

**RANGE EXTENDER WITH GAIN  
REG, LISTS 1, 2, 3 AND 5A REG, 5B REG  
INITIAL ALIGNMENT AND TESTS**

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**1. GENERAL**

**1.01** This practice covers the initial alignment and tests of the range extender with VF<sup>1</sup> (voice frequency) gain: REG, List 1 (SD-97716-01); REG, List 2 (SD-99716-02); REG, List 3 (SD-97716-02); 5A REG

(SD-97716-03); and 5B REG (SD-97716-04). Descriptions of the REG test fixture (SD-97718-01) and the 141A REG test set, either of which may be used in this operation, are also included.

**1.02** This section is reissued to include information on the new 5B REG which has enhanced lightning protection. Change arrows are used to denote changes.

**1.03** The 5A and 5B REGs are completely automatic and do not require adjustment. Preservice or trouble tests on circuits equipped with 5-type REGs are described in Parts 6 and 7 of this section.

**1.04** Lineup adjustments of gain and LBO (line build-out) networks on the REG, Lists 1, 2, and 3 will normally be made at the time of installation for service and should not require further adjustment.

**1.05** The test set is designed to enable the CO (central office) to perform tests of the supervision, dial pulsing, ring trip, and gain functions of the REG unit without assistance at the station. Use of the REG test set is required primarily for trouble investigation.

**1.06** Transmission requirements and design guidelines for use of the REG are specified in Section 902-215-121.

**2. SETTING UP THE REG UNIT**

**2.01** The following paragraphs describe a new method for determining LBO settings for REG, Lists 1, 2, and 3. The new procedure requires the calculation of the loop resistance between the CO and the second load coil (the first 9 kft of cable). Also, the length of the end section adjacent to the CO is required.

2.02 The method for determining LBO settings described in earlier issues of this section will also result in satisfactory impedance matching; however, the settings may differ slightly for the same cable section.

2.03 Table A lists the dc loop resistance factors per kilofoot for 19-, 22-, 24-, and 26-gauge cable facilities. The resistances shown do not include the resistance of the load coils since only the conductor resistance is required for computations.

2.04 For determining LBO and gain settings, the procedures in Chart 1 should be used.

TABLE A	
DC LOOP RESISTANCE FACTORS	
GAUGE	OHM / KFT*
19	16.3
22	32.8
24	51.9
26	83.3
* Factor does not include resistance of load coils.	

CHART 1

LBO AND GAIN SETTINGS FOR REG

STEP	PROCEDURE
1	Set gain as specified on CLR (circuit layout record). Tighten the appropriate screw switch, labeled 6 or 4.  <i>Note:</i> The 6-dB screw switch should be tightened only for services in zones 28 and 36. The 4-dB screw switch should be tightened for services in zones 16 and 18. See Fig. 1, 2, or 3 for location of gain and LBO screw switches.
2	Determine length of CO end section (length of cable from CO to first load coil) from cable records.
3	If cable is single-gauge from CO to second load coil, locate end-section length in Table B. Read across under appropriate gauge column for LBO screw-switch settings. The table lists screw switches which are closed (turned in).  <i>Note:</i> For single gauge facilities, resistance computations are not required.
4	For circuits working on mixed gauge facilities, determine resistance of first 9 kft of loop.  (a) From CLR or cable records, determine length of each gauge of cable in the first 9 kft.  (b) Multiply length of each gauge by appropriate resistance factor given in Table A.  (c) Add resistances of all gauges to obtain resistance of the first 9 kft. Note whether total resistance is greater than 365 ohms.
5	Locate length of CO end section in Table B. Read across under appropriate resistance column (140 to 365 ohms or 366 to 750 ohms) for resistance calculated in Step 4c. Read screw-switch settings.

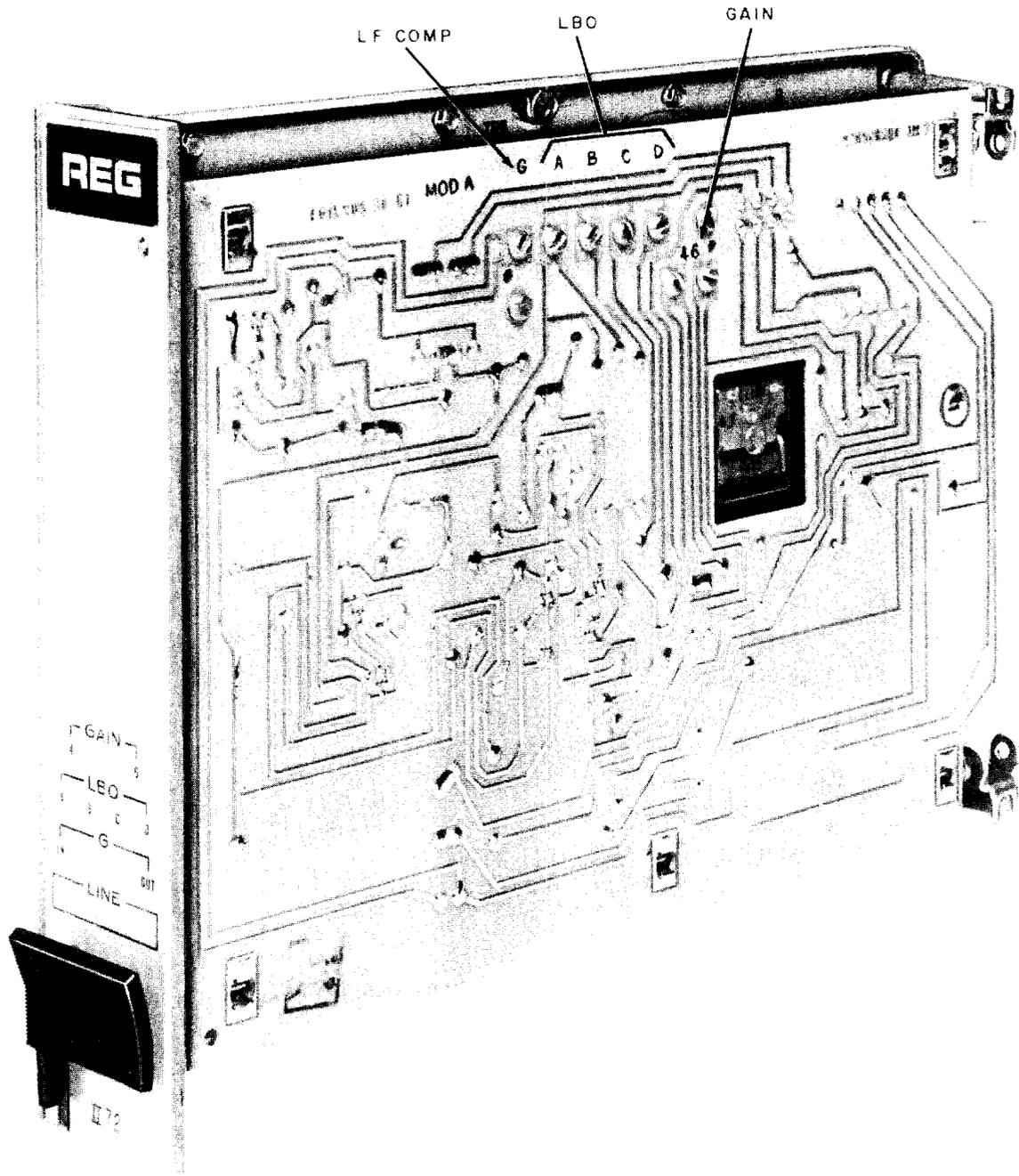


Fig. 1—Range Extender With Gain, List 1

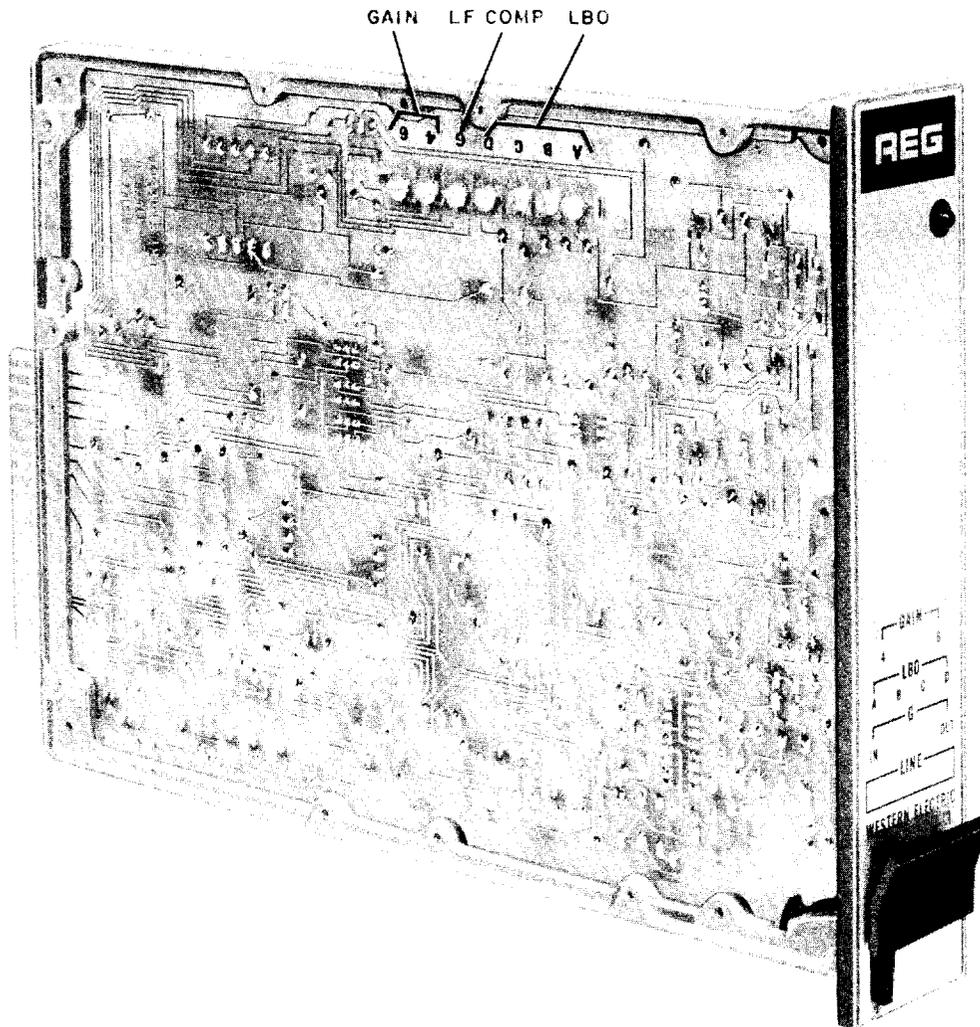


Fig. 2—Range Extender With Gain, List 2

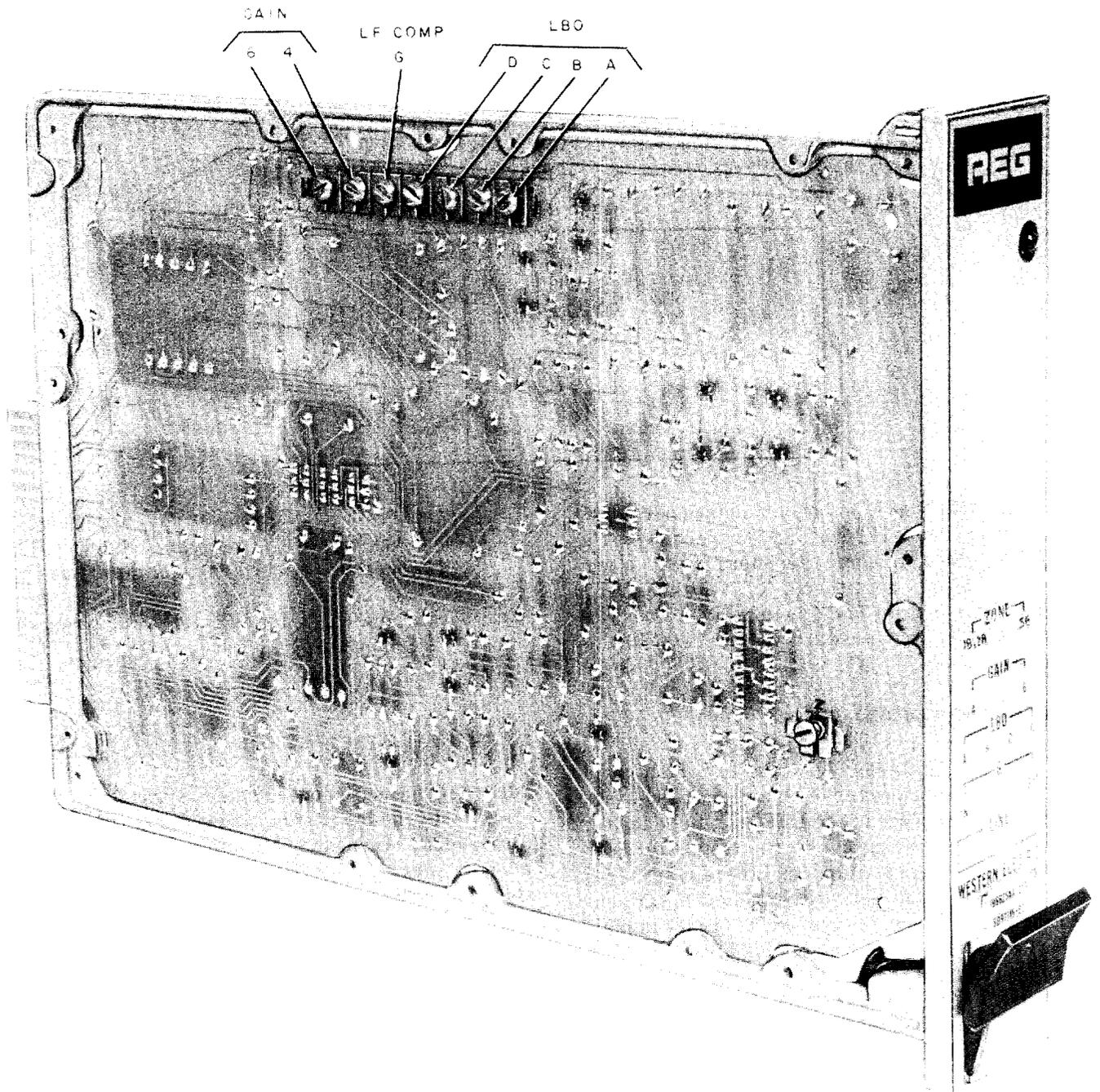


Fig. 3—Range Extender With Gain, List 3

TABLE B REG LINE BUILD-OUT NETWORK SCREW SETTINGS (SCREWS DOWN)		
CO END SECTION LENGTH (KFT)	SINGLE GAUGE 19 OR 22 H88 OR MULTIGAUGE RESISTANCE 140 TO 365 OHMS	SINGLE GAUGE 24 OR 26 H88 OR MULTIGAUGE RESISTANCE 366 TO 750 OHMS
2.2	A, B	A, C, G
2.4	A, C	A, G
2.6	A, D	B, C, D, G
2.8	A	B, C, G
3.0	B, C, D	B, D, G
3.2	B, C	B, G
3.4	B	C, G
3.6	C, D	D, G

2.05 The REG, List 3 has an additional screw switch, labeled Z, (see Fig. 3) which lowers the threshold of the loop current detector for zone 36 signaling applications using the SD-31777-01 line circuit in step-by-step offices. The Z switch should be closed when REG, List 3 is used with the SD-31777-01 line circuit in zone 36.

- One 3A or 3C NMS (noise measuring set), or equivalent, with C-message weighting that can measure bridged or high impedance
- Suitable cords for connection between the NMS and the REG test fixture.

3. DESCRIPTION OF TEST FIXTURE

3.01 The test fixtures (Fig. 4 and 5) have a cable connected to an extender board that plugs into the REG shelf in place of the REG unit to be tested. The REG is then plugged into the test fixture for evaluation. The test fixtures each have a terminal marked HDST in parallel with a 238 jack for attaching a 1013A handset, or equivalent; a 238 jack in multiple with a banana plug marked TMS for making transmission tests; and two switches designated MODE and FUNCTION. The MODE switch has two positions: one marked SIG for checking the signaling functions of the REG and the other marked TRANS for checking VF gain and return loss. The FUNCTION switch has three positions marked 1, 2, and 3 which select the test to be performed. The REG may be restored to service while plugged into the test fixture by operating the MODE switch to SIG and the FUNCTION switch to 3.

4. APPARATUS FOR THE REG TESTS

4.01 The following apparatus is required for making tests:

- One 1013A handset or equivalent

5. SETUP FOR THE REG TESTS

5.01 All measurements and tests are to be made with the test fixture plugged into the connector normally occupied by the REG and the REG unit plugged into the test fixture. The 1013A handset should be connected to the terminals marked HDST.

5.02 *All transmission measurements are to be made with the NMS in a bridged or high-impedance setting.*

6. OPERATION—SIGNALING TESTS

6.01 The failure of the REG unit in any of the following tests for *dial tone*, *dialing*, and *ring trip* may indicate a defective unit. The following test confirms only that the REG unit and its CO connections are correct. It is assumed that the assigned facilities meet transmission requirements.

**Warning:** *The REG, List 2 and List 3 contains a mercury relay and must be in a vertical position for signaling tests.*

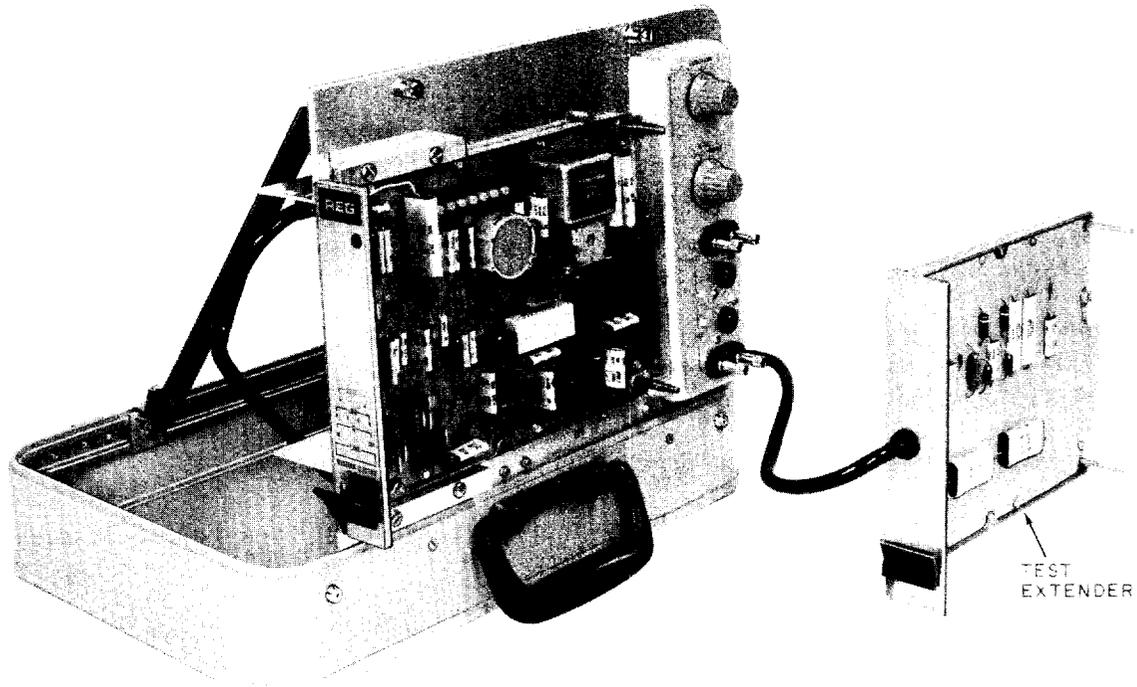


Fig. 4—REG Test Fixture—J98625TA

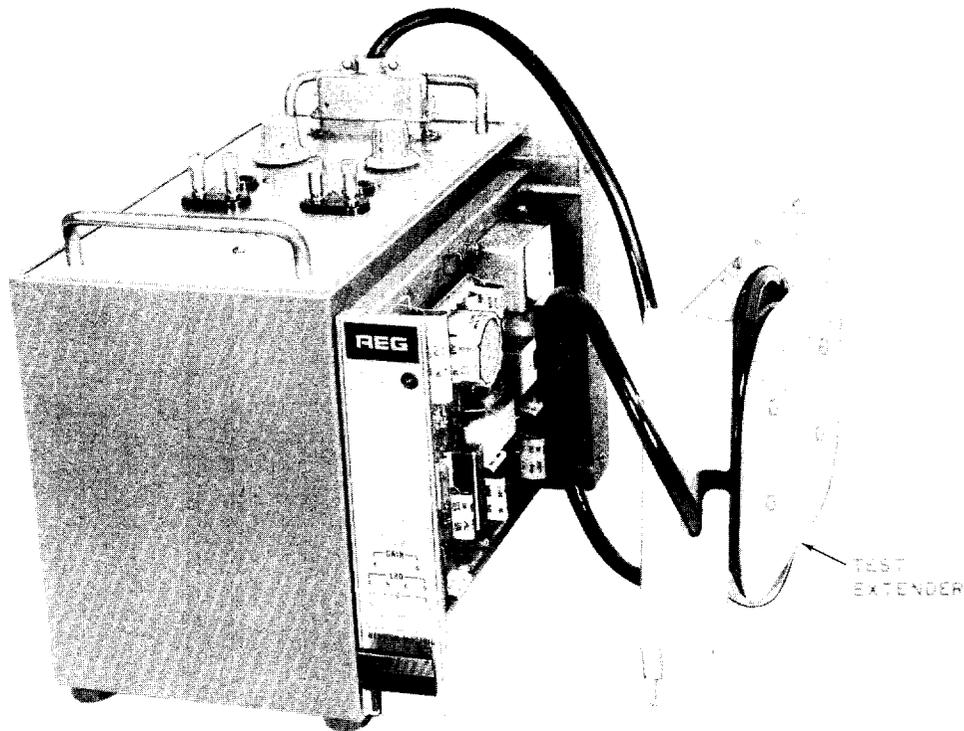


Fig. 5—141A REG Test Set

## CHART 2

## SIGNALING FUNCTION TESTS

STEP	PROCEDURE
1	Operate handset TALK-MON switch to the TALK position. Operate test fixture MODE switch to SIG position and FUNCTION switch to position 1.  <i>Note:</i> The handset is now connected through a network that simulates a long loop directly to the CO tip-and-ring leads. The REG is not in the circuit in this test, and it will probably be impossible to complete calls from the handset.
2	Operate FUNCTION switch to position 2.  <i>Note:</i> The handset is now connected through the long loop network and the REG. It should be possible to hear <i>dial tone</i> and to dial test numbers.
3	Dial CO ringback and switch handset TALK-MON switch to MON. Ring trip should not occur while in MON.
4	While monitoring ringback and during ringing cycle, operate TALK-MON switch to TALK and listen for <i>ringing trip</i> during the ringing interval. Return handset TALK-MON switch to MON; the ring should not return.

## 7. OPERATION—VOICE-FREQUENCY TEST

## Gain

7.01 The principal test is to determine if the amplifier is functioning and supplying gain. Due to the loading effect of the test set on the REG and the method in which the tests are made, the test is only

an indication that the amplifier is operating properly and not an accurate measurement of the true insertion gain of the REG. The REG, Lists 1, 2, and 3 may be tested in either the 4- or 6-dB gain mode depending on the screw-switch settings. ♦The 5A and 5B REG will automatically be in the 6-dB gain mode. The 4-dB gain mode of the 5A and 5B REG cannot be tested using the test set.♦

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**CHART 3**
**TRANSMISSION TESTS**


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STEP	PROCEDURE
1	Operate MODE switch to TRANS position. Connect 3-type NMS to 238 jack or banana plug marked TMS. The NMS FUNCTION switch should be set in BRDG position, with C-message weighting.
2	Operate test fixture FUNCTION switch to position 1 and handset TALK-MON switch to TALK position. Dial CO 1-kHz milliwatt tone.
3	Note level indicated on TMS. Switch FUNCTION switch to position 2, which switches in the REG amplifier. Note level on TMS. Difference between the two readings indicates gain of amplifier. For REG, List 1, 2, 3, or 5A, 5B REG, the 6-dB gain mode should measure $6.3 \pm 1.6$ dB. For REG, List 1, 2, or 3 in the 4-dB gain mode, the gain should measure $3.8 \pm 0.9$ dB.

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**Return Loss**

**7.02** As prescription settings are usually satisfactory, touchup is required only when trouble conditions occur or where requirements are not met.