OVERALL LINEUP

2-WIRE REPEATERED NONLOADED PBX-CO AND LOCAL WATS TRUNKS FOR PBXs NOT REQUIRING TERMINAL BALANCE

CONTENTS PAGE

1. GENERAL

1.01 This section provides lineup and installation procedures for the E6 repeater, including an 830E network, when the repeater is used on PBX-to-central office nonloaded trunks (Fig. 1).

1.02 This section is reissued to:

(a) Revise Table A and add Table E.

(b) Correct switch designations

(c) Make figures agree with text

(d) Add information on interconnections of test sets.

1.03 Use of these procedures should result in improvement in the frequency response and in the echo return losses at the central office end of the trunk circuit. Dial pulsing is not adversely affected.

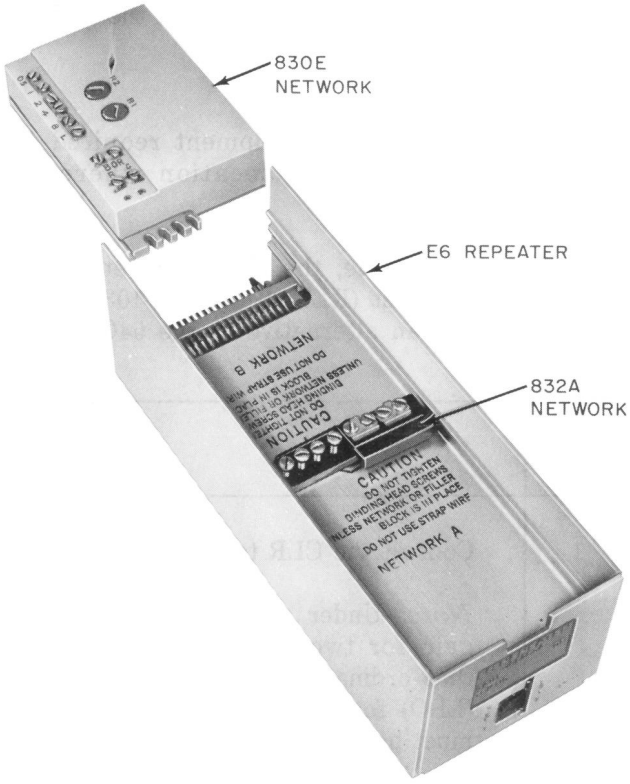

Fig. 1—E6 Repeater and Networks Used on Nonloaded Cable Between a Central Office and PBX

1.04 Because of the large number of facilities differing in gauge, length, and bridged tap, and the need to improve return losses and reduce insertion losses, three elements in the 830E network must be adjusted. It is not feasible, in advance of lineup, to prescribe the absolute settings for the adjustable elements to obtain optimum performance.

(Since there are slight variations from pair to pair in nominally identical layouts and variations in networks, each network must be adjusted to

the specific pair with which it will operate.)

1.05 The lineup procedure requires adjustment only at the repeater end of the facility. If a termination and a 1-kHz, 1-mW signal source are available at the nonrepeatered end of the facility, the repeater and network can be lined up from the central office without assistance at the PBX.

2. APPARATUS

2.01 Table A lists the equipment required for the lineup and the location where the equipment is needed.

2.02 Where available, the KS-20501 return loss measuring set (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-20501◀ set may be used. Where this section specifies using the 2000- to 3000-Hz sweep, the high range of the ▶KS-20501◀ set may be used. Although the readings of the 54C and the ▶KS-20501◀ sets would usually differ a little from each other, the same numerical requirements should be used for the readings of the ▶KS-20501◀ set as for those of the 54C set.

3. ADJUSTMENT OF REPEATER GAIN

3.01 The repeater gains should be set according to the ▶circuit layout record (CLR).◀ At the CO, the gain of the E6 repeater should be checked 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 line build-out (LBO) for the adjacent link. If a repeater disabler is used on this link, the enabler relay must be blocked in its operated position.
2	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 screwboards. Therefore, the screwheads should be either fully down on or fully clear of the printed wiring board, as required.
3	Set the 54B test stand and 54A transmission measuring set (TMS) near the −48 volt power distribution outlet, which is provided on bays equipped with E6 repeaters.
4	Connect −48 volt power to the 54B test stand and ▶patch the TMS TST PWR jack of the 54B test stand to the TEST PWR jack of the 54A TMS, using the P5F cords. Patch the TMS A and B jacks of the 54B to the A and B jacks of the 54A, using the 3P7B cords with 310-type plugs (see Fig. 2).◀ ***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.
5	Carefully insert the repeater into the 54B test stand. Lower (do not drop or force) the repeater into the stand so that the repeater terminals at the back of the repeater fit into

TABLE A

APPARATUS REQUIRED FOR E6 REPEATER

LINK LINEUP ON NONLOADED CABLE

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) (TMS) with Cords	1	—	—	X	110 to 120 volts, 60 Hz, 48 Vdc, and ground supplied from 54B test stand
J99254B Test Stand (54B)	1	—	X	X	
J99254C Return Loss Measuring Set (54C) (RLMS) with Cords	1	—	X	—	
3 Power Cords with P5F Jones Connectors	3	—	X	X	—
KS-2051 Return Loss Measuring Set (RLMS) (Alternative to the 54C set)	1	—	X	—	110 to 120 volts, 60 Hz
1-kHz, 1-Milliwatt Supply	1	—	—	X	—
J94023A Transmission Measuring Set (23A or D) (TMS) (or equivalent)	1	1*	—	X	—
KS-14418 Headphones with 419A Plug	1	—	X	—	—
4125A or 4125B Network or Termination of 900 ohms or 600 ohms† ±5% in series with 2 μF ± 20%, 500 wVdc	—	1	X	—	—
4066H Network	—	1	X	—	—
4097B Network	1	—	X	X	—
832A Network	1	—	X	X	—
Circuit Layout Record (CLR)	1	1	X	X	—
Shorting Plug	—	1	X	—	—

* Not needed at PBX if 1 milliwatt is available at PBX.

† Termination depends upon PBX impedance.

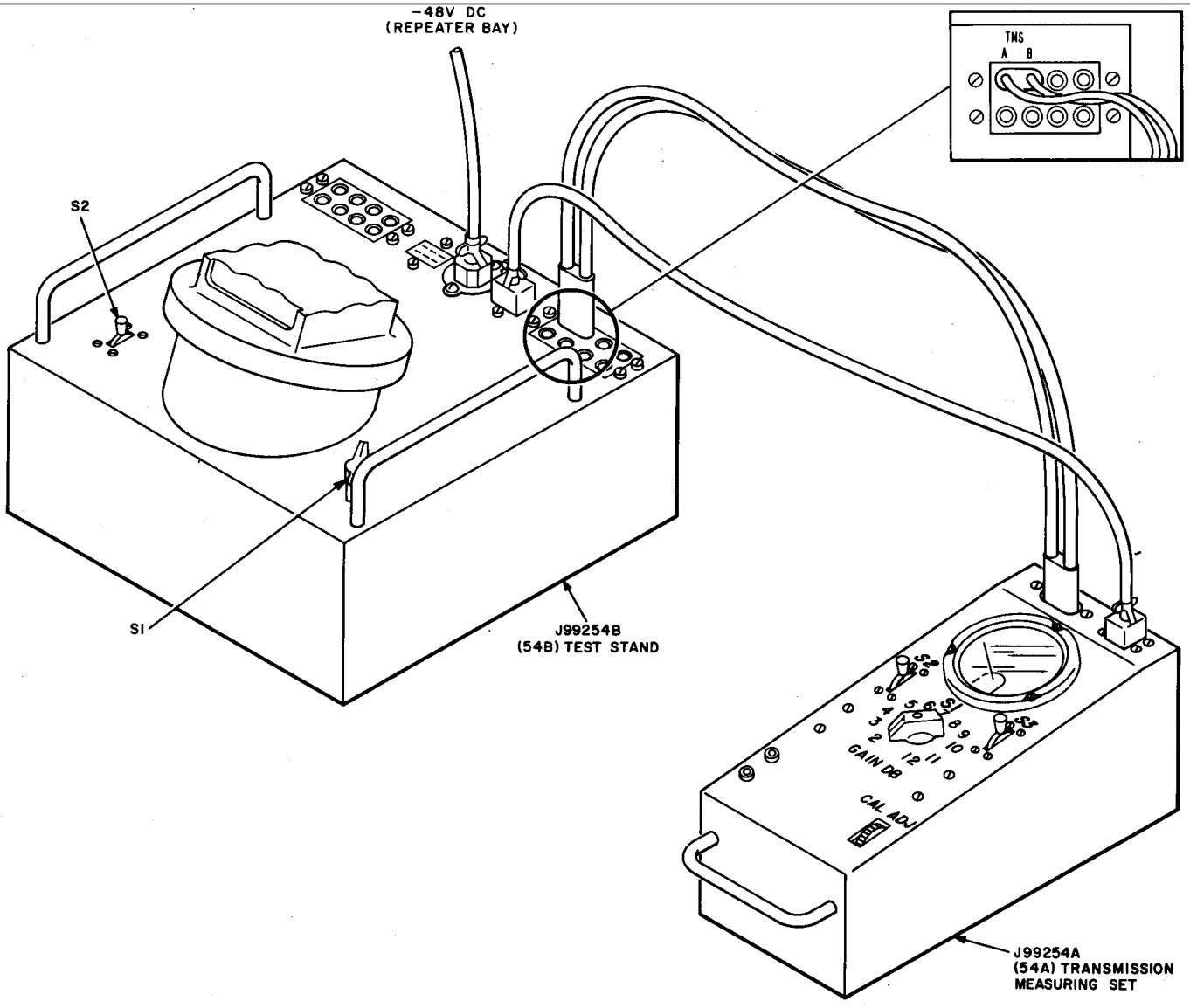

Fig. 2—▶Converter Gain—Test Equipment Connections◀

STEP	PROCEDURE
	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.
6	All screws on the gain-unit side should have been loosened as in Step ▶2◀ . Consult the CLR for the specified gain adjustment. Refer to Table ▶B◀ to determine the necessary screw settings for this specified gain value.

STEP	PROCEDURE
	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. ***Caution: Excessive tightening may strip threads.*** **Converter Unit Gains**
7	On the 54B test stand, set switch S2 to a neutral position and switch S1 to GAIN position.
8	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 the MEAS position. The position of other keys and knobs on the 54A set does not affect this reading.
9	Rotate GAIN DB knob S1 to 12 dB. 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.
10	Throw switch S3 from SERIES to SHUNT. Measure and note this gain.
11	Compare the two measured gain values with the value given for the 831-type network adjustment shown 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 follows.
12	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 ◗8◖ 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 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.
13	If the shunt-converter gain measurement deviates by more than $\pm$0.2 dB from the listed value, throw S3 to SHUNT and adjust the measured gain to within $\pm$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.
14	The gains of the individual converters must agree with each other within 0.2 dB before combined gain can be measured.

STEP	PROCEDURE
15	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.)
16	Recalibrate the 54A TMS.
17	Throw S3 to SH and SER and measure combined gain. This should check specified gain to within $\pm$0.3 dB. Record the measured gain in pencil in the rectangular recess on the front face of the repeater after the word GAIN.
18	With S3 on SH and SER, operate ▶S2◀ 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.
19	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.

4. OPTIMIZING THE 830E NETWORK

4.01 The following procedure applies to the 830E line building-out network:

STEP	PROCEDURE
1	Mount the 832A network on the NETWORK A side of the repeater and secure it by all four screws.
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 C or a 600-ohm termination on the trunk. See Section 311-100-500 for further detail.
4	▶Insert the repeater into the turret of the 54B test stand. Rotate the turret so that the adjusting screws on the 830E network are accessible at the front of the test stand. Set switch S1 to NORM and switch S2 to neutral.◀
5	Connect the ▶LINE EXT A and B jacks on the 54B test stand to the vacant position on the repeater shelf, using the cord per ED-97023-30, Group 2. Patch from the TST PWR jack of the 54C RLMS to the RLMS TST PWR jack of the 54B, using a P5F cord. Use a 3P7B cord to connect the RL jack of the 54B to the MEAS RL jack of the 54C. Connect the 4097B network to the pin jacks of the 830E network as shown in Fig. 3.◀ The 4097B

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

TABLE C

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.

network ▶(Section 103-104-101)◀ 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).

Note: If a 4097B network is not available, a cut-and-try method using 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. 3.

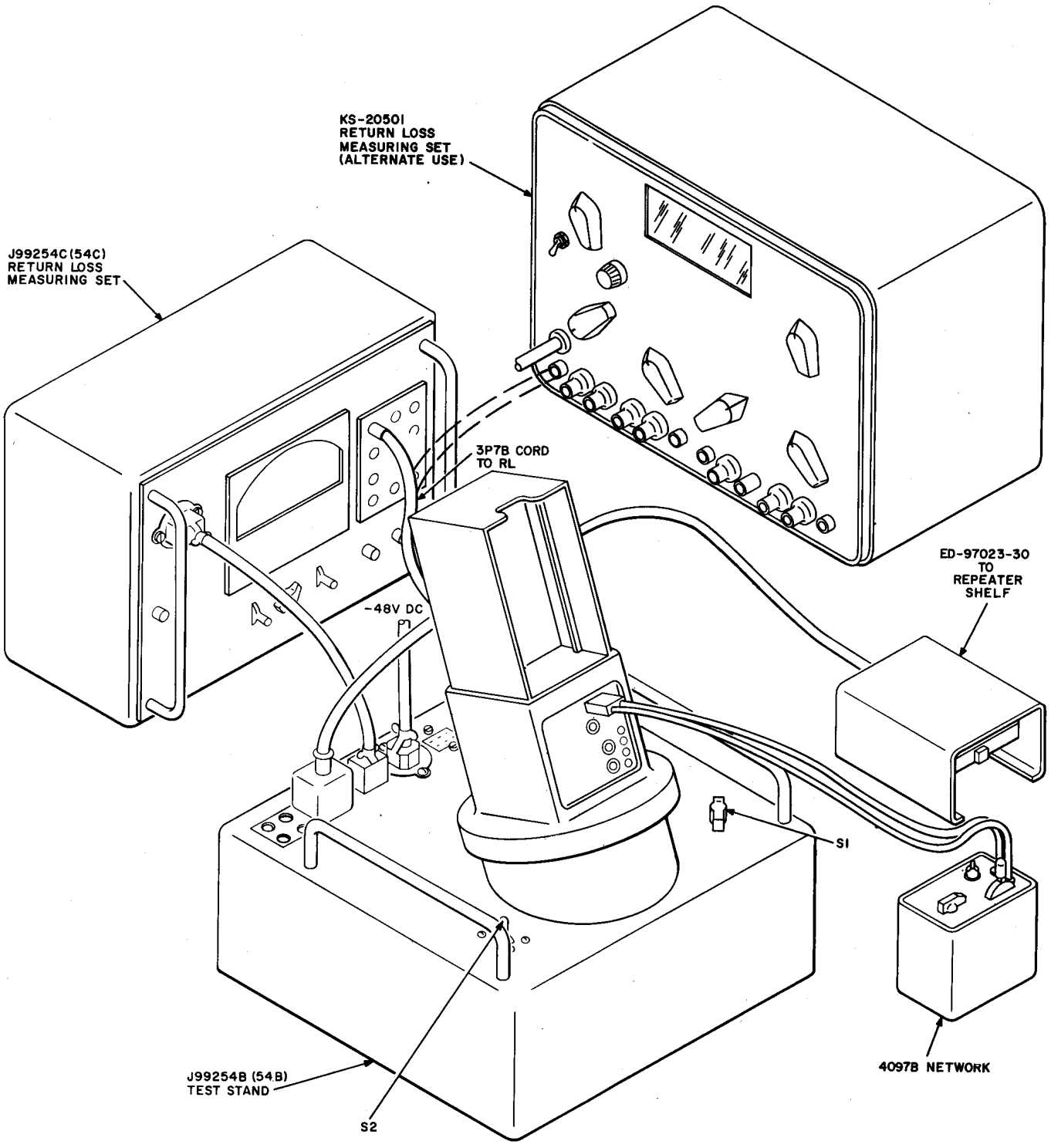

Fig. 3—Return-Loss Adjustment of E6 Repeater—Test Equipment Connections

STEP	PROCEDURE
7	Set the dials of adjustable resistors R1 and R2 on the 830E network to zero (fully counterclockwise).
8	Set the 830E network build-out resistance (BOR) screws, L screws, and C screws per Table D.  ***The BOR screws must be set the same (both tightened or both loosened) to prevent circuit unbalance.***
9	Set ▶switch (S1) to◀ the 500 to 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.  ***On subsequent readings, subtract 10 dB from the sum of the AT-1 dial and meter reading to obtain the true return loss.***

4.02 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:

STEP	PROCEDURE
1	Set switches on the 54C measuring set as follows: S1 to 500—2500~ S2 to MEAS S3 to 900Ω 2 MF
2	Adjust R1 ▶on the 830E network◀ for maximum return-loss indication on the 54C measuring set.
3	Adjust R2 ▶on the 830E network◀ for maximum return loss.
4	Increase the value of inductance (L) by operating the switch and key on the 4097B network until maximum return loss is obtained.
5	Repeat Steps 2 and 3.

TABLE D

830E NETWORK

INITIAL SETTINGS

BOR REQUIRED FOR VARIOUS LOOP RESISTANCES		
LOOP RESISTANCE* OF CABLE PAIR	SCREWS	POSITION
≤ 400 ohms	BOR R	UP DOWN
> 400 ohms	BOR R	DOWN 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 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 > 16 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
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.***
7	Set switch S1 to 2000—3000~and adjust R2 on the 830E network for maximum RL.
8	Repeat Steps 5, 6, and 7 until optimum adjustments are obtained.
9	The foregoing steps should lead to a maximum return loss (500 to 2500~) in excess of 20 dB (30-dB meter reading since the set was calibrated at 10 dB). If the ERL (500—2500~) is less than 20 dB or the SP (2000—3000~) 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.
10	If the minimum 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.
11	If acceptable values of return loss are obtained, tighten the L screw on the 830E network and set in the amount of inductance (L) that was obtained with the 4097B network (Table E.)
12	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.
13	Request that the termination at the PBX be removed.

5. MEASUREMENT OF 1-KHZ INSERTION LOSS

5.01 The insertion loss at 1 kHz is measured by applying 1 mW of power at 1 kHz at one end of the circuit and measuring the response at the other end with the 23A or 23D TMS (see Section 103-223-100). Depending upon the availability of 1-mW supply at the PBX, the following two methods of measurement may be used.

STEP	PROCEDURE
	Method with mW at PBX
1	If a mW of power at the PBX can be dialed up from the CO or if a 71B mW reference generator can be plugged in at the PBX, then use Fig. 4 for test equipment connections. In either case, the generator impedance should be that of the nominal PBX impedance (either 900 or 600 ohms). The generator should be calibrated to put 1 mW into a load equivalent to the nominal impedance of the PBX. ▶On the 54B test stand, set switch S1 to NORM and switch S2 to neutral.◀
	Method with mW at CO
2	If a mW supply is not available at the PBX, then a mW ▶supply◀ at the CO should be dialed from the PBX. Test connections are shown in Fig. 5. The 23A or D TMS at the PBX should be used to dial up the mW ▶supply◀ and to measure the loss. The impedance of the 23A or D should be set to the nominal PBX impedance. If the repeater at the CO is in the 54B test stand for this measurement, set S1 to NORM and S2 to neutral.
3	If the measured insertion loss on the 23A ▶or D◀ TMS at the PBX end of the line is not within $\pm$0.2 dB of the desired net loss (noted on CLR), change the gain of the E6 repeater as described in Part 3.
4	If the gain of the repeater requires a change in excess of 1 dB, recheck the 500- to 2500-Hz and 2000- to 3000-Hz return loss. If return loss requirements are not within limits, repeat the lineup procedure as described in Part 4.

6. STABILITY TESTS (CHECK FOR SINGING)

6.01 The E6 repeater is designed to be stable under all operating conditions (idle condition, dial pulsing, etc). After the circuit is lined up, there should be a margin of safety against singing. The following steps will assure this margin of safety when the circuit is checked for singing under the severe test of an open circuit at the central office and a short circuit at the PBX trunk circuit:

STEP	PROCEDURE
1	Connect the 54B test stand, repeater, and KS-14418 headset equipped with a 419A plug as shown in Fig. 6. The 419A plug connects into the TST 2 jacks on the front of the repeater. ***Caution: Do not plug headphone into the TST 1 jacks; it may make the repeater sing.***
2	Obtain a short circuit by operating the attendant dial at the PBX when it is connected to the trunk under test.
3	Obtain an open circuit by placing switch S2 in neutral position and switch S1 in the RL LINE B position on the 54B test stand.

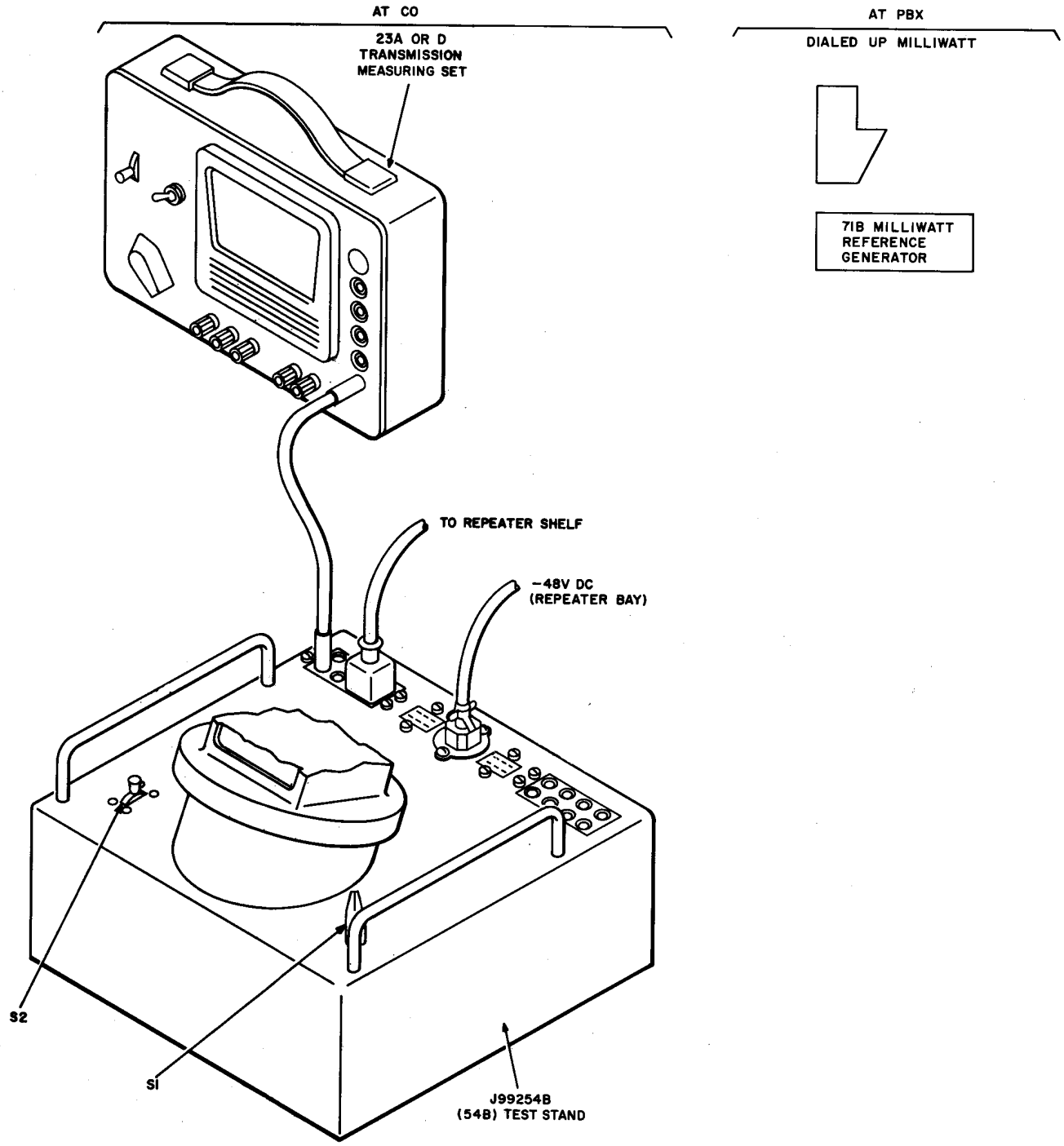

Fig. 4—Measurement of 1-kHz Insertion Loss—Test Equipment Connections Where 1 mW at 1 kHz is Available at PBX

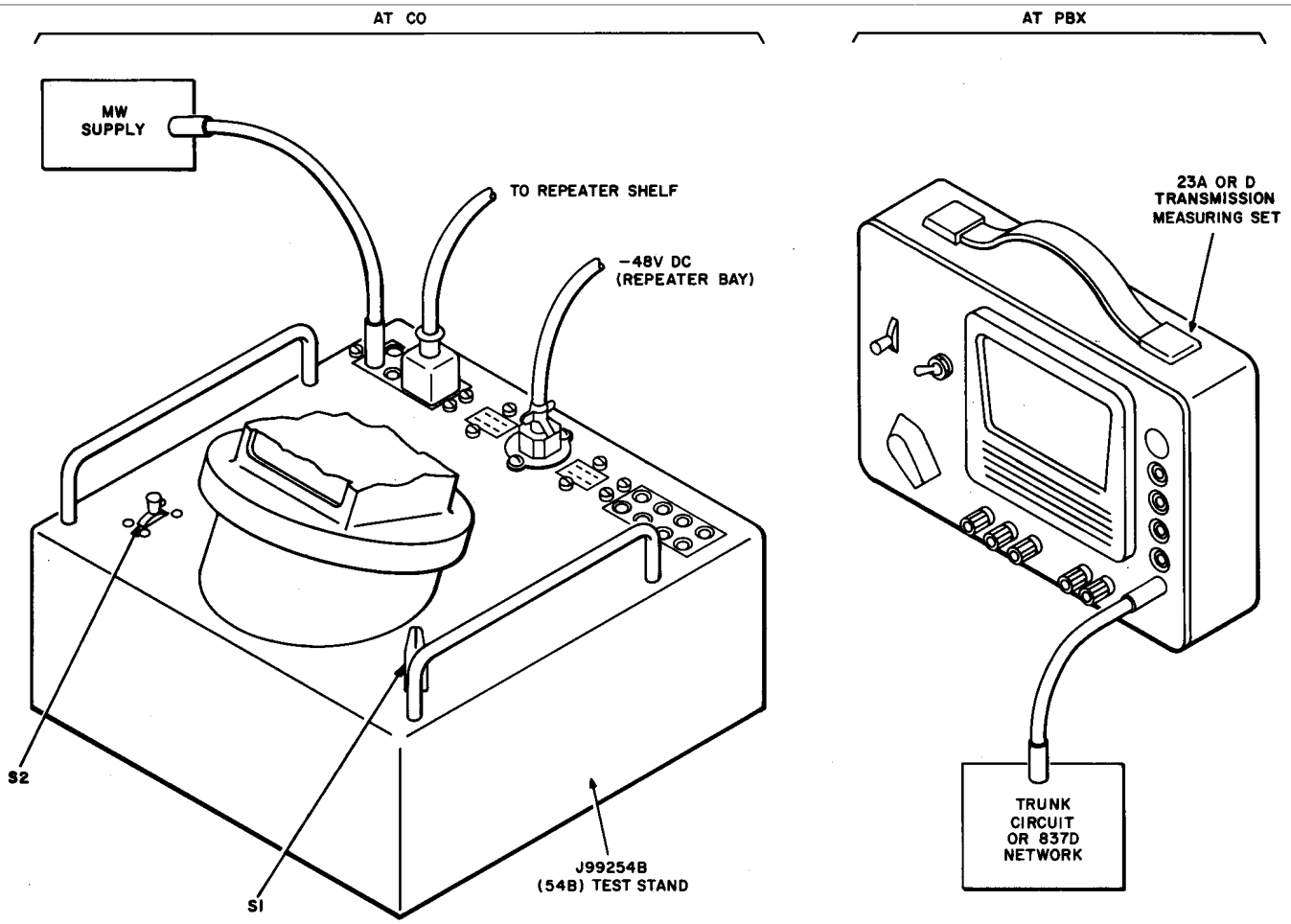

Fig. 5—Measurement of 1-kHz Insertion Loss—Method With mW at CO

STEP	PROCEDURE
	Note 1: With the headphone connected as shown in Fig. 6, no sound other than battery noise should be audible. If the repeater does not sing, refer to Part 7. ***Note 2:*** If a low-level 1-kHz tone is heard, it may be coming from the 54A TMS, which is still connected to the 54B test stand. Disconnect the power plug from the test stand.
4	If the repeater sings, the possible troubles are: (a) Improper test connections. (b) The insertion loss has been incorrectly measured and is less than permissible.

STEP	PROCEDURE
	(c) The 830E network is defective. (d) The makeup of the facility is outside limits.

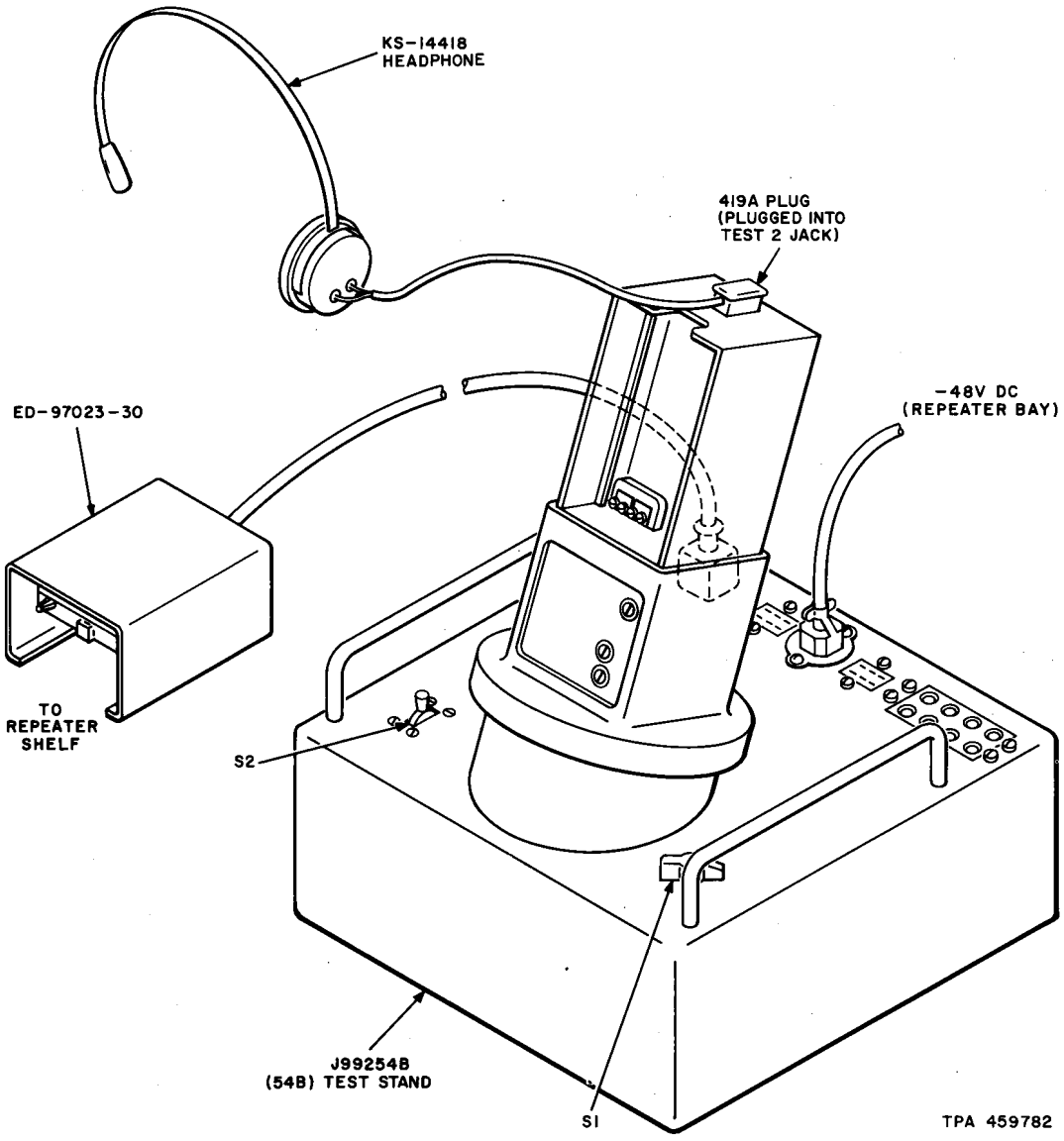

Fig. 6—Stability Test—Equipment Connections

7. PUTTING CIRCUIT INTO SERVICE

7.01 When stability tests are satisfactorily complete, proceed as follows:

STEP	PROCEDURE
1	Remove repeater from 54B test stand.
2	Remove plug from shelf socket.
3	Plug repeater into proper shelf position.
4	Have the circuit put in service.

TABLE E

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.