Test Equipment Connections

STEP	PROCEDURE
2	Have the circuit to be measured turned down at the originating end or at both ends if the circuit is a 2-way link.
3	Patch from the vacant position on the repeater shelf where the E6 repeater will be installed to the 54B test stand LINE EXT A and B jacks using the ED-97023-30 Group 2 cord as shown in Fig. 2. Insert the plug gently in order not to damage the shelf-connector spring contacts. Rotate the turret of the 54B test stand to bring the 830-type networks forward for easy accessibility. The network connected to line A is uppermost.
	Building-Out Capacitor (BOC) and LATTICE Adjustments
4	If the LBO network on line B is to be adjusted, have the line busied out but not terminated at the distant end on line B.
5	Set the switch on the 54B test stand to RL LINE B. Set S1 switch on the 54C RLMS to 2000—3000~. If the 54A TMS is also plugged into the 54B test stand, operate switch S3 to SH and SER. This is required only on early models of the 54B test stand.
6	Plug in the power cord of the 54C RLMS to a 120-volt 60-Hz ac outlet and turn the PWR switch on. A 10-minute warm-up period is required. On the 54C RLMS, set S2 to SEND LEVEL CAL, S3 to 900Ω 2 μF, and gain knob AT1 to 0 on the RETURN-LOSS scale. Calibrate the 2000—3000~ range of the 54C RLMS to 0 dB by adjusting the SEND LEVEL ADJ knob for 2000—3000~. Release S to MEAS.
7	Adjust gain knob AT1 on the 54C RLMS until the meter reads on scale.
8	Set the line B LBO network screws to the preliminary screw settings given on the CLR by tightening the specified screws and loosening all others. If the network being adjusted is an 830A or 830B network and no screw settings are given, start with A, C, E, F, 1, 2, and 1, 2 for 22-gauge cable, and TERM. for both terminal repeater and intermediate repeaters. This is required for special service circuits. These suggested initial settings correspond to those for a 22-gauge cable with a 3000-foot end section. If the network being adjusted is an 830G and no screw settings are given, start with A, E, F, and Y, Y. This initial setting corresponds to that of a 26-gauge cable with a 3000-foot end section. Only the X, X or Y, Y screws of the LATTICE section should be turned down in an 830G network. ***Never*** should both X, X and both Y, Y screws be turned down concurrently.
9	Bring the meter on scale by rotating AT1 on the 54C RLMS.
10	Request a termination at the distant end of line B and observe the meter of the 54C RLMS for a change indicating that the termination has actually been connected to the line being used. This termination is to be 900 ohms in series with 2.16 μF for a 900-ohm impedance PBX, or 600 ohms in series with 2.16 μF for a 600 ohm impedance PBX.
11	The 54B test stand includes a balanced inductor of 400-ohm resistance to permit holding dialed-up terminations while testing. For this purpose the tester operates a key that inserts the two balanced windings of the inductor in series with the tip and ring wires of the cable pair. A patch is thus provided for direct current from one end of the link to the other through the test location. At the same time, the two parts of the link are isolated at voice frequencies so that neither part affects tests made on the other.

STEP	PROCEDURE

12 Optimize the return loss by adjusting BOC screws A through G to obtain the highest return loss. Do this by increasing the BOC in 0.004-μF steps; if this causes the return loss to rise, increase the capacitance still further until a maximum is reached. If no maximum is found by increasing the BOC, decrease the capacitance in 0.004-μF steps and follow up until a maximum return loss is obtained. If the adjustment is critical, repeat with 0.002-μF steps.

Note 1: In some cases the adjustment may not be critical. In such cases, use the average of the two settings where a decrease in return loss is just noticeable.

Note 2: If there are two BOC settings that give the same average meter reading, choose the setting for which the meter needle wavers less.

Note 3: Negative values of return loss sometimes occur.

Note 4: Remove screwdriver from screwheads when observing 54C RLMS readings.

Note 5: If the network being adjusted is an 830G network, the BOC should not exceed 0.039 μF when both Y, Y screws are down. Should the optimization procedure indicate that more BOC is necessary, use screws X, X; turn down screws 1, 2, 3 and 1, 2, 3; and add BOC in the above described manner.

13 The values of the BOC screws are as follows:

CAPACITANCE OF BOC SCREWS OF NETWORK ±2%

A 0.001 μF	D 0.007 μF	F 0.025 μF
B 0.002 μF	E 0.013 μF	G 0.049 μF
C 0.004 μF		

Example: Tightening a screw adds capacitance. Thus, when the A, E, and F screws are down, they equal 0.001 plus 0.013 plus 0.025, or 0.039 μF. In this case, 0.004 μF could be added by tightening screw C. To remove 0.004 μF, the screws would be A, B, D, and F down.

830A and 830B Networks—Low-Frequency (LF) Adjustment

14 Set S1 on the 54C RLMS to 500—2500~. Set S2 to SEND LEVEL CAL. Calibrate the 500—2500~ range of the 54C RLMS to 0 dB by adjusting the SEND LEVEL ADJ knob for 500—2500~. Release S2 to MEAS. Bring the reading of the meter on scale by rotating gain knob AT1. Turn out LBO screw(s) for the cable gauge originally selected. Turn LBO screw(s) in for one of the other gauges.

Note 1: The screw setting that gives ▶the greater◀ return loss value is the better setting, but screw(s) for one gauge only shall be left down.

Note 2: If the setting for two different gauges gives the same results, use the one for coarser wire, ie, set for 19 gauge when the same results within 0.5 dB are obtained on 19 and 22 gauges.

STEP	PROCEDURE

830A, 830B, and 830G Networks—Building-Out Resistor (BOR) Adjustment

15 Set S1 on the 54C RLMS to 500—2500~ sweep. Reduce the initial BOR value on LBO to the next lower value to verify that the return loss is increased. If not, increase the BOR value.

Note 1: The condition that gives the greater return loss value is the better setting. If the same results are obtained for two different values of BOR, set for the lower value of resistance. Be sure that the same value of resistance is used in the tip and ring side of line, ie, 1 + 1, 2 + 2, 3 + 3 screws must be in a corresponding position. When different values are used, the circuit becomes unbalanced and is susceptible to noise.

Note 2: The resistance values that can be obtained are as follows:

	NETWORK	
	830A & 830B	830G
All screws down	0 ohms	0 ohms
1, 2 and 1, 2 down	28 ohms	33 ohms
1, 3 and 1, 3 down	56 ohms	66 ohms
1 and 1 down	84 ohms	99 ohms
2, 3 and 2, 3 down	112 ohms	132 ohms
2 and 2 down	140 ohms	165 ohms
3 and 3 down	168 ohms	198 ohms
No screws down	196 ohms	231 ohms

B. 837A, 837B, 837E, 837F, or 837G Network Adjustment (For Touch-Up Only)

1 At the PBX, make an initial adjustment of the 837-type network according to the CLR. If the prescription settings are not specified, use the following preliminary settings for the 0.5 section:

NETWORK	BOC	DBOC*	LBOR	LATTICE
837A	0.033μF	—	—	—
837B	—	0.033μF	112, 112	—
837E	0.033μF	—	—	—
837F	—	0.033μF	—	—
837G	0.039μF	—	—	Y,Y

* A DBOC is used for terminal balance and should usually be set to zero.

STEP	PROCEDURE

2 Connect the 54C ▶RLMS,*◀ the J87241B power supply, and the 837-type network as shown in Fig. 3 (an 837D is shown). Set the switches on the 54C RLMS as follows:

S1 to 2000—3000 ~

S2 to SEND LEVEL CAL

S3 to 900Ω 2MF ▶for 837A, 837B, and 837G networks.◀

▶S3 to EXT NET for 837E and 837F networks. Connect a 600-ohm plus 2.16-μF termination to the EXT NET jacks.◀

▶AT1◀ to RETURN LOSS scale.

▶*Where available, the KS-20501 return loss measuring set may be used as an alternative to the 54C RLMS. It is powered from commercial 60-Hz supply only and needs no auxiliary supply. Where this section specifies using the 500- to 2500-Hz sweep of the 54C RLMS, the echo range of the KS-20501 RLMS may be used. Where this section specifies using the 2000- to 3000-Hz sweep, the high range of the KS-20501 RLMS may be used. Although the readings of the 54C RLMS and the KS-20501 RLMS usually differ a little from each other, the same numerical requirements should be used for the readings of the KS-20501 RLMS and the 54C RLMS.◀

3 Calibrate the 2000—3000~ range of the 54C RLMS to 0 dB and then throw switch S2 to MEAS.

4 Increase the 837-type network BOC (or LBOC) by 0.004-μF steps (capacitance of BOC and LBOC screws are the same as listed in Step 13 above for the 830A, 830B, and 830G networks); if this causes the return loss to rise, increase the capacitance still further until a maximum return loss is reached. If no maximum is found, decrease the capacitance by 0.004-μF steps until a maximum is obtained.

Note 1: The DBOC in the 837B and the 837F networks is used for adjustment of terminal balance. Initial setting should be 0.0 μF (all screws out).

Note 2: Only the X, X or Y, Y screws of the LATTICE section should be turned down in an 837G network. Never should both X, X and both Y, Y screws be turned down concurrently. The BOC in an 837G network should not exceed 0.039 μF when both Y, Y screws are down. Should the optimization procedure indicate that more BOC is necessary, use screws X, X; turn down screws 1, 2, 3 and 1, 2, 3; and add BOC in the above described manner.

5 When a maximum return loss is obtained, repeat Step 4 with the 0.002-μF step.

6 If there are two settings that give the same average meter reading, choose the setting for which the meter wavers less. Remove screwdriver from screwheads when observing 54C meter reading.

7 Set the S1 switch on the 54C to 500—2500~ and S2 to SEND LEVEL CAL range. Calibrate the 500—2500 ~ range of the 54C RLMS to 0 dB and then throw switch S2 to MEAS.

STEP	PROCEDURE
8	Observe the measured return loss and then turn out the GAUGE screw(s) for the cable gauge originally selected. Turn in screw(s) for one of the other gauges.
9	The screw setting that gives the greater return loss value is the better setting, but screw(s) for one gauge only shall be left turned down. If the setting for two different gauges gives the same results, use the one for the coarser gauge, ie, set for 19 gauge when same results within 0.5 dB are obtained on 19 and 22 gauges.

837A and 837B Networks—Low-Frequency (LF) Adjustment (Gauge Screws)

10 Set S1 on the 54C RLMS to 500—2500~. Set S2 to SEND LEVEL CAL. Calibrate the 500—2500~ range of the 54C RLMS to 0 dB by adjusting the SEND LEVEL ADJ knob for 500—2500~. Release S2 to MEAS. Bring the reading of the meter on scale by rotating gain knob AT1. Turn out LBO screw(s) for the cable gauge originally selected. Turn LBO screw(s) in for one of the other gauges.

Note 1: The screw setting that gives the greater return loss value is the better setting, but screw(s) for one gauge only shall be left down.

Note 2: If the setting for two different gauges gives the same results, use the one for coarser wire, ie, set for 19 gauge when the same results within 0.5 dB are obtained on 19 and 22 gauges.

Note 3: There are no gauge screws on the 837E or F networks (600Ω drop impedance). These networks are suitable for 19, 22, and 24 gauges.

837B and 837G Networks—Building-Out Resistor (BOR or LBOR) Adjustment

11 Set S1 on the 54C RLMS to 500—2500~ sweep. Reduce the initial BOR (or LBOR) value on LBO to the next lower value to verify that return loss is increased. If not, increase the BOR value.

Note 1: The condition that gives the greater return loss value is the better setting. If the same results are obtained for two different values of BOR, set for the lower value of resistance. Be sure that the same value of resistance is used in the tip and ring side of line, eg, 1 + 1, 2 + 2, 3 + 3 screws must be in a corresponding position. When different values are used, the circuit becomes unbalanced and is susceptible to noise.

Note 2: The resistance values that can be obtained are as follows:

837B NETWORK		837G NETWORK	
All screws down	0 ohms	All screws down	0 ohms
112, 112 and 56, 56 down	28 ohms	132, 132 and 66, 66 down	33 ohms
112, 112 and 28, 28 down	56 ohms	132, 132 and 33, 33 down	66 ohms
112 and 112 down	84 ohms	132 and 132 down	99 ohms
56, 56 and 28, 28 down	112 ohms	66, 66 and 33, 33 down	132 ohms
56 and 56 down	140 ohms	66 and 66 down	165 ohms
28 and 28 down	168 ohms	33 and 33 down	198 ohms
No screws down	196 ohms	No screws down	231 ohms

STEP	PROCEDURE

C. 837C or 837D Network Adjustment

Note: The 837D network resembles the 837C but provides for matching a PBX of either 900-ohm or 600-ohm impedance on the drop side. In the rest of this procedure, "837D network" will mean "837C or 837D network."

1 Make an initial adjustment of the 830C network at the CO according to the CLR. If the prescription setting is not specified, adjust the 830C network as follows:

(a) Set the dials of adjustable resistors R1, R2, and R3 on the 830C network to midrange. Set the inductance value of the network to the prescription setting or to 0.8 mH if no prescription setting is supplied. (Do this by loosening or screwing out the screw[s] required and ensuring that the remaining screws are tightened or turned in.)

(b) Remove the repeater from the 54B test stand, ▶insert the 832B network into the NETWORK A side of the repeater (this network terminates the office side of the repeater in 900 ohms),◀ and plug the repeater into the proper slot on the E6 repeater shelf. Tag or place an identifying mark on the repeater so that it may be easily identified for final adjustment. Ensure that the repeater is powered and that disabling plugs have been removed from the jack strip.

2 At the PBX end of the line, install the 837D network. Using the CLR for reference, connect terminals 1 and 2 of the network to the proper line, and connect terminals 3 and 4 to the proper tip and ring terminals of the special service circuit.

3 Set the adjusting screws labeled 57 and 114 on the face of the 837D network to the BOR required on the CLR. If building out is not required, the screws should be tightened or turned into the network. BOR is added to the circuit for those cases in which insufficient loop resistance allows false dial pulsing, and BOR is also added to reduce temperature effects on the line. Set the R potentiometer to the value given on the CLR (if none is given, set to midpoint). Set the 837D adjusting screws labeled 600 and 900 to the impedance of the PBX as specified on the CLR.

Caution: Set both 57 screws or both 114 screws and both 600 screws or both 900 screws to the same position to avoid severe circuit unbalance.

4 Connect the 54C ▶RLMS,*◀ the J87241B power supply, and the 837D network as shown in Fig. 3. Set the switches on the 54C RLMS as follows:

S1 to 500—2500∼.

S2 to SEND LEVEL CAL.

S3 to 900Ω 2MF ▶for the 837C and 837D when used with 900Ω.◀

▶S3 to EXT NET for 837D when used with 600Ω. Connect a 600-ohm plus 2.16-μF termination to the EXT NET jacks.◀

▶AT1◀ to RETURN LOSS scale.

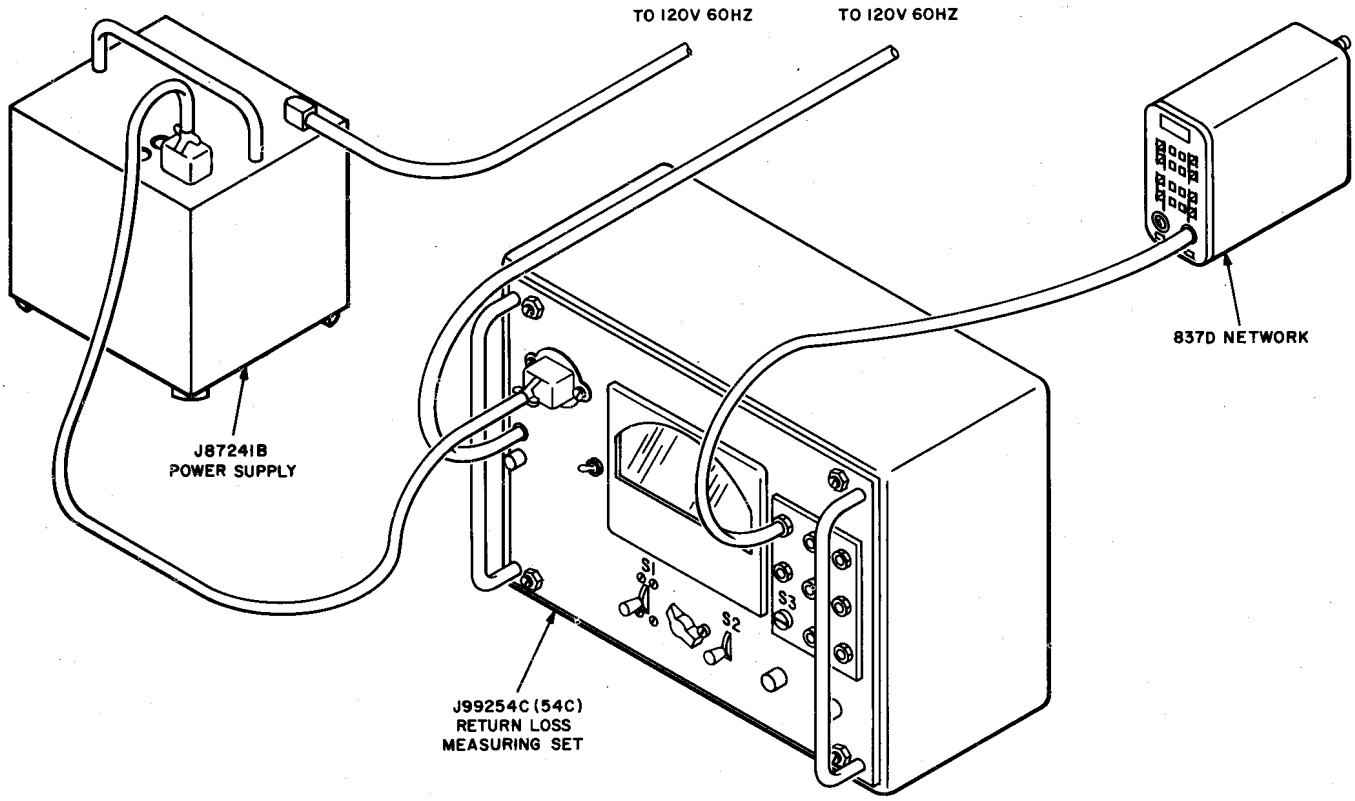


Fig. 3—Return Loss Adjustment of 837D Network—Test Equipment Connections

STEP	PROCEDURE

*Where available, the KS-20501 return loss measuring set may be used as an alternative to the 54C RLMS. It is powered from commercial 60-Hz supply only and needs no auxiliary supply. Where this section specifies using the 500- to 2500-Hz sweep of the 54C RLMS, the echo range of the KS-20501 RLMS may be used. Where this section specifies using the 2000- to 3000-Hz sweep, the high range of the KS-20501 RLMS may be used. Although the readings of the 54C RLMS and the KS-20501 RLMS usually differ a little from each other, use the same numerical requirements for the readings of the KS-20501 RLMS and the 54C RLMS.

5 Calibrate the 500—2500~ range of the 54C RLMS to 0 dB and then throw switch S2 to MEAS.

6 Adjust the R dial on the 837D network for a maximum return loss reading on the 54C RLMS.

Requirement: The return loss reading should be at least as great as the value given on the CLR.

STEP	PROCEDURE

7 If the requirement in Step 6 cannot be met, check the cable connections between the 837D network and the 54C RLMS. Then make the following checks in the order given:

(a) Check 837D network terminal connections.

(b) Ensure that the E6 repeater is firmly in place on the shelf and that dc power has been applied.

(c) Install a new 837D network and repeat the lineup procedure.

8 If a satisfactory return loss was obtained in Step 6, disconnect the 54C RLMS and the power supply from the 837D network. This completes the lineup of the 837D network.

D. 830C Network Adjustment

1 At the PBX end of the link, request that a 900-ohm or 600-ohm ▶plus 2.16 μF◀ termination be placed on the drop side of the network (PBX impedance may be obtained from the CLR; a 4125A ▶[900-ohm plus 2.16 μF]◀ or 4125B ▶[600-ohm plus 2.16 μF]◀ termination may be used to terminate the link).

2 Carefully remove the 832B network and insert the appropriate network into the A side of the repeater. Insert the repeater into the 54B test stand as instructed in ▶Part 12, Step 6.◀ Set the mode switch (S1) on the 54B test stand to ▶RL LINE B◀ . Rotate the ▶turret◀ of the 54B test stand so that the adjustable resistors on the 830C network are easily accessible. Set S2 to neutral.

3 Connect the 54B test stand to the repeater shelf, to the 54C RLMS, and to the 4097-type network (Section 103-104-XXX) as shown in Fig. 2. Table C provides data for transcribing the value of inductance obtained with the 4097-type network. If using the 4097B, set switch S1 to the 830C position.

Note: If a 4097-type network is not available, a cut-and-try method utilizing the inductance screws on the 830C network must be used to obtain the proper inductance setting. This may be done as follows:

(a) Tighten down the L screw on the 830C network. This enables the internal inductance of the network.

(b) Set the inductance to the prescription value or, if the prescription setting is not supplied, to 0.8 mH. The latter is obtained by loosening or screwing out the screw labeled 0.8 mH and tightening down the 0.05, 0.1, 0.2, and 0.4 screws. Tightening down a screw removes the particular value of inductance from the network circuit.

(c) To increase or decrease network inductance, use combinations of screws as shown in Table C.

TABLE C

SETTING OF INDUCTANCE IN 830C NETWORK
FROM 4097A OR 4097B NETWORK

INDUCTANCE* (4097A or 4097B NETWORK)	SCREW TERMINALS† (830C NETWORK)				
	.8	.4	.2	.1	.05
0	X	X	X	X	X
0.05	X	X	X	X	—
0.10	X	X	X	—	X
0.15	X	X	X	—	—
0.20	X	X	—	X	X
0.25	X	X	—	X	—
0.30	X	X	—	—	X
0.35	X	X	—	—	—
0.40	X	—	X	X	X
0.45	X	—	X	X	—
0.50	X	—	X	—	X
0.55	X	—	X	—	—
0.60	X	—	—	X	X
0.65	X	—	—	X	—
0.70	X	—	—	—	X
0.75	X	—	—	—	—
0.80	—	X	X	X	X
0.85	—	X	X	X	—
0.90	—	X	X	—	X
0.95	—	X	X	—	—
1.00	—	X	—	X	X
1.05	—	X	—	X	—
1.10	—	X	—	—	X
1.15	—	X	—	—	—
1.20	—	—	X	X	X
1.25	—	—	X	X	—
1.30	—	—	X	—	X
1.35	—	—	X	—	—
1.40	—	—	—	X	X
1.45	—	—	—	X	—
1.50	—	—	—	—	X
1.55	—	—	—	—	—

Note: The maximum value of 1.60 mH, obtainable on the 4097A network, cannot be set into the 830C network.

*Sum of inductance indicated on rotary and key switches on 4097A or 4097B network.

†X indicates screws that should be tightened down to obtain equivalent inductance on 830C network.

STEP	PROCEDURE

4 When connecting the 4097-type network to the 830C network, the screw labeled L on the 830C network should be loosened. This removes the internal inductance of the 830C network from the circuit and replaces it with the inductance of the 4097-type network. Set the 4097-type network as prescribed on the CLR.

5 Set the dials of adjustable resistors R1, R2, and R3 on the 830C network to the approximate center of their adjustable range or to the midrange mark if the network has one.

6 Set the BOR on the 830C network as prescribed on the CLR.

7 Calibrate both frequency ranges (500—2500~ and 2000—3000~) of the 54C RLMS to 10-dB return loss on the meter, rather than to 0 dB. This will prevent overloading the E6 ◗repeater.†◖

◗*Note:* ◖ Subsequent readings will have to be reduced by 10 dB to give the true return loss.

◗†Since the output of the KS-20501 RLMS is appreciably lower than that of the 54C RLMS, no provision has been made for reducing its output.◖

8 The objective in the next part of the lineup procedure is to obtain the maximum return loss for the specific facilities assigned to the link. A high return loss assures adequate margin against echo and singing. Measure return loss with the 54C RLMS by performing the following steps in sequence:

(a) Set switches on the 54C RLMS as follows:

S1 to 500—2500~

S2 to MEAS

S3 to 900Ω 2 MF.

(b) Adjust R3 for maximum return loss indication on the 54C RLMS.

(c) Adjust R2 for maximum return loss.

(d) Adjust R1 for maximum return loss.

(e) Increase or decrease the value of inductance (L) by operating the switch and key on the 4097-type network until maximum return loss is obtained.

(f) Repeat Steps (b), (c), and (d).

(g) Repeat Step (e). If a significant increase in return loss is indicated (ie, 0.5 dB), repeat Steps (b), (c), and (d) at least twice or until additional return loss cannot be obtained.

(h) Throw switch S1 on the 54C RLMS to the 2000—3000~ position.

STEP	PROCEDURE

(i) Adjust R1 for maximum return loss.

(j) Readjust the value of inductance as instructed in (e).

(k) Readjust R1 for maximum return loss.

(l) Throw switch S1 on the 54C RLMS to the 500—2500~ position.

(m) Readjust the value of inductance as instructed in (e).

(n) Readjust R1 for maximum return loss.

(o) Readjust R2 for maximum return loss.

(p) Readjust R3 for maximum return loss.

(q) If ▶the◀ return loss in the ▶500- to 2500-Hz◀ range is greater then ▶that in the 2000- to 3000-Hz range, no further adjustment is necessary. If the indicated return loss in the 500- to 2500-Hz range is less than that in the 2000- to 3000-Hz range (with switch S1 in the 500—2500~ position),◀ decrease the value of inductance in 0.05-mH steps until the return loss in the 500- to 2500-Hz range is greater. Repeat (o) and (p) for optimum results.

Requirement: The return loss measurement obtained should be equal to or greater than the value specified on the CLR.

9 If the requirement in Step 8 cannot be met, readjust R1, R2, R3, and the inductance. If requirements still cannot be met, replace the 830C network and repeat the entire lineup procedure. If requirements still cannot be met, refer to the responsible engineering department.

10 If acceptable values of return loss are obtained in the lineup procedure, tighten the L screw on the 830C network and set in the amount of inductance (L) that was obtained with the 4097-type network (see Table C).

Example: ▶Tightening down a screw removes inductance; loosening a screw adds inductance, thus screws 0.8 and 0.2 up equal 1 mH of inductance.◀

11 Disconnect the 4097-type network from the 830C network and, if there has been any noticeable reduction from the previous indication, readjust R1, R2, and R3 for maximum return loss with the 54C RLMS in the 500—2500~ range.

12 Request that the termination be removed at the PBX.

E. 830E Network Adjustment

1 Mount the 832A network on the NETWORK A side of the repeater and secure it by all four screws.

STEP	PROCEDURE

2 Slide the 830E network into the NETWORK B side of the repeater and secure it with all four screws on the connector block.

Note: All four screws are needed since they also make the required electrical connections between the gain unit and the networks.

3 Request that the PBX connect a "live" telephone or place a 4066H network adjusted per Table D or a 600-ohm termination on the trunk. See Section 311-100-500 for further detail.

TABLE D

ADJUSTMENTS OF 4066H NETWORK

RANGE OF DIRECT CURRENT SUPPLIED TO 500-TYPE TELEPHONE SET WITH HANDSET OFF THE CRADLE (MILLIAMPERES)	SCREW SWITCH TO BE CLOSED (TURNED IN); ALL OTHERS TO BE OPEN (TURNED OUT)
36 or less	A
37—50	B
51—61	C
62 or more	D

Note: Only one adjusting screw should be in the turned-in position for any of the dc ranges of current supplied to the 500-type set being balanced by the network. All others should be turned out two complete turns.

4 Set the mode switch (S1) on the 54B test stand to ◗RL LINE B◖. Rotate the ◗turret◖ of the 54B test stand so that the adjustable resistors on the 830E network are easily accessible. Set S2 to neutral.

5 Connect the 54B test stand to the repeater shelf, to the 54C RLMS, and to the 4097B network (Section 103-104-101), as shown in Fig. 2. The 4097B network provides an easily adjusted inductance for determining the proper setting of inductance in the 830E network. Operate the key on the 4097B to 830E; dial readings will correspond to the inductance settings on the network (ie, if dial reads 0.4 as optimum setting, the 0.4 screw on the network should be loosened; all others should be tightened).

STEP	PROCEDURE

Note: If a 4097B network is not available, a cut-and-try method utilizing the inductance screws on the 830E network must be used to obtain the proper inductance setting. This may be done as follows:

(a) Tighten down the L screw on the 830E network. This enables the internal inductance of the network.

(b) Set the inductance initially to 0.0 mH by tightening down all screws. Tightening down a screw removes the particular value of inductance from the network circuit.

(c) Network inductance may be increased by loosening or turning out screws marked 0.05, 0.1, 0.2, 0.4, 0.8.

6 Loosen the screw labeled L on the 830E network. This removes the internal inductance of the 830E network from the circuit and replaces it with the inductance of the 4097B network. Set the 4097B network to 0.0 mH and connect the network to the L pin jacks on the 830E network as shown in Fig. 2.

7 On the 830E network, set the dials of adjustable resistors R1 to 1/4 range (90° clockwise) and R2 to zero (fully counterclockwise).

8 Set the 830E network BOR screws, L screws, and C screws per Table E.

The BOR screws must be set the same (both tightened or both loosened) to prevent circuit unbalance.

9 Set the CAL (S1) key for the 500—2500~ frequency range of the 54C set and adjust the SEND LEVEL ADJ control to obtain a 10-dB reading on the black scale. This will prevent overloading the E6 repeater.

Note: On subsequent readings, subtract 10 dB from the sum of the AT-1 dial and meter reading to obtain the true return loss.

Maximum Return Loss

Note: The objective in the next part of the lineup procedure is to obtain the maximum return loss for the specific facilities assigned to the trunk. A high return loss assures adequate margin against echo and singing. Perform the following steps:

1 Set switches on the 54C measuring set as follows:

S1 to 500—2500 ~

S2 to MEAS

S3 to 900Ω 2 MF.

2 Increase the value of inductance (L) by operating the switch and key on the 4097B network until maximum return loss is obtained.

TABLE E

830E NETWORK
INITIAL SETTINGS

BOR REQUIRED FOR VARIOUS LOOP RESISTANCES		
LOOP RESISTANCE* OF CABLE PAIR	SCREWS	POSITION
≤ 400 ohms	BOR	UP
	R	DOWN
> 400 ohms	BOR	DOWN
	R	UP
L SCREWS		
Start† with either all L-value screws (including the L screw) down or, when using the external 4097B network (with L screw up on 830E), start with knob set to 0.		
POTENTIOMETERS		
Start† with potentiometers R1 and R2 set to 0 (arrow at counterclockwise position).		
C SCREW		
Total Bridge Tap (BT) < 3 kft		UP‡
Total BT between 3 and 6 kft and most located closer than 2 kft from repeater.		UP‡
Total BT between 3 and 6 kft and most beyond 2 kft from repeater.		DOWN‡

Notes:

* Average temperature.

† Initial settings are for starting only. Final settings must be obtained by optimizing with a 54C RLMS or a KS-20501 RLMS.

‡ If > 20 dB ERL and > 12 dB for the 2 to 3 kHz RL (with 4066H network termination) are not met, try other condition of C screw. If results are about the same, use C in UP condition.

STEP	PROCEDURE
3	Adjust R1 for maximum return loss indication on the 54C measuring set.
4	Set switch S1 to 2000—3000~ and adjust R2 for maximum RL.
5	Set switch S1 to 500—2500~ and repeat Steps 2 and 3.
6	Repeat Step 4. ***If a significant increase in return loss is indicated (ie, 0.5 dB), repeat Steps 2 and 3 at least twice or until additional return loss cannot be obtained. If an increase or decrease of 0.05 in L improves the RL in the SP (2000—3000 Hz) band, use that value.***
7	Repeat Steps 5, 6, and 7 until optimum adjustments are obtained.
8	The foregoing steps should lead to a maximum return loss (500 to 2500 Hz) in excess of 20 dB (30-dB meter reading since the set was calibrated at 10 dB). If the ERL (500 to 2500 Hz) is less than 20 dB or the SP (2000 to 3000 Hz) is less than 12 dB, change the position of the C screw and repeat lineup procedure. Use the C screw position that gives the better values for ERL and SP. If the results are almost equal for both conditions, use C in the UP position for better high-frequency response.
9	If the maximum return loss cannot be obtained, make sure the termination is on circuit and the B side of the repeater is connected to the cable pair. If requirements still cannot be met, replace the 830E network with a new network and repeat the entire lineup procedure. ***Note:*** Removing the termination should always reduce the return loss. It is possible to ***misalign*** the repeater without a termination at the PBX and obtain return losses in the order of 11 dB, but the circuit would be unstable.
10	If acceptable values of return loss are obtained, tighten the L screw on the 830E network and set in the mount of inductance (L) that was obtained with the 4097B network (Table F).
11	Disconnect the 4097B network from the 830E network and, if there has been more than a 1-dB reduction from the previous indication, readjust R1 and R2 for maximum return loss. This completes the lineup of the 830E network. ***Note:*** Record the measured return loss (meter reading −10 dB) on the CLR for future reference.
12	Request that the termination at the PBX be removed.

TABLE F

TRANSCRIBING INDUCTANCE FROM 4097B NETWORK TO 830E NETWORK

INDUCTANCE* (4097B NETWORK)	SCREW TERMINALS† (830E NETWORK)				
	.8	.4	.2	.1	.05
0	X	X	X	X	X
0.05	X	X	X	X	—
0.10	X	X	X	—	X
0.15	X	X	X	—	—
0.20	X	X	—	X	X
0.25	X	X	—	X	—
0.30	X	X	—	—	X
0.35	X	X	—	—	—
0.40	X	—	X	X	X
0.45	X	—	X	X	—
0.50	X	—	X	—	X
0.55	X	—	X	—	—
0.60	X	—	—	X	X
0.65	X	—	—	X	—
0.70	X	—	—	—	X
0.75	X	—	—	—	—
0.80	—	X	X	X	X
0.85	—	X	X	X	—
0.90	—	X	X	—	X
0.95	—	X	X	—	—
1.00	—	X	—	X	X
1.05	—	X	—	X	—
1.10	—	X	—	—	X
1.15	—	X	—	—	—
1.20	—	—	X	X	X
1.25	—	—	X	X	—
1.30	—	—	X	—	X
1.35	—	—	X	—	—
1.40	—	—	—	X	X
1.45	—	—	—	X	—
1.50	—	—	—	—	X
1.55	—	—	—	—	—

Note: *Sum of inductance indicated on rotary and key switches on 4097B network.

†X indicates screws that should be tightened down to obtain equivalent inductance on 830E network.